adha American Dental Hygienists' Association

Winter 2012
Volume 86
Number 1

Journal of Dental Hygiene

Proceedings from the 2nd North American/ Global Dental Hygiene Research Conference

Bethesda, MD, October 20-22, 2011

Sponsored by the National Center for Dental Hygiene Research & Practice
Ostrow School of Dentistry of USC

Funded by an unrestricted educational grant from:
P&G Professional Oral Health

Journal of Dental Hygiene

VOLUME 86 • NUMBER 1 • WINTER 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. Subscription rates for nonmembers are one year, $45; two years, $65; three years, $90; free for members.

SUBMISSIONS

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

Inside

Journal of Dental Hygiene
Vol. 86 • No. 1 • Winter 2012

Proceedings

Editorial

Jane L. Forrest, RDH, EdD, Conference Co-Chair
Ann Eshenaur Spolarich, RDH, PhD, Conference Co-Chair

Conference Overview and Acknowledgments

The 2nd North American/Global Dental Hygiene Research Conference was held on October 20-22, 2011, in Bethesda, Maryland. The 3 day conference provided an opportunity for dental hygiene researchers throughout the U.S., Canada, Europe, Asia and Australia to convene and explore commonalities in their research interests, learn from each other about new and ongoing research programs and foster future collaborations. It is our hope that discussion and interest generated at the conference provided the networking support and intellectual stimulation needed to systematically and purposefully move our research forward. To this end, the purpose of the conference was to:

- Share new knowledge obtained through research investigations
- Explore how to translate research to practice in a meaningful and useful manner
- Increase and diversify the number of individuals engaged in oral health research
- Captivate, advance and nurture a cadre of dental hygiene researchers
- Provide information about valid and useful research tools and resources
- Develop and refine research project conceptualization and grant writing skills
- Provide workshops for hands-on training in manuscript preparation, statistics, clinical research, qualitative research and searching for best evidence
- Promote the effective use of web-based technology for networking, collaborating and disseminating research findings

In order to achieve these objectives, a program devoted to a wide range of topics was created. Participants had the opportunity to hear updates on oral cancer research and screening, and the state of the science related to use of lasers in dentistry to enhance their ability to translate this knowledge into education and clinical practice. Participants also were able to meet colleagues who are conducting original research about problems encountered every day in practice in order to improve the quality and type of care we provide to our clients. Opportunities to learn about this research were made through 33 poster and 26 oral presentations.

Another opportunity to network with colleagues with similar research interests was through the 10 different Special Interest Group (SIG) sessions devoted to access to care, caries, clinical dental hygiene practice, educational research, health behaviors, health literacy, oral cancer, oral systemic link, periodontics and technology. Through the DHNet Network Section, we look forward to providing a home base for future discussions and building a critical mass of dental hygienists who can participate in future research activities and projects.

Finally, based on the outcomes from the first conference in June 2009, a program was created to enhance training and skill development on a wide range of topics. Eight different continuing education workshops were specifically designed on the following topics: Grant Writing, Manuscript Preparation and Professional Presentations, Keeping Current: Clinical Decision Support Systems, Overcoming the Fear of Statistics, Getting Started in Clinical Research, Introduction to Preparing a Systematic Review, Design Considerations in Qualitative Research and Emerging Science that Influences Practice (bisphosphonate-induced osteonecrosis, tobacco cessation interventions, CAMBRA and its implementation in practice). Over 18 hours of CE credit were offered over the 3 day conference.

This conference has required over a year of planning, and we must acknowledge the contributions and support that we have received from many individuals and organizations along the way. First, we thank the Canadian and American Dental Hygienists' Associations for again partnering with the National Center for Dental Hygiene Research & Practice to invite dental hygienists from across the continent to participate in this event. Conference attendees represented 9 countries, including 35 states in the U.S., Canada, Australia, Denmark, Germany, Great Britain, Italy, Japan, the Netherlands and Sweden. Participants included 22 graduate dental hygiene students, 85 full and part-time faculty from universities, dental schools and community colleges, 7 dental hygienists from dental school research centers and private research companies, 18 full-time dental hygiene clinical practitioners and public health/hospital dental hygienists, 1 government director, 28

hygienists, dentists and leaders representing various industries, 6 professional association representatives, 4 journal editors and 3 entrepreneurs/independent contractors.

We thank the members of our Advisory Board for volunteering their time and talents, for facilitating workshops and for moderating each of the sessions during the meeting. We also thank our volunteers for managing the registration tables and the many companies who graciously donated copies of their research to share with all of the conference participants to further our knowledge and understanding of their products and services.

Most importantly, we extend our deepest and most heartfelt gratitude to our corporate sponsors, The Procter & Gamble Company, Colgate-Palmolive Company, Philips Sonicare, Discus, a Philips company, Johnson & Johnson and 3M ESPE. We gratefully acknowledge Hu-Friedy Manufacturing Company for an educational grant to support the attendance of our full-time graduate dental hygiene students. This conference would not have been possible without educational grants from our corporate partners, and we thank them for their kindness and generosity.

Advisory Board: Denise Bowen, RDH, MS; Jan Clarkson, BDS, PhD; MaryAnn Cugini, RDH, MHP; Jacquelyn Fried, RDH, MS; JoAnn Gurenlian, RDH, PhD; Harold Hensen, RDH, MS; Alice Horowitz, RDH, PhD; Salme Lavigne, RDH, MS; Tara Johnson, RDH, PhD; Linda Kraemer, RDH, PhD; Margaret Walsh, RDH, EdD; Patricia Walters, RDH, MS; and Karen Williams, RDH, PhD

Editorial

Rebecca S. Wilder, RDH, MS, Editor in Chief: Journal of Dental Hygiene
Katherine Zmetana, DipDH, DipDT, EdD, Scientific Editor, Canadian Journal of Dental Hygiene

Growth of the Dental Hygiene Profession

Growth in a profession is connected to acquiring knowledge and dissemination of that knowledge to its members and the public. Dental hygienists from around the word met to learn from the experts, share their knowledge and plan for the future in October, 2011, at the 2nd North American/Global Dental Hygiene Research Conference held in Bethesda, Maryland, USA. Attendees traveled from many areas of the globe including the United States, Canada, Australia, Europe and Asia, representing dental hygienists from private practice, corporate entities, laboratory and clinical research, undergraduate and graduate dental hygiene programs and professional organizations, such as the American Dental Hygienists' Association and the Canadian Dental Hygienists Association. Particularly exciting for us was to see the future leaders of our profession - the dental hygiene graduate students representing several of the Master of Science degree programs. These students had an opportunity to learn from the experts in the fields of Dentistry and Dental Hygiene, Medicine and Public Health, among other fields, and to learn about their professional journeys. Knowledge was shared and mentoring occurred, one of the hallmarks of a successful conference!

We are happy to share the proceedings of the 2nd North American/Global Dental Hygiene Research Conference through a joint collaboration between the American Dental Hygienists' Association and the Canadian Dental Hygienists Association. If you were at the conference, the proceedings will be a wonderful review of content discussed at the meeting. If you were unable to attend, please read the proceedings from cover to cover! The amount of knowledge in these pages is phenomenal!

As editors, we wish to extend a warm word of thanks to Dr. Ann Eshenaur Spolarich and Dr. Jane Forrest for their commitment to the dental hygiene profession and for the many hours it took to plan such a great conference. We hope to see you at the next conference!

Current Topics in Oral Cancer Research and Oral Cancer Screening

Brian L. Schmidt, DDS, MD, PhD

Early identification and proper evaluation of suspicious oral lesions offers the oral health practitioner the opportunity to positively impact our patients' health. In this presentation, I will review the available adjunctive methods and devices for the evaluation of suspicious oral lesions. I will review the studies that have analyzed the effectiveness of these approaches in a clinical setting. The adjunctive techniques which I will discuss are toluidine blue, tissue fluorescence, tissue reflectance and brush cytology. At the end, I will discuss the role that genomics might play in the future in diagnosing and predicting the clinical behavior of oral cancer.

Toluidine blue: Toluidine blue is a vital stain that binds to nuclear material and preferentially stains tissues with high rates of cellular proliferation. Toluidine blue is an effective adjunctive screening tool for identifying premalignant lesions or oral cancer recurrences in those who have already been diagnosed with oral dysplasia or oral cancer. Gray and colleagues reviewed 14 large studies on toluidine blue and found that sensitivity for detecting oral cancer ranged from 40% to 100%, and the specificity ranged from 31% to 92%.[1] Toluidine blue can be associated with a high false positive and high false negative rate. For example, 50% of oral lichen planus lesions were positive and only 42% of dysplasias stained positively.[2] Therefore, the provider must be careful not to overextend the utility of this tool. Although toluidine blue is highly sensitive as a screening tool, it should not be used to rule out malignancy – a scalpel biopsy remains the standard of care. Toluidine blue has also been proposed as a tool to predict progression of oral dysplasia to cancer. In one study, toluidine blue stained lesions with high-risk histologic features, with staining correlated to patient outcome.[3] There is no evidence to support the use of toluidine blue as an oral cancer screening tool for the general population.

Tissue fluorescence: Certain cellular molecules, especially those within mitochondria and lysosomes, absorb the energy from light of specific wavelength. When these molecules move back to their unexcited state, the absorbed energy is released. This energy is referred to as fluorescence emissions. Porphyrins in erythrocytes also contribute to autofluorescence. Oral cancer cells have different autofluorescence emission relative to normal oral mucosa. Technology, such as VELscope, has been developed to capitalize on this difference in autofluorescence between cancer and normal tissue and to use this approach to detect pathologic lesions in the oral cavity. VELscope emits a high intensity light that is blue. Unaffected mucosa fluoresces green, while areas of dysplasia or cancer are darker and do not fluoresce. Indications for the VELscope, according to the manufacturer, are to assist in identifying suspicious oral lesions that may require a surgical biopsy and also to delineate the lesional margins at the time of resection.

To date, there are no rigorous studies demonstrating that VELscope improves oral cancer diagnosis or improves outcome. While one study of 44 patients reported a sensitivity and specificity of 98% and 100% for identifying oral dysplasia or oral cancer, respectively, and was verified by surgical biopsy, all of these lesions were visible with standard incandescent lighting, and the majority of them were clinically suspicious.[4] At this time, it is unclear whether VELscope is useful in detecting suspicious lesions that are not visible with white light. Similar to toluidine blue, VELscope should not be used to rule out malignancy in visible lesions.

Tissue reflectance: Chemiluminescence, or tissue reflectance, is an adjunctive screening tool that is used to detect cervical premalignant or malignant lesions. Two systems using chemiluminescence developed for the oral cavity are ViziLite® Plus and MicroLux DL. The increased nuclear to cytoplasmic ratio characteristic of squamous cell carcinoma increases light reflectance relative to normal epithelium.

The sensitivity of the chemiluminescence devices for highlighting potentially pathologic lesions is high; however, benign lesions, such as leukoedema and traumatic ulcers, test positive. In the available studies, lesions detected by tissue reflectance were also visible under incandescent lighting.[5-9] Because surgical biopsies were not performed to diagnose all detected lesions in the available studies, actual sensitivity and specificity are difficult to report. It is not clear whether these instruments provide any benefit over conventional oral examination under standard incandescent lighting. Oh and Laskin reported that the use of ViziLite® actually made visualizing lesions more

difficult due to the distracting highlights it created.[8] At best, tissue reflectance technology can be used as an adjunctive screening tool to the conventional oral examination. A scalpel biopsy of suspicious lesions is required.

Brush cytology: The brush biopsy (Oral CDx® from CDx Laboratories) is intended for oral lesions that appear innocuous and would not normally be biopsied by the provider. The brush biopsy is intended to be an adjunct diagnostic tool and not a screening tool. Demonstrating efficacy for the diagnosis of suspicious oral lesions with brush cytology is not easy. The population investigated must have lesions that are not already highly suspicious for malignancy, and all lesions in the population must be subjected to surgical biopsy. The available studies evaluating the brush biopsy are not selective for the target population and include likely or biopsy proven malignant lesions. In most of the available studies, lesions that were reported as negative based on the brush biopsy have not been confirmed by a surgical biopsy. In one study, all lesions had both a brush biopsy and a surgical biopsy. The sensitivity and specificity were 92.3% and 94.3%, respectively.[10] A false negative rate of 7.7% is unacceptably high for an adjunctive diagnostic tool. A further significant drawback of this study is that lesions highly suspicious for malignancy were included. Therefore, the sensitivity might be lower. The current literature does not strongly support adding the brush biopsy to the diagnostic armamentarium.

Genomics: The human genome project, completed in 2002, was to revolutionize surgery and medicine. Scientists predicted that once the entire human genome sequence was known that many cancers, including oral cancer, would be curable. However, our comprehensive understanding of the human genome has not cured cancer. In this lecture, I will attempt to explain why cancer has proven to be more elusive and complex than we expected and why genomics has not led to a cure. I will present the modest headway we have made in predicting cancer behavior with genomics and show how this knowledge has impacted our understanding of the key elements of oral carcinogenesis, including: transformation of normal oral mucosa to cancer, local recurrence following resection, development of second primaries and metastasis to the cervical lymphatics. I will show how state-of-the-art genomics might be used in the future to understand and treat oral cancer.

References

1. Gray M, Gold L, Burls A, Elley K. The effectiveness of toluidine blue dye as an adjunct to oral cancer screening in general dental practice. *West Midlands DES Report*. 2000.

2. Martin IC, Kerawala CJ, Reed M. The application of toluidine blue as a diagnostic adjunct in the detection of epithelial dysplasia. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 1998;85(4):444-446.

3. Zhang L, Williams M, Poh CF, et al. Toluidine blue staining identifies high-risk primary oral premalignant lesions with poor outcome. *Cancer Res*. 2005;65(17):8017-8021.

4. Lane PM, Gilhuly T, Whitehead P, et al. Simple device for the direct visualization of oral-cavity tissue fluorescence. *J Biomed Opt*. 2006;11(2):024006.

5. Huber MA, Bsoul SA, Terezhalmy GT. Acetic acid wash and chemiluminescent illumination as an adjunct to conventional oral soft tissue examination for the detection of dysplasia: a pilot study. *Quintessence Int*. 2004;35(5):378-384.

6. Epstein JB, Gorsky M, Lonky S, Silverman S, Jr., Epstein JD, Bride M. The efficacy of oral lumenoscopy (ViziLite) in visualizing oral mucosal lesions. *Spec Care Dentist*. 2006;26(4):171-174.

7. Kerr AR, Sirois DA, Epstein JB. Clinical evaluation of chemiluminescent lighting: an adjunct for oral mucosal examinations. *J Clin Dent*. 2006;17(3):59-63.

8. Oh ES, Laskin DM. Efficacy of the ViziLite system in the identification of oral lesions. *J Oral Maxillofac Surg*. 2007;65(3):424-426.

9. Ram S, Siar CH. Chemiluminescence as a diagnostic aid in the detection of oral cancer and potentially malignant epithelial lesions. *Int J Oral Maxillofac Surg*. 2005;34(5):521-527.

10. Scheifele C, Schmidt-Westhausen AM, Dietrich T, Reichart PA. The sensitivity and specificity of the OralCDx technique: evaluation of 103 cases. *Oral Oncol*. 2004;40(8):824-828.

The State of the Science of Lasers in Dentistry

Georgios E. Romanos, DDS, PhD

Introduction: In the modern surgical therapy of oral diseases there are beneficial applications of minimally invasive surgical techniques, like the use of the laser light, which is able to cut, coagulate or ablate tissues due to its high power density. In general, LASER is an acronym of Light Amplification by Stimulated Emission of Radiation, which is light with a high power concentrated in a focused area, i.e. the target tissue. There are special characteristics for the laser light. Laser light is coherent, which means that the light is directed in a long distance without divergence, in contrast to the sun or a flashlight. It is collimated, which means that the laser light can be concentrated in the target tissue with the highest level of energy in the focus (spot) as well as monochromatic, which means that it has only 1 wavelength. The main part of the laser unit is the active medium. It is the "brain" of the whole system, where electrons can be activated for the emission of photons.

According to the active medium, lasers can be classified into: a) using solid active mediums (crystals), i.e. Er:YAG, Nd:YAG, Ho:YAG lasers; b) using fluids, i.e. the dye lasers; c) using gases, i.e. CO2, He:Ne, Argon lasers and d) using semiconductors, i.e. diode lasers. Dependent on the used power setting, we distinguish lasers to "soft" lasers using a power setting in mW to W level and to "hard" (surgical) lasers using a power level between W and kW. Moreover, all laser units are classified into 5 groups according to the laser safety level (1, 2, 3A, 3B and 4 safety class) according to laser properties that damage vital tissues irreversibly or not (skin, retina). Most of the lasers used in medical applications belong to the class 3B or 4, and for that reason a laser safety officer is requested when lasers are used.

Laser-tissue interactions: There are specific laser-tissue interactions dependent on physical parameters (power, power density, etc.), tissue consistency and laser wavelength. Most important among optical tissue properties are the reflection, absorption, scattering and transmission of the light which take place during laser irradiation. The laser light emission is higher and completely different in the blood vessels, but not in the connective tissue when the wavelength represents the Nd:YAG (1,064 nm) or the diode lasers (980 nm or 810 nm). These tissue interactions are different when the laser wavelength is 10,600 nm (CO2) or the 2,940 nm (Er:YAG laser).

In a similar way, the CO2 laser or the Er:YAG laser can be absorbed better by the superficial soft tissues, especially from lesions with light colors, and have a reduced absorption from pigmented lesions. In addition, Er:YAG laser light emission is higher in the enamel, dentin, bone or other calcified tissues, and does not have high penetration depth in comparison to other laser systems. Therefore, the Er:YAG laser is used today for cavity preparation, decay or bone removal and not as often for soft tissue procedures. The penetration depth of the Nd:YAG laser is 3 to 4 mm in comparison to the CO2 laser, which has only superficial layer effects at a depth of 0.1 to 0.3 mm.

Laser applications in Dentistry: The characteristic differences in properties of laser wavelengths explain the variable clinical effects of lasers observed in dentistry. When treating oral soft tissue lesions, 2 different techniques can be used: excision or ablation. The laser beam can be used in a focused way in order to excise the tissue. For ablative techniques, tissue is removed with vaporisation layer by layer, without the possibility of a histological examination with biopsy. In the case of tissue removal using a laser system, a special informed consent has to be given to the oral pathologist in order to better explain possible structural changes caused by the laser. Because water content in the surface of most oral tissues is high, use of the CO2 laser may be indicated in most soft tissue surgery cases. This allows a relatively precise incision line with sufficient coagulation properties. Table I shows the indications of different laser wavelengths in dentistry.

Hard tissue Applications/Cavity preparation/ Operative Dentistry: Due to high absorption of the Er:YAG laser by hydroxyapatite, cavity preparations can be performed using the correct settings of the Er:YAG laser. However, only small carious lesions can be treated this way today, and unfortunately, this does not take place on a routine basis.

Endodontics: Bacterial reduction in the pulp and canal has been studied using different laser systems. The rapid development of laser technology will make it possible to apply this technology for various endodontic procedures, including the cleaning and disinfection of the root canal.

Periodontology – Implant Dentistry: Periodontal diseases may be treated in a more simple and effective way. Lasers can be used for calculus removal, de-epithelization and to significantly reduce bacteria in the pocket using different laser systems, as well as photodynamic therapy (PDT) in conjunction with non-surgical and surgical therapy. The potential of this treatment is superior; however, large multicenter studies and randomized controlled clinical trials are necessary to compare this kind of therapy with conventional treatments. Patient acceptance and postop-

erative healing events should also be evaluated.

Surgical removal of gingival overgrowth has been performed using the CO2 laser. Use of the CO2 laser produces a comfortable and easy excision, and drug-induced gingival overgrowth can be excised relatively quickly. Occasionally, use of the high-pulsed CO2 laser or combination scalpel excision with laser coagulation in a defocused mode for ablation is recommended. Peri-implant soft tissue overgrowth can also be excised without complications using the CO2 laser. Implant surface irradiation reduces bacteria and may stimulate tissues for bone regeneration as a potential therapeutic advantage for using lasers in the treatment of peri-implantitis. Osseointegration depends upon the laser settings and the selected wavelength used.

Laser Phototherapy: Biomodulative effects with lasers of low power have additional advantages and potential applications due to increased cellular activity, cell proliferation and collagen synthesis. These effects have indications for bone and periodontal regeneration, in the treatment of postoperative edema and oro-facial pain and for improving wound healing mechanisms without complications. However, the exact explanation as to how these effects are produced requires further clarification in the future.

Oral and Maxillofacial Surgery: For the removal of soft tissue tumors and premalignant lesions, the CO2 laser may be used easily using a non-contact, focused beam in a continuous wave mode. In most cases, a power setting between 2 to 6 watts (depending upon the laser unit) is sufficient for most minor surgical procedures. For larger-sized and malignant tumors of the oral cavity, use of the CO2 laser in an ultra-pulse mode may be more advantageous.

For removal of small soft tissue tumors in the oral cavity, the application of fibre-delivery laser systems, like the diode (810 and 980 nm) or the Nd:YAG laser also can be used. Because of the higher penetration depth of these laser wavelengths, the light direction during surgery has to be under control in order to avoid necrosis or other complications in the surrounding healthy tissues. Such complications can be observed when the laser is applied incorrectly near healthy periodontal tissues.

The laser beam will be in contact with the tissue in order to excise the tumor and to make histological examination possible. Non-contact devices lead only to coagulation of the tumor. This may alter the tissue structure after coagulation of the blood vessels, presenting challenges for the pathologist. The coagulation properties of these devices are excellent, and therefore can be used in the treatment of patients with systemic bleeding disorders. Cases of treated premalignant and malignant lesions should be monitored postoperatively to detect possible recurrence.

Table I: Indications and laser wavelengths in dentistry

Application	Laser system
Cavity preparation	Er:YAG
Endodontics	Nd:YAG, diode, Er:YAG
Calculus removal	Er:YAG, ErCr:YSGG
Epithelial removal	CO2, diode, Nd:YAG, ErYAG
Drug-induced gingival overgrowth	CO2, diode
Peri-implant gingival overgrowth	CO2, diode
Peri-implantitis therapy	CO2, diode, Er:YAG
Soft tissue tumors	CO2, diode, Nd:YAG, Er:YAG
Pre-prosthetic surgery	CO2, diode
Precancerous lesions	CO2, Er:YAG
Bone removal	Er:YAG, Er,Cr:YSGG
Bleeding disorders	Nd:YAG, diode, CO2
Bacterial reduction	PDT, diode
Phototherapy	soft lasers

References

1. Gutknecht N, editor. Proceedings of the 1st International Workshop of Evidence-Based Dentistry on Lasers in Dentistry. Berlin: Quintessence Publishing; 2007.

2. Pick RM, Pecaro BC. Use of the CO2 laser in soft tissue dental surgery. *Lasers Surg Med*. 1987;7(2):207-213.

3. Romanos GE, Nentwig GH. Present and future of lasers in oral soft tissue surgery: clinical applications. *J Clin Laser Med Surg*. 1996;14(4):179-184.

4. Roodenburg JL, Panders AK, Vermey A. Carbon dioxide laser surgery and oral leukoplakia. *Oral Surg Oral Med Oral Pathol*. 1991;71(6):670-674.

5. Takasaki AA, Aoki A, Mizutani K, et al. Application of antimicrobial photodynamic therapy in periodontal and peri-implant diseases. *Periodontology 2000*. 2009;51:109-140.

6. White JM, Chaudhry SI, Kudler JJ, Sekandari N, Schoelch ML, Silverman S Jr. Nd:YAG and CO2 laser therapy of oral mucosal lesions. *J Clin Laser Med Surg*. 1998;16(6):299-304.

An Introduction to Grant Writing: De-Mystifying the Process

Margaret M. Walsh, RDH, MS, MA, EdD;
Denise M. Bowen, RDH, MS

This workshop, an expansion of a session presented at the North American Research Conference in Bethesda, Maryland in 2009,[1] was designed to provide an overview of important components of writing a clear, concise and tailored grant application. Topics discussed included: review criteria of significance, approach, innovation, investigators and environment, as well as grant application components of abstract, specific aims, research questions and/or hypothesis statements including PICO components, background and discussion of theoretical model guiding the research, preliminary studies, biographical sketch, timeline and budget. Activities highlighted some aspects in the grant writing process. Our goals were to enhance participants' understanding of the grant writing process, cultivate a persuasive approach for addressing the essential components of a well-written grant and provide insight into how to embark upon a successful, comprehensive grant development process.

Develop a Track Record: The author of a successful grant application and principal investigator of a grant project must first establish a track record. Experience related to the project and to management of a budget are reasonable expectations for any agency or organization granting funding. The path that we followed is similar and may serve as an example for others.

Develop an area of specialty by focusing on a study topic and acquiring knowledge and experience related to becoming an authority in your area of study. Assure your other work contributes to this goal, for example:

- Volunteer to collaborate with established researchers conducting related studies
- Conduct small scale/pilot studies in the area of interest, and publish or present results at research meetings
- Apply for small grants from your institution, associations, foundations or organizations with similar goals; identify new investigator opportunities
- Seek opportunities to gain experience with research protocols, personnel management, budgeting and accounting procedures
- Choose community involvement and design community-based projects related to your study area and build collaborations or coalitions, versus volunteering for others' priorities. Later, you may want to involve community providers in your grant-funded program
- Present related oral presentations, scientific papers and continuing education programs at professional meetings
- Assure work is directed toward benefitting society rather than solely focusing on advancing the dental hygiene profession

Writing the Successful Grant Application: The most important lesson we learned on the path to successful grant writing was that writing a clear, concise and focused grant application with good science is not enough. The successful application must tell an interesting story, plus:

- Be tailored specifically to the funding agency's mission. Present ideas that are easy for reviewers to understand, including why the study is significant and feasible
- Convince reviewers you have the expertise to conduct the planned study and you have the appropriate environment, equipment, collaborators and budget[2]
- Prepare a reviewer-friendly application that is well organized and clear to minimize the reviewers' work. Make it easy for them to understand your ideas, locate information within the application and be your advocate. Be specific about what you want reviewers to know and what they need to know
- Follow application instructions exactly
- Take advantage of institutional resources for assistance in preparing your application and budget and submitting it as required
- Contact the funding agency's program officer as needed for information related to the agency's goals and procedures

All successful projects require planning, development, implementation and evaluation. Start early, seek collaborators and support, and note internal as well as external deadlines. Allow at least 3 months for writing the application. Consider carefully evaluation criteria to be used by reviewers to score your application.

Most funding entities have similar criteria for evaluating grant applications. The following discussion is based on the review criteria of the National Institute of Health of the U.S. Department of Health and Human Services. These criteria include: significance, approach, innovation, investigator and environment.[3]

Significance: Your study's significance must be made clear and concise and answer questions such as:

- Does the study address an important problem from the funding agency's perspective?
- If the aims are achieved, how will scientific knowledge be advanced?
- What will be the effect of your study on the concepts or methods that drive the field?

Approach: Your study's approach must answer such questions as:

- Are the conceptual/theoretical frameworks, design, methods and analyses adequately developed, well-integrated and appropriate to the aims of the study?
- Are potential problem areas acknowledged and alternative strategies considered?

Innovation: In addressing your study's innovation:

- Specifically state why you believe the proposed research is original and innovative, and offer examples
- Explain how your project challenges existing paradigms or requires developing new methods, techniques or technologies

Investigator: In addressing this criterion, answer the following questions:

- Are you appropriately trained and well suited to carry out this work?
- Is the work proposed appropriate to your experience level (and that of your collaborators)? Explain how the proposed study is similar to those you have already completed
- Does the investigative team bring complimentary expertise to the project?
- Are the contributions of each collaborator delineated?
- Have you included letters of commitment and consultation on appropriate letterhead?

In addressing the environment criterion, answer such questions as:

- How does your scientific environment contribute to the probability of success?
- Is there evidence of institutional support (e.g., a letter stating what your institution will provide)?

Grant Application Components

Abstract: The abstract, your research summary, may be the only part of your application reviewers read. The best approach is to write it first and revise it last when you know your final application content. The abstract states broad, long-term objectives related to the agency's mission, lists specific aims, concisely describes the research design and methods to achieve aims and highlights relevance to public health.

Specific Aims: The Specific Aims, the most important section of the grant application, should be well focused, not overly ambitious and hypothesis driven. It is critical to write them early, circulate them to your team of experts and incorporate their feedback before writing the rest of the proposal. Usually 2 to 4 aims are the norm.

This section typically includes 3 general sections:

1. The "set-up" paragraph, which explains the relationship between a pressing problem and your research theme. This paragraph should strongly persuade reviewers that the topic is important and worthy of their attention
2. The "specific aims" paragraph starts with a sentence like, "The specific aims of the study are to…" and then lists the aims. Each aim should allude to the techniques used to achieve each one. In listing the specific aims use active verbs, rather than passive ones
3. The "hypothesis" paragraph points to a specific problem or area and culminates in the statement of the hypothesis. Quantitative hypotheses contain PICO components: problem/population, intervention, comparison and outcome

Participants were provided with an example of specific aims to critique and edit in small groups by applying information discussed.

Background and Significance: This section must establish 3 things: the project is important, the science is interesting, and there is a high probability of success. This is not a literature review. Educate the reviewers to your way of thinking. Show how the proposed project builds on previous work and identify gaps in previous knowledge.

Preliminary Studies: This section should convince reviewers that you know what you are doing. Show that the work is feasible and that you have completed suitable groundwork.

Biographical Sketch: A formatted Biographical Sketch is used to convey information about the qualifications, productivity and the role of the key personnel involved in the proposed project. It is important to convince reviewers that you are highly qualified to carry out the project. A good biosketch includes a personal statement about the goal of the

proposed research and your related experience, employment positions, other experiences and professional memberships, honors, peer-reviewed publications and previous research support.

Workshop participants listed qualifications they would include in a biographical sketch and worked partners to brainstorm about enhancing their sketch.

Timeline: The timeline needs to clearly demonstrate that you can complete the project in the time allocated, be feasible, and realistic. A visual format is easier for reviewers.

Detailed Budget and Justification: Itemize and justify direct costs. Denote in-kind support and institutional requirements for indirect costs.

Conclusion: In conclusion, always remember that your application is a work of persuasion. It is not merely a description of the work you want to do. Rather you are making an argument that it is work that needs to be done, and that you are the right person to do it.[4]

References

1. Walsh MM. Lessons learned from grant writing: Establishing a track record for funding and involving community partners. *J Dent Hyg.* 2009;83(4):212-213.

2. Derish P. Writing and effective grant proposal, section by section. *University of California at San Francisco*. 2005.

3. Peer review process. National Institute of Health [Internet]. [cited 2011 July 30]. Available from: http://grants.nih.gov/grants/peer_review_process.htm#Criteria

4. Mohan–Ram, V. How not to kill a grant application, Part Five, The facts of the case so far. *Science*. 2000.

Techniques for Professional Presentation of Scientific Information

Jacquelyn Fried, RDH, MS

Scientific presentations, whether delivered via posters or Power Point, are critical vehicles for disseminating cutting edge research findings.[1] Creating and delivering effective, informative and attention-grabbing presentations is no easy feat. Similar to written manuscripts, scientific presentations must be thoroughly planned, outlined and logically organized. Both the written and verbal elements of presentations are critical to the success of the whole package. The speaking and writing components of successful presentations can be taught, practiced and cultivated.[2] This workshop will discuss and detail the key elements to consider in the planning and delivery of quality scientific presentations. Topics addressed will include: creating compelling research posters and Power Point "slide shows" that incorporate visual appeal, timely content and enhanced readability, verbal delivery that considers word choice, voice flow and modulation, effective use of nonverbal communication such as eye contact and physical movement, use of approaches that appeal to different learning styles and developing a communication style that exhibits confidence, credibility and an element of fun and lightness to capture and keep the audience's attention.

Researchers who create effective scientific posters for presentation at professional meetings convey information succinctly, attractively and meaningfully. A poster should highlight the key components of a research manuscript; i.e., abstract, introduction/background, methods, results, discussion and conclusions. Attractiveness and readability are 2 major features of a well-done poster. To create visual appeal, provide different options for information giving that "pull in" the viewer. Text should be balanced with photographs, tables, graphs and/or charts. Too much text can be overwhelming and can detract from the key "take home" points. Graphics enable the concise presentation of data. Bulleting is useful for presenting a listing of information, such as delineating steps in a methodology. Font size and style must be considered as well as color. As with Power Points, too much color or the use of harsh color will deter viewers. Color has an effect on how information projects.[3] Other important elements to address include: judicious use of diverse graphics, incorporating main and subcategories to emphasize the importance of information, grammatical and punctuation parallelism, using spacing to enhance readability and key points and appropriate color variation. Posters must be titled appropriately and computer printed on high quality glossy paper. Appropriate references and institutional/corporate logos also must be included in the final poster.

Power Point presentations are another means for delivering scientific information. Some describe Power Point as the prima lingua of science since its presence in research presentations is ubiquitous.[1] The creation of effective Power Point slides (and handouts), i.e., the written components of an oral presentation, can be achieved through adherence to relatively straightforward yet critical standards or foundational guidelines. These guidelines serve to enhance audience receptivity and learning; they consider slide/content readability, viewer comprehension and the prudent use of multiple media techniques and movement for maintaining audience interest. A partial listing of elementary guidelines for successful creation of Power Point presentations includes:

- Using bullets versus complete sentences
- Keeping slides crisp and simple
- Limiting the amount of content per slide
- Selecting appropriate slide lay-outs
- Using templates that are kind to the eye and help control spacing and printing options
- Applying unity of design

Hand-outs are accompaniments to the verbal presentation and offer supplemental information that, for lack of space or other reasons, may not have been included in the slide show. Hand-outs also may reiterate and emphasize key points. They should be professionally printed. Many of the guidelines stated above apply to hand-outs.

The verbal component of the oral presentation is paramount. Power Points should be used for enhancement; the audience can read so the presenter need not and should not read slides.[3] Presenters must be tuned into their audiences. By maintaining eye contact with the audience, the presenters will know if they have captured or lost the audience. If attention seems to be waning, a different tactic should be adopted; e.g., voice modulation, a slide that shifts the tone or the presenter may ask the audience if they understood the previous point.[3] Frequent summarizations or reiterations help hold the audience's attention. Other key speaker rules include:

- Beginning the presentation in a manner that establishes rapport
- Honoring starting and ending times
- Speaking slowly and loudly

- Stepping away from the podium, if possible, in a non-distracting manner to help engage the audience
- Using good posture
- Encouraging, repeating and paraphrasing questions so that all audience members can hear and be engaged

Givens include the need to know the presentation material thoroughly, having the ability to roll with technological challenges and acknowledging others' contributions when appropriate. Ideally, the audience should feel that the presenters are passionate about their topic, enjoy being in front of the crowd and is able to say "I do not know" when an unanswerable question is posed.

In summary, the research community relies on scientific presentations as a means to disseminate and gather information, to consider new theory and to craft future research to generate new knowledge. Sophisticated technology allows for the delivery of scientific presentations that reach audiences around the world. Visuals, in the form of Power Point and poster presentations, accompany the majority of these presentations. Thus, the researcher of today and tomorrow will benefit from skills in creating effective visuals and in communicating compellingly and professionally.

References

1. LaPorte RE, Linkov F, Villasenor T, et al. Papyrus to PowerPoint (P 2 P): metamorphosis of scientific communication. *BMJ*. 2002;325(7378):1478-1481.

2. Adams C. PowerPoint, habits of mind, and classroom culture. *Journal of Curriculum Studies*. 2006; 38(4):389–411.

3. Clark J. Powerpoint and pedagogy: maintaining student interest in university lectures. *College Teaching*. 2008;56(1):39-45.

Writing For Publication in Scientific Journals

Rebecca S. Wilder, RDH, MS

Writing and contributing to the scientific literature is necessary for the progression of a profession. The American Dental Hygienists' Association has adopted the National Dental Hygiene Research Agenda which provides direction to dental hygienists on priority research areas that can help advance the profession of dental hygiene. While conducting research is vital to growth of the profession, if investigators do not write and publish the results for public review and critique, it does little to advance the status of the profession.

Writers can contribute to the literature by writing various types of manuscripts. Examples include letters to the editor, case reports, a review of the literature, short reports on a topic of interest, book reviews, systematic reviews and original research. This paper will focus on the publication of original research in a peer reviewed, scientific journal.

When planning to write a paper, it is important to determine the type of publication one wishes to contribute. Dental hygienists have several magazines and journals from which to choose. The journals that will have the most significant impact for moving the profession forward are those that are categorized as scientific, peer reviewed publications. For example, the Journal of Dental Hygiene, Journal of Dental Education and Journal of Dental Research are all examples of publications that are highly respected and publish results of original research investigations. Publishing in journals that are peer reviewed is important because readers know that the papers have been subjected to a rigorous review process by experts in the field that includes an evaluation of the research methodology, statistics and outcomes for accuracy, content and clarity. Another important aspect of the publication of original research is that it is published in a journal that is accessible via MEDLINE so that readers from around the world can access the article.

Following are guidelines for writing an original research publication for a peer reviewed, scientific journal:[1]

1. The first step is to decide on the journal to which the paper will be submitted. Once this has been determined, it is imperative that the author(s) thoroughly read the Guidelines to Authors to ensure that the paper is written in the correct format. When an author fails to strictly adhere to the required format, it is an automatic "red flag" to reviewers that other flaws may exist.
2. Abstract: The abstract is typically written last, but it is placed at the beginning of the manuscript. The abstract should provide a complete overview of the article including the question posed in the study, methodology, results and conclusions. The abstract should provide the major points of the paper.
3. Introduction/Review of the Literature: This section introduces the topic and communicates why the information is applicable or important. It states the problem and reviews the current knowledge related to the subject, points out gaps in the current knowledge, and sets the stage for why the current study was needed. Typically, journals do not require or allow a long introduction or review of the literature, so it is imperative that writers prepare a succinct section that reviews only the most important studies. Many writers think they have to review and include every article that has been written on the topic. Reviewers want to know that the writer has included the most important literature. Quantity does not always equal quality when it applies to an introduction and literature review.
4. Methods and Materials: This section should provide the reader with enough detail such that the methodology could be duplicated, including statistical tests used to analyze the data. If the author has conducted a survey, for example, they should provide samples of the questions asked in the questionnaire. Was the survey pilot tested prior to distribution to the test audience? Was it approved by an Investigational Review Board? Is the study set up to get positive results only? Was there a control group, if appropriate, for the methodology? Are subjects randomized in groups so that control and experimental groups are comparable or equal at the start of the study? It is important that studies be designed so that every obstacle that might interfere with getting objective results is accounted for before study initiation.
5. Results: The results section should report the findings from the data collection. Since this section is sometimes difficult for readers to understand, writers should use every available resource to present the results in an understandable and accurate way. Use of tables, charts and figures are one way to provide a visual display of results. Text should be used to emphasize important findings but it should not duplicate what can be found in the tables and figures. Tables and figures should be easy to read and interpret. The reader should not have to refer back to the text of the paper to understand what was presented. Many investigators will have a statis-

tician who will help them with the analysis of results. These experts can be extremely beneficial in helping the author(s) with the writing of this section of the paper.

6. Discussion: The discussion section should bring all of the elements together. It can be one of the more enjoyable parts of the paper to write because the author can provide his/her opinion and or speculate why certain results were achieved. In all other parts of the scientific paper, strict guidelines and content must be adhered to but the author has freedom in the discussion section to have an opinion as well as to suggest future directions for research related to the topic. The discussion section should also compare the results found in the study to previously published papers and speculate why similarities and/or differences were discovered.
7. Summary or Conclusions: The summary and conclusion section should be short and concise. Authors should not reiterate the results section but should briefly restate the problem, procedures and findings. No new information is introduced.
8. Acknowledgements: If an author has received funding for the project, this should be acknowledged in the paper in the acknowledgement section at the end of the summary section. In addition, authors should acknowledge a conflict of interest where one might exist. For example, if the author has received research funding from a corporate entity and one of the authors is a member of that company's scientific advisory board, this must be acknowledged. It is not necessarily a negative implication for the paper, but the relationship should be disclosed.
9. References: Every writer is ethically responsible for ensuring that the references cited are the most current ones available. Occasionally, references are cited from classic studies if no current studies have been conducted. The references should support the theoretical basis for the research results and conclusions.[2] Only original references (not secondary references) should be cited, and they should be references the writer has personally read for accuracy.

Readers rely on references to be accurate and obtainable. Web references should adhere to strict guidelines by the journal and be accessible to the reader. In general, references should be cited from peer reviewed references and not professional magazines. Also, many journals have limitations on the numbers of references that are deemed acceptable. This requirement is typically stated in the Guidelines to Authors.

Once the paper has been written, authors should have the paper reviewed by individuals who are either content experts or excellent scientific writers, or both. Many authors make the mistake of submitting a paper for publication without having it critiqued. This oversight can delay the review process.

When a paper is submitted to a journal, the editor will decide if the paper is appropriate to send to peer reviewers. Sometimes papers are returned to authors if the paper is not in the correct format or if the editor does not think the paper is appropriate for the journal. Otherwise the editor will approve for the paper to be sent out for peer review. This process may take several weeks or months. Once the first reviews have been returned to the editorial staff, they are then sent to the authors. Occasionally, papers are accepted on the first attempt but most often, the authors are asked to make revisions to the manuscript. Timelines may be incorporated in the review such that writers need to make the revisions and return it to the journal within a few weeks. If authors do not adhere to the timeline, the paper will be treated as a first submission and sent to new reviewers.

When authors submit revisions back to the journal, it is imperative that they also include a written response back outlining every revision they have made according to the request of the reviewers. This simplifies the process for the reviewers and ultimately expedites the publication process.

Of course, the final reward is seeing the paper published and knowing that a contribution has been made to the scientific literature in the author's field. Although the process becomes easier with time and experience, it is a journey that takes effort. However, the effort is worth it once the author sees his/her paper in the peer reviewed literature. Challenge yourself to become a writer and contribute to the dental hygiene profession.

References

1. Wilder RS. Understanding and evaluating research: developing skills in evaluating research articles. *Access*. 2006;20:51-53.

2. Darby M, Bowen D. Research methods for oral health professionals: An introduction. St. Louis: Mosby; 1980.

Keeping Current: Clinical Decision Support Systems

Jane L Forrest, RDH, EdD; Syrene A. Miller, BA, RDA; Greg Miller, DDS

The desire to improve the oral health of patients must start with the clinician's commitment to keep up-to-date with important and useful scientific knowledge. Although the desire may be there, the increase in the number of published articles, new devices, products and drugs has made it nearly impossible to do so. In fact, studies have shown there are widespread discrepancies among practitioners and their ability to stay current, and in some cases those variations are beyond the range of acceptability. Consequently, we now need specific skills to know how to access and critically appraise what we find, to see if clinical articles are valid and relevant. The challenge for dental hygienists is to integrate new knowledge whenever it is needed in order to provide the most appropriate care to their patients.

The combination of evidence-based skills and having computers or mobile devices with access to online databases and clinical resources begins to address this challenge. Evidence-based decision making (EBDM) incorporates the skills necessary for life-long learning that are an important part of the decision-making ability to understand, translate and apply relevant scientific evidence to patient care. This goes beyond the skills that most practitioners learned in their formal education. Therefore, this workshop is designed to introduce participants to basic EBDM concepts and skills, and clinical decision support (CDS) resources that can be used in education and practice through using case scenarios.

EBDM Concepts and Skills: EBDM is the formalized process of using a specific set of skills for identifying, searching for and interpreting clinical and scientific evidence so that it can be used at the point of care. The scientific evidence is considered in conjunction with the clinician's experience and judgment, the patient's preferences and values and the clinical/patient circumstances.[1] Thus, optimal decisions are made when all 4 components are considered.

It is important to understand research designs and the corresponding level of evidence that results from a research study. For example, knowing the level of evidence helps guide clinicians in locating appropriate research studies and then decide about whether or not they can place confidence in the findings. Since not all evidence is equal, a hierarchy of evidence exists to guide clinical decision making.[2]

The hierarchy consists of 2 categories of evidence sources: primary, or original research studies and secondary, or pre-appraised or synthesized publication of the primary/original research. Pre-appraised means that the research evidence has undergone a filtering process to include only those studies that are of higher quality, and they are regularly updated so that the evidence accessed through these resources is current.[3] Figure 1 illustrates the hierarchy[4] and the division among the 2 categories of evidence sources.

The "gold standard" for treatment questions includes the meta-analysis or systematic review (synthesis of 2 or more randomized controlled trials (RCTs) answering the same question). Also considered at Level 1 is an individual RCT. Ideally, this level of evidence is used in preparing clinical practice guidelines. These are followed respectively by cohort studies (Level 2), case-control studies (Level 3), case reports (Level 4) to studies not involving human subjects. Although each level of the hierarchy may contribute to the total body of knowledge, "...not all levels are equally useful for making patient care decisions."[5] As you progress up the pyramid, the number of studies decreases, while at the same time their relevance to answering clinical questions increases. Recognizing the level of design used to answer a question is important to evidence-based clinical decision-making.

Hierarchy of Pre-Appraised Evidence: To streamline the integration of research into practice and make it more user-friendly for practitioners, clinical decision support (CDS) resources are emerging to simplify access to relevant, usable information. Many of these resources are pre-appraised and are presented in an easy to read format that allows the user to minimize the time needed to digest the information, learn of its clinical application and determine its relevancy to the patient problem or question at hand. (Figure 2) "The goal of CDS is to provide the right information, to the right person, in the right format, through the right channel, at the right point in workflow to improve health and health care decisions and outcomes."6, p.13

Computerized Clinical Decision Support Systems (CDSS) are at the top of the hierarchy3 and require input of patient-specific clinical variables in order to provide patient-specific recommendations. At this level, the individual patient's electronic health record is automatically linked to a database that can provide the current best evi-

dence for his or her specific circumstances. This assists the clinician by providing suggestions for appropriate care, warning of possible adverse drug events and applying new information through the analysis of patient-specific clinical variables.

If a CDSS does not exist, the next best step is to look for Summaries. In dental hygiene and dentistry, these include Clinical Practice Guidelines (CPGs) that are based on a full range of evidence from the lower levels (individual studies/synopses of systematic reviews). Guidelines integrate evidence-based information about specific clinical problems and provide regular updating. CPGs are broader in scope and provide more general care and treatment suggestions than CDSS. CPGs often can be found on the websites of specific associations and organizations including the:

- American Academy of Pediatric Dentistry (http://www.aapd.org/media/policies.asp)
- American Academy of Periodontology (http://www.perio.org/resources-products/posp-pr3-1.html)
- American Dental Association, Center for Evidence-based Dentistry (http://ebd.ada.org)
- Centers for Disease Control and Prevention (http://www.cdc.gov/OralHealth/guidelines.htm)
- Agency for Healthcare Quality and Research (www.ahqr.gov)
- American Heart Association (http://www.heart.org/HEARTORG/)

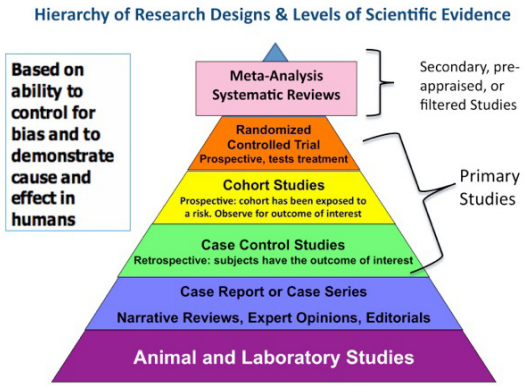
If no evidence exists at the Summaries level, the next step would be to look for Synopses of Systematic Reviews, which can be found in such journals as the Journal of Evidence-Based Dental Practice and Evidence Based Dentistry. Each journal provides a 1-2 page peer reviewed critical summary of an original systematic review with expert commentary so that the reader is able to quickly determine if it is clinically relevant to the patient.

If no evidence is available at this level, then search for individual Systematic Reviews, which can be found through such databases as PubMed, the Cochrane Library and the American Dental Association's Center for Evidence Based Dentistry. Finally, the bottom two levels relate to primary research studies. A Synopsis of single studies can be accessed through PubMed and also found in the evidence-based dentistry journals, and an individual single study also can be accessed through PubMed.

Emerging CDS Tools/Use of Mobile Technology: The infrastructure to support the application of evidence at the point of care is evolving. Not everyone has a computer chairside or is using an electronic record. However, evidence resources can be accessed via the Internet and many important topics for dental hygiene can be found. Having Clinical Decision Support tools can enhance the use of the most relevant clinical evidence in making 'real-time' decisions chairside when they are needed.

CDS includes a variety of printed and electronic tools that make knowledge readily available to help make more informed and individualized health care decisions. Some of these tools include computerized alerts and reminders, drug-dosing calculators, antibiotic management, clinical guidelines, and patient data reports. Having an electronic health record also allows a provider to quickly read legible information in the office and to access the record when away from the office.

Figure 1: Hierarchy of Scientific Evidence and Research Designs for Treatment Questions



Hierarchy of Research Design. Modified from the Evidence Pyramid. Copyright permission granted by SUNY Downstate Medical Center, Medical Research Library at Brooklyn, http://library.downstate.edu/EBM2/2100.htm[4]

Figure 2: The 6S Hierarchy of Preappraised Evidence

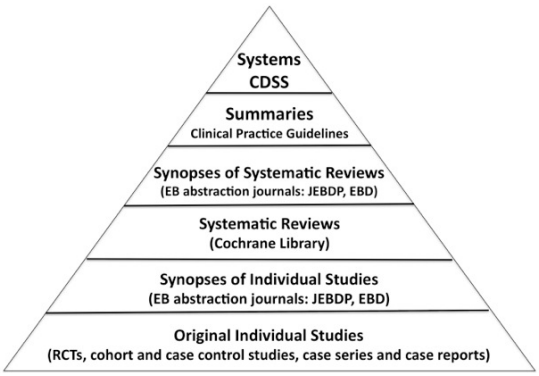


Figure adapted from the 6S Hierarchy of Preappraised Evidence by DiCenso A, Bayley L, Haynes RB. ACP J Club, 15 September 2009;151(3): JC3-3.

For example, if a patient calls the office needing a prescription, the patient can be verified as a patient of record, and the health history, treatment record and radiographs reviewed remotely via a smart phone. A prescription can then be called into the pharmacy or an e-prescription sent.

Using alert systems and accessing electronic resources through the use of mobile devices are becoming the norm. For example, journals will email their Table of Contents, which can be scanned for articles of interest. Sites such as MedScape and PubMed have specific apps for mobile devices, so again, information is at your fingertips 24/7.

Conclusion: Clinicians are inundated with information and struggle to keep current with an ever increasing knowledgebase. The development of evidence-based skills are necessary to enhance the movement of research information to the point of care (chairside) in order to ensure that better treatment decisions are made that will help improve oral health outcomes. The hierarchy of evidence helps the clinician understand research design and the corresponding level of evidence for primary and secondary research. CDS resources also are available that analyze the quality of research and synthesize study results in a precise summary. These emerging tools are designed to streamline the integration of evidence into practice.

References

1. Sackett D, Straus S, Richardson W. Evidence-Based Medicine: How to Practice & Teach EBM, 2nd ed.London: Churchill Livingstone; 2000.

2. Evidence-based Medicine Working Group. Users' Guides to the Medical Literature, A Manual for EB Clinical Practice. Chicago: American Medical Association; 2002.

3. DiCenso A, Bayley L, Haynes RB. Accessing preappraised evidence: fine-tuning the 5S model into a 6S model. *ACP Journal Club*. 2009;151:JC3-2-JC3-3.

4. SUNY Downstate Medical Center, Medical Research Library of Brooklyn. SUNY Guide to Research Methods, The Evidence Pyramid. SUNY [Internet]. Available from: http://library.downstate.edu/EBM2/2100.htm

5. McKibbon A, Eady A, Marks S. PDQ, Evidence-Based Principles and Practice. Ontario: B.C. Decker Inc. Hamilton; 1999.

6. Oshreroff JA, Teich JM, Middleton BF, Steen EB, Wright A, Detmer DE. A Roadmap for National Action on Clinical Decision Support. HiMSS [Internet]. [cited 20016 June 13]. Available from: http://www.himss.org/content/files/MU_CDS_FAQ_FINAL_April2010.pdf

Overcoming the Fear of Statistics: Survival Skills for Researchers

Karen B. Williams, PhD, RDH

ANOVA. Hierarchical linear analysis. Quadratic function. Mixed effects models. Sphericity. Heteroscedasticity. Collinearity. Non-parametric tests. A priori. Post hoc.

Statistics? Sadistics?

Statistical terminology and formulas typically evoke a natural reaction of distress, apprehension or outright fear in many researchers, both novice and experienced alike. I hear many people say: What do these terms mean? I don't understand this jargon. How do I decide which test to use? What is a power analysis? How do I grow as a researcher when I feel intimidated by statistics? Where can I get help?

Introduction: In the 1800's Benjamin Disraeli, a British Prime Minister, was thought to have quoted that there are "Lies, Damn Lies and Statistics." Some have also attributed this quote to Mark Twain. Even today, the lay public is highly suspicious about statistics and prematurely conclude that all statistics are misleading or distort the truth. Even among clinicians, researchers and scientists there is a general misunderstanding about the meaningfulness, usefulness and shortcomings of statistics in application. I cringe when I hear scientist/clinician researchers state, "The differences between groups were highly significant at p=0.008. The result of our study proved X causes Y." Inherent in these comments are 2 common fallacies. The first is that a small p value is evidence of "truth" and the second is that smaller values can be construed as a large effect. In order to understand why these assumptions are fallacies, it is important to know what the p value does and does not represent.

In research, the accepted convention for separating systematic explanations (X causes Y) from chance explanation (sampling error or measurement error) is based on testing the null hypothesis. Sampling error can occur if treatment groups differ simply by chance. Random assignment, the accepted process for assigning individuals to intervention/treatment groups in experimental research, removes procedural bias but it does not ensure that groups are equal with respect to all factors that might influence the outcome. Error can also be introduced into the data as a function of how, when, where and by whom outcomes are measured. Because both of these sources of error exist, they introduce doubt that differences between intervention/treatment groups in the outcome (Y) are solely attributable to the intervention (X). This makes it impossible to "prove" that X caused changes in Y.

We can, however, estimate the likelihood that any observed differences between groups are solely based on chance variation or dumb luck – via the null hypothesis. Abelson aptly points out that testing the null hypothesis using statistical tests is a "ritualized exercise of devil's advocacy."[1] The null hypothesis is an artificial argument that any difference between intervention/treatment groups is due to chance; it also assumes that the treatment has no effect on systematically affecting the outcome. Researchers hope that the likelihood of this is really small. The p value derived from statistical testing provides that estimate – the probability that, assuming the intervention is not effective, the intervention/treatment groups are different due to chance variation. If a small p (conventionally <0.05) is obtained, then the researcher can reject the assumption of difference likely due to chance and accept the more logical alternative – that differences are likely due to the intervention/treatment (an interesting note is that the 0.05 was established years ago and has become an accepted standard, although the researcher could just as easily determine 0.1 to be the critical p for determining significance). Notice in this description that the issue is about making a logical argument based on the most likely explanation.

The second statement, that a smaller p value can be construed as a bigger effect, is fundamentally inaccurate. The p value is strongly influenced by 3 factors: the magnitude of the effect (effect size measure), the sample size (number of observations in the study) and the amount of variation in the data (commonly the standard deviation). Because sample size drives magnitude of the p value, it is inappropriate to equate it with large effect size. The effect size is a different issue and can be computed 2 ways – the raw effect size (difference between group means) or standardized effect size (the raw effect size divided by the standard deviation). From a clinical perspective, it is helpful for researchers to think about raw effect size as the minimally important difference, which is the smallest difference in mean scores that would be considered meaningful. The standardized effect size, which takes into account the amount of variance, is a more valuable index and can be used as a measure of importance. Because it is not influenced by sample size and is independent of the measurement scale from which it is derived, it gives an objective estimate of the strength of association between the outcome and intervention/treatment. Common effect size measures include r^2, eta squared, odds ratio and Cohen's d.

The effect of sample size on the p value cannot be overlooked when interpreting statistical tests. The sample size has a direct influence the magnitude of the p value. A study with 1,000 subjects will always have a much smaller p value than a study with 100 subjects, given the same effect size or magnitude of difference between groups. Power of a statistical test (the likelihood of rejecting the null hypothesis when there is a real difference) is largely determined by the number of observations/sample size.

Finally, it should seem intuitive that if there is a large amount of variance in the outcome, the effect size will be smaller and thus the p will be larger. The bottom line is that if researchers want to get a very small p value in a statistical test, they will use a large number of subjects, will attempt to maximize the effect of the intervention and minimize the amount of variation in scores. For example, several years ago a product was developed that appeared to have good antimicrobial properties in vitro. The clinical trial used a very large sample size, had very stringent criteria for selection to limit the amount of variation between subjects and had subjects withhold oral hygiene to maximize the effect of the antimicrobial. The results of this trial showed a statistically significant reduction in plaque (<0.05) and gingivitis (<0.01). The study design maximized all factors associated with the p value. Subsequent studies that had a broader group of subjects using the product in addition to brushing failed to show statistical significance.

So, why is it that intelligent individuals are so hasty to equate getting a p value of <0.05 with truth and meaningfulness? Is this convention wholly accepted in the scientific community? The answer is, not necessarily. As early as 1978, Carver succinctly spoke out on the "fantasy" of statistical testing to provide proof of the hypothesis and then argued for caution in interpreting statistical significance.[2] In 1993, he expanded this premise of caution and added suggestions for logical interpretation of data along with use of the p value, effect size estimate and replication.[3] Since then, standards have shifted towards a more rational application of statistical testing. Probably the best example is the development of the CONSORT Guidelines for publication of clinical trials, The Improved CONSORT statement and guidelines now suggest that researchers provide information about what would be a meaningful minimally important difference in outcome, that this difference be defined in advance and that value be used as the effect size in designing and planning clinical trials.[4] Despite changes in publication standards and improved statistical techniques available via desktop programs, there is still a tendency for clinicians and researchers to fear statistics and make rash judgments about the meaningfulness of statistical analyses.

Humans innately have a need for certainty. When individuals feel uncertain and there are numerous cues to be considered simultaneously, there is a tendency to rely on one-dimensional rule-based decision making.[5] Such is the case with statistical analysis and interpretation. As Carver stated in 1995, multiple cues must be considered in order to derive valid conclusions based on study design, statistical output and exploration of defensible interpretation. Adding to this, clinician/researchers know the importance of statistics in research, but only a small percentage can proficiently conduct analyses and interpret results with confidence. In point, a cross-sectional study of faculty, residents and students at the Mayo Clinic showed that although 87% felt that training in biostatistics was important, only 14.6% felt that they could meaningfully conduct and interpret their own statistical tests.[6] While there are no comparable studies on dental or dental hygiene researchers, anecdotal evidence suggests that few clinician/researchers are comfortable and confident with biostatistics. My personal experience over the last 2 decades is that, in fact, most regress to a position of apprehension that leads them to abdicate the responsibility to a statistical consultant. In fact, that can be a very good strategy. However, getting a good statistical consult requires a level of understanding, active engagement and advanced preparation.

The goal of this workshop is to help demystify statistical testing and provide realistic strategies that can be used to improve the quality of one's own research efforts and make getting a statistical consult an opportunity for growth and clarity. I will focus on the role statistics play in helping researchers make a cogent, logical and supported argument for any research findings. In and of themselves, statistical analyses provide only 1 piece of information in the larger puzzle that needs to be considered in making a persuasive argument about the results of a study. Let us start at the beginning and outline the basics of making sound judgments regarding statistical validity in research.

The Logic of Establishing Causality: When attempting to establish whether some treatment, characteristic or intervention causes real change in a given outcome, some basic criteria must be met. At the very least, there must be a logical or biologically plausible relationship between the cause and the outcome. Simply stated, logic must prevail at the most fundamental level.

Let us take a simple example. A researcher is interested in determining if hydrogen peroxide (H_2O_2) is effective in reducing gingivitis. In vitro research has demonstrated that H_2O_2 affects gram negative and gram positive organisms though the release of

oxygen. So we can say that the first criterion of "biologic plausibility" is met. Secondly, exposure to the cause must precede development of the outcome. Back to our example of H^2O^2 and gingivitis, we obtain a group of individuals with clinically evident gingivitis (defined as having at least 40% of sites that bleed on probing (BOP)). The subjects are given an H^2O^2 product to use twice daily for 3 months and BOP is assessed at this point. If change occurs, at least we have met the criterion that the intervention precedes change in the outcome. Third, there has to be an evidence of strength of association. In other words, there is an actual relationship between the suspected "cause" and the outcome. In our example, we also randomly assigned subjects to receive the active product and a sham product without H_2O_2. We observe a reduction in the H_2O_2 group of 15% BOP whereas the sham treatment group shows no change. From this we can estimate the size of the effect using one of the effect size measures discussed earlier. We could also assess a dose-response relationship by having 3 groups (1 sham group that receives product without H_2O_2, 1 group that receives the product with 3% H_2O_2 and 1 group that receives product with 10% H_2O_2). If results show a gradient effect on BOP reduction such that the sham group <3% H_2O_2 group <10% H_2O_2 group, good evidence of causality exists because one can link "amount of intervention" with "amount of outcome."

Fourth, and critically relevant to both proper design and statistical testing, is that there has to be a lack of competing explanations. In our example, the study would have to have been designed to standardize other oral hygiene methods (brush, dentifrice, flossing and frequency of rinsing) at a minimum, but there also might be a need to explore the data for other possible explanations, such as whether groups were equivalent in amount of gingivitis at the start or differed regarding relevant factors (gender, age, etc.) that might impact amount of BOP reduction. Ultimately, the question of whether change in outcome is attributable to factors other than the intervention gets at the degree to which researchers are willing to confront their own confirmation bias. We will address that more in the next section on Comparison.

Lastly, one needs to consider the consistency of the evidence. A single study does not provide sufficient evidence to support causality, although it may contribute to the body that will eventually establish "proof." The important question is whether the results can be replicated in different samples, by other researchers and in different settings. In our example, let us say that these results show a clinically meaningful and statistically significant effect favoring the 10% H_2O_2 product compared to both the sham and 3% groups. That would provide preliminary evidence to support causality; however, unless these results are replicated by others using similar methodology, the argument for causality cannot be supported over time.

Comparison: Most, if not all clinician/researchers would argue that good design is fundamental to confidently conclude that X causes Y, irrespective of results from a statistical test. Applying good statistics to poor quality data is like putting perfume on a pig – it might smell better but it is still a pig. Certainly, having a comparison group (or better yet, a control group if possible) is necessary in order to tease apart whether any observed changes are attributable to whatever intervention (or possible causative variable) is being imposed on subjects or might result from other factors. It is through the counterfactual model that we can observe the "effect". If we impose some treatment/intervention on one group of individuals, we must also have a different group of individuals (who are relatively the same) who do not receive the treatment/intervention – any difference we observe between the groups should give us some estimate of the "effect" of the treatment/intervention.

Comparison then is a necessary element for establishing causality of a treatment or other intervention. Statistical tests allow us to decide if the difference between groups is what one would expect simply because groups vary. If it is unlikely that one would simply (by chance) have groups that differed on the target outcome by a certain magnitude, the statistical test will give us an approximate estimation of the likelihood of that event. Now, herein is the rub. While the statistical test (and associated p value) can give us an estimate of chance differences, it is not sufficient. There are always other competing explanations for why the groups might or might not have differed – and these require applied logic and consideration. These can include factors too numerous to mention, but some might include:

- Individuals in the respective groups looked the same but differed in subtle ways that we were unable to detect up front (despite randomly assigning them to groups)
- While observing people over time, what we were observing was naturally changing (e.g. aphthous ulcers and healing)
- Our measurement strategy was problematic or unequally implemented
- The study timeline was insufficient to capture real change over time
- There were missing data because not all subjects were available for all observation periods or some dropped out of the study
- There were too few subjects to capture a differ-

ence if it existed or there were so many subjects that even a trivial difference would be found to be statistically significant

The bottom line: Hypothesis testing using statistical test gives us one piece of information that is important to a larger decision process – determining the likelihood that some intervention/treatment is causally related to the outcome.

Using Statistical Tests as Part of a Logical Argument: One of the most compelling books in print today is Statistics as Principled Argument.[1] Abelson argues for use of applied logic and good judgment along with hypothesis testing to make good decisions about study results. Like Carver, he posits that for any difference observed in a study, several possible explanations are possible. In this regard, statistics, along with applied logic, can assist the researcher in exploring for and identifying possible alternative explanations. Psychologists have demonstrated repeatedly that people, even researchers, are highly susceptible to confirmation bias. Confirmation bias results in people selectively focusing on information that reinforces preexisting beliefs and ideas. Confirmation bias can result in overestimating the influence of systematic factors (like an imposed treatment) and underestimating influence of alternative explanations, including chance. The tendency to jump to the conclusion that an intervention is effective, especially if there is a p value from a statistical test of <0.05, without thoughtful consideration.

Being aware of confirmation bias, recognizing the human tendency to simplify complex decision making and developing a systematic approach to considering results is the hallmark of a good scientist/researcher. Abelson proposes a systematic approach aimed at creating a persuasive argument with the data, statistical analysis and data presentation.[1] Abelson's approach is valuable for consumers of research, but has distinct utility for researchers in the data analysis and writing phases. The approach is based on what he calls the MAGIC criteria. This acronym stands for: Magnitude (think effect size or magnitude of association), Articulation (specificity of detail that might include exploring an observed effect on subgroups or in different contexts), Generality (framing results within the appropriate context or across contexts if possible), Interestingness (given the results, how does this change the field of knowledge) and Credibility (results are conceptually grounded, logical and supported given the methods and statistical analysis). I encourage dental hygiene researchers to get this reference - learning to apply these criteria to one's own research has the potential for improving evidence used in patient care.

It should be obvious at this point that statistics and statistical analyses sit within a much larger topic of "quality of evidence" that includes design, conceptual framework, critical thought and unassailable logic. Viewed this way, statistical tests should be considered as one of many decision tools that researchers need to derive valid conclusions about their results. Since very few clinical researchers also have the depth of understanding that underlies the field of statistics and biostatistics, they are likely to not be sufficiently aware of how these tools can be used to their maximal benefit to answer meaningful research questions. Actively seeking out a consultation with a biostatistician with experience in the broad field of health-related research is one of the most effective ways to overcome a fear of statistics.

Getting a Statistical Consult: Obtaining a statistical consult and power analysis during the design phase of a study is one of the best ways to circumvent problems, maximize efficiency in the research process and reduce one's fear of statistics. There are always competing approaches that change the manner in which the study is conducted and data are analyzed. Addressing these during the planning phase will make the research process much less stressful and will promote high quality research. At our institution, we have a Research and Statistical Consult Service that is available at no cost to health care researchers. Many institutions have similar services or have individuals on the faculty who provide comparable services. Check to see what is available to you. Find someone who is knowledgeable with whom you can discuss your project.

Once you have identified a person or service, prepare for the consult in advance so that you have relevant information at hand. Review the literature relevant to the topic so that you are well prepared for the questions that the statistician will ask during the consult. Be aware that it is not sufficient to do a shallow review of the literature. As you review the literature, be attentive to how results may have changed over time. An interesting observation about study results is that effects often decrease over time. Lehrer suggests that "truth wears off" over time because our illusions about the meaningfulness of various research question declines over time. Paying attention to this and being able to articulate this trend will be important for conducting the power analysis. Having the right estimate of sample size up front will improve the likelihood of planning a doable study and having meaningful results.

In advance, draft an abstract that summarizes the project using the PICO format. In doing so, consider the following:

Population: What is the population being studied? It is helpful to know as many details about this population in advance. For instance, if the researcher is interested in targeting a specific condition, what is the prevalence of this condition in the target population? Is there a range of severity that must be considered? What other factors are related to the condition that might influence selection of subjects or design of the study?

Intervention: What is the intervention or exposure variable? What is the proposed mechanism of action of the intervention or exposure variable? Is there a threshold of intervention or exposure that needs to be considered? What have previous studies shown with respect to variations in response (effect size) for the intervention? How has the intervention/exposure variable been defined?

Comparison or Control Group: What is the most appropriate comparison or control group? What would comprise an appropriate comparison group? For experimental clinical trials, is there an attention control that could be used in lieu of no treatment? If this is an observational study, is there a comparison group that is sufficiently similar to the target group that would allow fair comparisons? For observational studies, selection of the appropriate control or comparison group can largely influence the results.

Primary Outcome Measure: What outcomes are feasible to measure? How can the primary outcome be operationally defined? Are there secondary outcomes that should be captured as well? Given these operational definitions, how have these outcomes been previously measured? Is it possible to obtain measurements in a valid and reproducible manner? If using an existing instrument, what is known about using the instrument? Under what conditions can this instrument be used? What is the unit of measurement and characteristics of how attributes of the outcome are quantified (measurement scale)?

Approach the consult with an open mind. A good consultation will usually result in modifying some aspects of your original research plan. Be prepared to capture the important recommendations from the statistician – either in writing or audio recording. Clarify any areas that seem confusing at the time. A good consultant will help you identify potential confounding variables that should be controlled either by design or statistically controlled. Make sure you leave with an understanding of how the design, measurement and statistical analysis pieces fit. Once you have drafted a proposal (comprehensive design and analysis plan), get confirmation from the consultant that you have "gotten it right."

During the consult, discuss how you will set up your data set for analysis. The statistical analysis plan, design of the study, capture of confounders, number and type of outcome measures and statistical software will dictate how your data should be entered. Unless you are completely comfortable with the statistical software and analysis plan, do not do this on your own. There is nothing more frustrating than to have all of your data entered, only to realize that it is not analyzable in that format. Most importantly, enjoy the process. Leave your apprehension at the door and look at the consult as a unique opportunity to engage in creative planning.

Statistics are wonderful tools that help researchers plan, implement and make sense of their data. Effective use of statistics, while grounded in math, really relies on applied logic. Statistical programs manage the computational aspects of the process, but do not overcome bad design and incorrect analyses. Approach the research process just as you would plan a trip to a foreign country, and you can avert the fear of statistics and pain of failure.

References

1. Abelson RP. Statistics as Principled Argument. New York: Taylor and Francis Group, Psychology Press; 1995.

2. Carver RP. A case against statistical significance testing. *Harvard Educ Review*. 1978;48(3):378-399.

3. Carver RP. A case against statistical significance testing, revisited. *J Experimental Educ*. 1993;61(4):287-292.

4. Zwarenstein M, Treweek S, Gagnier J, et al. Improving the reporting of pragmatic trials: an extension of the CONSORT statement. *BMJ*. 2008;337:1-8.

5. Erick J, Boomer J, Smith J, Ashby F. Information-integration category learning and the human uncertainty response. *Mem Cogn*. 2011;39(3):536-554.

6. West CP, Ficalora RD. Clinician attitudes towards biostatistics. *Mayo Clinic Proceedings*. 2007;82(12):939-943.

7. Lehrer J. The truth wears off: Is there something wrong with the scientific method? New York Times [Internet]. 2010 October [cited 2011 August 2011]. Available from: http://www.newyorker.com/reporting/2010/12/13/101213fa_fact_lehrer

Getting Started In Clinical Research

MaryAnn Cugini, RDH, MHP; hristine Charles, RDH, BS; Janet Kinney, RDH, MS, MS

Research career opportunities and settings are varied and diverse. Areas include public health or epidemiological research, dental hygiene profession-based research, practice-based research, university research programs and corporate research, including basic clinical and product evaluation.

Interestingly, when asked about careers in research, some hygienists associate these opportunities with "lab jobs" or "desk jobs," leaving patient contact and clinical experiences behind. Basic science is a very necessary component of clinical research, but for those wanting to utilize their basic science training combined with clinical skills gained during practice, a career in clinical research may be of interest.

Career paths in any discipline have basic building blocks or steps that enhance the journey. For clinical research, the steps include clinical experience, advanced education, networking and mentoring. In fact, career paths in clinical research for the dental hygienist include the obvious – therapist or examiner – maximizing the clinical experience provided through dental hygiene training and patient care. More advanced roles include sponsor and/or principal investigator, coordinator/manager of the research project or, in the regulatory audit or quality assurance function, usually achieved after further education in the field of clinical research. Formalized educational programs have been created to train individuals from many professions for these roles in clinical research.

There are many educational programs offered for advancement in clinical research. A Google search using "clinical research training" yielded 18,400,000 results. Programs are varied and are offered at the university level (eg: full degree or certificate-granting), through private educational services companies and associations dedicated to clinical research professionals. For example, in the U.S., Drexel University offers an online master's degree in Clinical Research Organization and Management and a Master of Science in Clinical Research for Health Professionals, in addition to online certificate programs. Other universities and colleges offer similar options. A check of local area institutions is the first search to conduct when investigating further education. One example of an international educational program can be found at The University of Kent, U.K. Private educational services, such as Barnett Educational Services, offer online training and certificate programs in clinical research.

Two professional organizations dedicated to the support of clinical research professionals are the Society of Clinical Research Associates and the Association of Clinical Research Professionals. These organizations offer training and certification for Clinical Research Associates and Clinical Research Coordinators. Additionally, these sites offer current lists of available clinical research positions.

Mentoring and networking play important roles in getting started in clinical research. Students can begin by seeking guidance from professors involved in research. Practicing professionals can access information through national dental hygiene websites that contain lists of available mentors. Dental and dental hygiene schools are another source for networking. Schools are involved in conducting clinical trials and may be advertising for clinicians to participate as therapists and research subjects. Another important resource to consider is professional publications. Authors can be contacted to provide guidance as well as offer discussion in their area of research.

Important personal attributes that may help in a successful career in clinical research include strong written and oral communication skills, adaptability, being a self-starter, attention to detail and good time management skills. Success of a study highly depends upon a variety of people being able to effectively work together, so being a good team player is crucial.

This workshop will provide interactive discussions and presentations by clinical research from academia and private industry. The goals of the workshop are to:

- Provide the participant with a good understanding of the roles and responsibilities involved in a career in clinical research
- Explore the process involved in day to day conduct of clinical trials from the perspective of the sponsor and investigator
- Compare and contrast industry and academic research career pathways
- Learn about Dental Practice-Based Research Networks designed to train clinician investigators to study problems encountered on a daily basis in practice

Using role play and open discussions, the clinical trial process will be explored from hypothesis inception through publication of results. The workshop

format is designed such that attendees will gain an understanding of the skills, roles and responsibilities involved in all aspects of clinical research. The workshop will be given by 3 experienced research dental hygienists, each providing her unique perspective on her own career path, discussing the clinical research process from each of their experiences and providing insights from the academic, corporate and contract research organization perspectives.

MaryAnn Cugini brings her career experiences in academic and industry research settings to the workshop. She will share her regulatory experience and provide a basic understanding of the importance of maintaining protocol adherence and abiding to the regulatory standards of clinical research.

Having managed clinical trials for several corporate organizations and with independent clinical research organizations as well as academic institutions, Chris Charles will provide her insights regarding selecting and validating research sites and investigators, protocol development and the rigor surrounding conduct of clinical trials, and communication/publication of results.

Janet Kinney will speak about the importance of having clinical experience and good patient management skills prior to commencing a career in clinical research. In addition, she will share how educational training in the area of research methods helps to answer the "why" questions during the inception, development and conduct of studies. And finally, as a fairly new investigator, Janet will share with the audience her thoughts about the importance of networking and having strong mentors to help guide the newcomer during the early career years.

In summary, getting started in clinical research takes some concerted effort and forethought on your part. Prepare yourself by seeking educational opportunities that train you in the field, and then be proactive about building diverse networks and relationships with experienced people who are in a position to help you achieve your career goals. Once engaged in clinical research, exercise exemplary levels of confidentiality and protection of intellectual property and always be cognizant of your obligation to comply with Good Clinical Practice procedures and behaviors.

Whether you are a just starting a career in clinical research or are a well-seasoned professional, the field of clinical research offers challenging and exciting opportunities allowing for continual growth both personally and professionally.

Introduction to Preparing a Systematic Review

James D. Bader, DDS, MPH

The profession of dentistry has developed a store of specialized knowledge that serves as the basis for decision making. This knowledge base has evolved over time, as the methods for the creation, synthesis and dissemination of knowledge have changed. At first, dental knowledge was accumulated and synthesized through experience by itinerant dentists and barber surgeons, and dissemination was limited to master–apprentice arrangements for training new individuals.

As the profession matured in the late 1700s and through the 1800s, texts, journals and dental schools emerged to aid in the synthesis and dissemination of the knowledge base. But the creation of knowledge did not change radically until the 1900s, when results of formal clinical studies began to supplant experts' opinions as the most valued form of knowledge. As the number of studies on a topic grew, the literature review emerged as an important means for synthesizing the results of individual studies.

In recent years, changes in the synthesis and dissemination of the knowledge base that have been occurring signal the beginning of a new era. The preferred means of summarizing the literature that addresses a particular question topic is now the systematic review, an approach designed to minimize the biases inherent in the review process while at the same time improving the utility of the literature synthesis for the practitioner.

The Rationale for Systematic Reviews: Systematic reviews are designed to minimize the biases that are usually present in traditional literature reviews.[1] The most frequent sources of bias in traditional reviews involve not including all of the relevant studies and not combining the information from the studies in an objective manner that takes individual study weaknesses into account. In part, these biases arise because traditional reviews of the literature tend not to be well-focused on a specific problem. Traditional reviews tend to be non-specific, and as a result it is difficult to include and carefully analyze all of the relevant literature on the broad general topic the review purports to address. In addition, bias is likely to arise when the author of a review holds strong pre-existing opinions concerning the topic. It is human nature that decisions about what studies to include and how to synthesize the results will be influenced by these opinions.

Systematic reviews focus on specific clinical questions. This more narrow focus permits a much more careful and complete search and selection process to identify and include all relevant studies that have addressed the question of interest. Because systematic reviews are designed to maximize objectivity, they require the prior determination of search methods, inclusion criteria and evaluation criteria, which helps reduce the chances of bias in inclusion of articles in the review and evaluation of the strength of included articles.[2]

Steps in Performing a Systematic Review: The initial step in performing a systematic review is the formulation of a clinically relevant key question, which identifies 4 crucial "PICO" elements. These elements are the population or patient type (i.e., the individuals or groups for whom an answer is sought),the intervention (i.e., the treatment or clinical condition of interest), the comparison (i.e., an alternative treatment or control) and the outcome (i.e., the measures used to assess effects of an intervention).

The second step is defining criteria for including and excluding studies. These criteria arise from the key question and other considerations, such as study designs, publication dates and languages and details of treatment procedures. Careful definition of these inclusion criteria, together with the key question, will define the group of individuals to whom the results of the systematic review can be generalized. Criteria for assessing the quality of individual studies are also identified in this step.

The third step in performing a systematic review is designing a search strategy. Since systematic reviews attempt to identify all studies relevant to the key question, the search for such studies should be exhaustive. It characteristically includes searching electronic indices, such as MEDLINE, EMBASE and more specialized indices depending on the key question. Examination of reference lists of all potentially eligible studies identified in the initial stages of the search is a standard technique, and the "gray literature" should also be examined, including dissertations and theses, conference reports, abstracts and unpublished studies identified through inquiries to colleagues and manufacturers.

The fourth step involves the application of the inclusion and exclusion criteria to determine eligibility for every study identified in the search. Multiple reviewers do this independently and then follow a predetermined procedure for resolving disagreements. A written record is maintained of reasons for exclusion of studies.

The fifth step of a systematic review is abstract-

ing specific information from each included study in a standardized manner. Information includes details of the study design, subjects, methods and results, along with information needed to assess the quality of the study. The extraction process is usually performed independently by 2 reviewers. Where disagreements occur through error, they are corrected. When the problem is a matter of interpretation, a third reviewer may decide, or the authors of the study in question might be contacted for clarification.

The sixth step is the analysis and presentation of results of the systematic review. All extracted data are presented in an evidence table, which facilitates comparison of the included studies. A qualitative summary of these studies, based directly on the evidence table, is usually presented that provides an overview of the designs and findings of the included studies. In most instances, the study results are evaluated for heterogeneity or between-study differences. Depending on the extent of heterogeneity, study designs and data available in the published studies, the systematic review team may also conduct a meta-analysis of the outcome data.

The final step in the systematic review, interpreting the evidence, is the only step not guided strictly by the review protocol, and the only one where some subjectivity is permissible. Here, the review's limitations and the strength of the evidence are discussed, and applicability of the study results to the clinician is considered. Equally important, the systematic reviewers may identify implications for future research.

Systematic reviews are usually completed by teams, rather than individual authors. An advisory committee composed of both clinicians and researchers with expertise in the topic may be appointed to provide critical commentary concerning the key question, the inclusion and exclusion criteria, the final list of included studies, the completed evidence table and the draft final report. Such oversight acts as an important additional step in maximizing the likelihood that the review is objective.

It is important to remember that the structure of a systematic review facilitates, but does not guarantee, an objective summary of the evidence for a clinical question. Departing from accepted standards for conducting a systematic review will increase the likelihood that the results will be biased. The reader must then determine if the increased likelihood of bias is sufficient to render the review not useful. Checklists and guidelines are available that can be used to assess adherence to recommended practices and completeness of reporting.[3,4]

Whether the question addressed by the systematic review can be definitively answered by the review is not a measure of its overall quality. Surprisingly, the results of systematic reviews are often equivocal because either the necessary studies have not been done or the quality of the studies is judged to be insufficient to address the clinical question without bias. Thus, from the standpoint of clinical applications, a primary advantage of the systematic review is also one of its greatest frustrations: it not only tells us what we do know, but also what we do not.

This workshop summary is based on content that has appeared previously.[5] Reprinted with permission from the Texas Dental Journal.

References

1. Mulrow C, Cook D, Davidoff F. Systematic reviews: critical links in the great chain of evidence. Mulrow C, Cook D, editors. Systematic reviews. Philadelphia: American College of Physicians; 1998. 1-4 p.

2. Egger M. Smith G. Principles of and procedures for systematic reviews. Egger M, Smith G, Altman D, editors. Systematic reviews in health care. 2nd ed. London: BMJ Books; 2001. 23-42 p.

3. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JP, Clarke M, Devereaux PJ, Kleijnen J, Moher D. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS Med*. 2009;6:e1000097.

4. Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, Porter AC, Tugwell P, Moher D, Bouter LM. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. *BMC Med Res Methodol*. 2007;7:10.

5. Bader JD. Systematic reviews and their implications for dental practice. *Tex Dent J.* 2004;121(5):380-387.

Design Considerations for Qualitative Research: Getting At Strawberry Milk

Alice M. Horowitz, PhD; Wendy L. Child, MS

Overview: This interactive workshop is designed to build dental hygiene researchers' confidence and skills for effectively using qualitative research methodologies, particularly focus groups and interviews, for oral healthcare research. The presenters' approach incorporates brief highlights of an institutional review board-approved qualitative research plan for, and preliminary findings from, a 2010–2011 Maryland qualitative and quantitative oral health study with pregnant women and parents of young children, and also with health care providers (dental hygienists, dentists, pediatricians, family practitioners and nurse practitioners). The study was conducted by the Herschel S. Horowitz Center for Health Literacy at the University of Maryland.

The workshop title refers to how qualitative methods, carefully and sensitively applied, can help researchers deepen their understanding of health beliefs, behavior and literacy and their origins among health care consumers, as well as the health care practices and beliefs about patients among health care providers, including oral health care and other health care providers. For example, in one focus group the presenters conducted, a young mother described her frustration with her baby's grandmother who refused to switch from chocolate milk in the baby's bottle to more healthful, fruit-based strawberry milk. The workshop addresses how to structure qualitative research to encourage candid, detailed and authentic responses, as well as ways to organize and utilize the findings, especially to help inform oral health education and oral health care practice and policy.

Following this workshop, participants will:

- Understand different ways in which qualitative research using focus group and interview methods have been used to support oral health and other health-related studies, and local, state and national health education programs.
- Understand more deeply some of the primary components of a qualitative research plan, particularly important issues that institutional review boards may not require be addressed in advance, and therefore, can be overlooked or undervalued. In particular, the presenters cover various aspects of defining the participant audience for focus groups and interviews to support research goals, developing screening criteria and instruments and methods for recruiting participants, deciding where to conduct the research, developing an engaging and productive group or interview guide, "deep listening" moderating and interviewing priorities, keeping track of data, common reporting options for simple qualitative studies and dilemmas and basic concepts in qualitative analysis.
- Know about professional resources and literature to support qualitative research for a variety of purposes.

Workshop Content: During the workshop, the presenters will use a combination of lecture, slides, demonstrations and audience participation activities to:

1. Highlight examples of their own and others' use of focus groups and interviews for oral health and other health topics to demonstrate varied use of these methodologies and the information they generate. Topics include assessing target audience knowledge, awareness, and beliefs about preventing tooth decay and oral cancer in Maryland, gauging response to messages and materials about these and other health topics, including examples from national women's health education and social marketing programs by the Centers for Disease Control and Prevention and the National Institutes of Health and pretesting survey instruments before they are fully developed and fielded.
2. Discuss the components of a research plan for focus groups and interviews, with a particular emphasis on some of the overlooked or undervalued aspects of executing research plan components, including:
   a. Defining and recruiting participants for basic focus group and interview research: You are interested in learning about low income parents' awareness of tooth decay and how to prevent it to inform the development of messages and materials to prevent tooth decay. What do you consider in defining and locating appropriate participants? The presenters will discuss various means, including building partnerships for outreach, such as with local health departments, non-government organizations (NGOs) in communities and contracting with market research companies and qualitative research consultants. They will address concerns about culturally appropriate screening criteria and recruiting methodologies that will both identify qualified participants and help to discourage "no-shows" and low engagement. Issues and options for providing honoraria for research participants are also covered.
   b. Choosing a setting and "setting the stage" for participants: Where and how do you talk

with and/or observe participants? The presenters discuss considerations for appropriate and convenient settings (in terms of location, transportation and myriad other details for different types of participants) and creating a comfortable atmosphere for research participants, including the advantages and disadvantages of professional focus group facilities, community locations, people's offices, homes, on conference calls or online. Logistical issues such as refreshments are covered, especially for oral health and other health care-related research studies given nutrition, cultural and allergy considerations.

c. Developing a focus group or interview guide and choosing a moderator or interviewer: Why are qualitative instruments called guides? And is the answer important for productive, and useable, data collection? The main elements of the interview guide and types of common questions are covered, with an explanation of critical techniques for putting participants at ease – with the moderator or interviewer, the research topic and questions (e.g., tone, semantics, language, activities), with each other, the presence of recordings and observers – to help to encourage honest, in-depth input. It matters.

   The advantages and caveats of conducting your own groups, or having students conduct groups or interviews are discussed, as well as understanding the types of services that professional qualitative moderators and interviewers offer. What kind of professional and personal background do these research professionals have? What should you look for? Does personality matter? What about language/culture/race/ethnicity/gender? How much do external consulting resources typically cost in 2011? Where do you find these resources, especially for academic research?

d. Data records, common reporting formats and dealing with qualitative data: What are the options and caveats for keeping track of qualitative data? The presenters will discuss audio and video recordings, inviting and training observers and utilizing their field notes, and guidelines for transcribing qualitative research. How do you analyze qualitative information? Can you? The presenters will highlight some of the challenges and basic concepts and products widely discussed today as qualitative research becomes more popular: content analysis, grounded theory, phenomenology, Social Cognitive Theory and other tools, such as NUDIST software. Examples of qualitative studies published in peer reviewed journals in different fields are noted, including some featuring oral health studies utilizing only notes-based analyses and themes.

3. Provide participants with opportunities to discuss and debate different aspects of qualitative techniques based on their own experience and research interests, and to ask the presenters questions.
4. Share a wide range of literature and resources regarding qualitative research, professional resources sensitive to the needs of academic researchers as peer-reviewed publications increase openness to qualitative studies and selected published articles from qualitative studies of possible interest to dental hygiene researchers.

References

1. Krueger RA, Casey MA. Focus groups: A practical guide for applied research. 4th ed. Thousand Oaks: Sage; 2009.

2. Fern EF. Advanced focus group research. Thousand Oaks: Sage; 2001.

3. Sim J. Collecting and analyzing qualitative data: issues raised by the focus group. *J Adv Nurs.* 1998;28(2):345-52.

4. Hruschka DJ, Schwartz D, St John DC, Picone-Decaro E, Jenkins RA, Carey JW. Reliability in coding open-ended data: lessons learned from HIV behavioral research. *Field Methods*. 2004;16(3):307-331.

5. Bandura A. Social foundations of thought and action: A Social Cognitive Theory. Englewood Cliffs: Prentice Hall; 1986.

Osteonecrosis of the Jaw and Oral Hygiene: A Case-Control Study from Condor Dental PBRN

Study Authors: Hujoel P, Barasch A, Cunha-Cruz J, Curro FA, Sung AH, Vena D, Voinea-Griffin AE, Beadnell S, Craig RG, DeRouen T, Dasanayake A, Gilbert A, Gilbert GH, Goldberg K, Hauley R, Hashimoto M, Holmes J, Latzke B, Leroux B, Lindblad A, Richman J, Safford M, Ship J, Thompson VP, Williams OD, Yin W

Presented by: Philippe Hujoel, PhD, DDS, MSD, MS

Introduction: The exposure of dead necrotic bone in the oral cavity is commonly referred as OsteoNecrosis of the Jaw (ONJ). Some known causes of ONJ include exposure to radiation, ingestion of radioactive elements such as radium, exposure to phosphorus or intake of intravenous or oral bisphosphonate medications. It is unclear what factors may prevent ONJ if either medical or environmental exposure is unavoidable.

Oral hygiene was suggested as effective ONJ prevention in the 19th century when the industrial fabrication of matches became associated with a first wave of ONJ cases.[1] The hypothesis that "clean teeth do not decay" was popular in those days. The specific recommendations were to clean the teeth with a small toothbrush with stiff bristles at least once a day with powder (soap with precipitated chalk). Rinsing after each meal and avoiding potential traumatic injury to the teeth (for instance, by eating nuts) was also recommended.[2]

The recommendation to practice good oral hygiene has survived the centuries. An expert panel convened by Novartis Pharmaceuticals Corporation reported that for the prevention of ONJ, "patients should be educated on maintaining excellent oral hygiene to reduce the risk of infection."[3] Similarly, the American Dental Association reported that good oral hygiene is the best way to lower the risk for ONJ.[4] To our knowledge, no controlled evidence is available to determine whether oral hygiene is an effective preventive method.

We briefly report here on some preliminary findings of a nationwide case-control study on the etiology of ONJ as it relates to the role of oral hygiene. Three Practice Based Research Networks (PBRNs) funded by the National Institute of Dental and Craniofacial Research designed a common protocol for a case-control study of ONJ.[5] This case-control study collected data on oral hygiene to determine its relationship to subsequent ONJ risk. Information on brushing, flossing and rinsing approximately 5 years before the onset of ONJ was collected. The question on the use of oral rinses was not specific with respect to the ingredients or active agents. A total of 191 cases and 573 controls formed the basis for the primary analyses. In univariate analyses, there was no significant association between brushing, flossing, or the use of oral rinses with ONJ. Patients reporting to brush once or more than 1 time per day versus those reporting not to brush once a day did not have a lowered ONJ risk (OR = 0.84, p-value = 0.69). Patients reporting to floss once or more per day had no reduced odds for ONJ when compared to those not reporting to floss once a day (R=0.9, p-value=0.56). Finally, no association was present between the use of oral rinses and ONJ. When comparing those individuals that rinsed 4 or more times a week versus those reporting to rinse 3 or fewer days a week, the odds ratio was 0.95 (p-value=0.82). After adjustment for confounding variables, no association could be identified between oral hygiene procedures and the prevention of ONJ.

In conclusion, these exploratory findings in this case-control study could not find evidence that oral hygiene plays a role in the prevention of the onset of ONJ. The potential bias associated with recollecting oral hygiene habits is an important weakness of these presented data. Future studies could collect information on oral hygiene habits to either confirm or refute these first evidence-based data on oral hygiene and ONJ prevention.

This study was supported by grants U01DE016747, U01DE016755, U01DE016750, U01DE016746, U01DE016754, and U01DE016752 from the National Institute of Dental and Craniofacial Research, National Institutes of Health, Bethesda, MD 20892, USA. Data from this manuscript were presented at the Annual Meeting of the American Association for Dental Research in Washington, DC, on March 4, 2010.

*Collaboration on Networked Dental and Oral Health Research consists of members of PEARL (Practitioners Engaged in Applied Research and Learning, http://pub.emmes.com/study/pearl/), Northwest PRECEDENT (Practice-based REsearch Collaborative in Evidence-based DENTistry, www.nwprecedent.net), and DPBRN (Dental Practice Based Research Network, http://www.dentalpbrn.org/users/publications/collaborativegroup.asp).

References

1. Andrews JB. Bull Bureau of Labor. 1910.

2. Oliver T, Cunningham G. Reports to the Secretary of State for the Home Department on the

Use of Phosphorus in the Manufacture of Lucifer Matches London. 1899.

3. Novartis Pharmaceuticals Corporation, Expert Panel. Recommendations for the Prevention, Diagnosis, and Treatment of Osteonecrosis of the Jaws. June 2004.

4. American Dental Association Council on Scientific Affairs. Dental management of patients receiving oral bisphosphonate therapy: expert panel recommendations. *J Am Dent Assoc*. 2006;137(8):1144-1150.

5. Barasch A, Cunha-Cruz J, Curro FA, et al. Risk factors for osteonecrosis of the jaws: a case-control study from the CONDOR dental PBRN. *J Dent Res*. 2011;90(4):439-444.

Dental Practice Implementation of a Point of Care Electronic Referral System for Patients Who Smoke: A Dental PBRN Study

Study Authors: Judith Huff-Shack, BS, RDH[1], Heather L. Coley, MPH[2], Thomas K. Houston, MD, MPH[3,4], Jessica H. Williams, MPH[5], Anne Hubbell, MS, RD, LD[6], Rajani S. Sadasivam, PhD[3], Ellen Funkhouser, PhD[6], Gregg H. Gilbert, DDS, MBA[7], Midge N. Ray, MSN, RN[8], for the DPBRN Collaborative Group[1]

Presented by: Judith Huff-Shack, BS, RDH[1]

Background: Tobacco use is the leading preventable cause of death in the U.S. and has been called the number one behavioral health problem. Although 1 in every 5 Americans smoke cigarettes, approximately 70% report that they want to quit smoking. There are many public health self-management interventions for smoking cessation that have been found to be effective; however, they are substantially underutilized. As more than half of smokers see a dentist at least once per year, patient referrals at point of care to a self-managed smoking cessation intervention could greatly increase their use.

Methods: We conducted a randomized controlled trial with community-based dental practices testing point-of care referrals of smokers to an interactive, tailored patient education website. Intervention practices referred patients via an electronic referral system (ReferASmoker) and control practices referred patients via a paper-based information prescription. Both control and intervention practices had access to the ReferASmoker website that has resources to assist with tobacco cessation services. The intervention practices, but not the control practices, received feedback about their number of patient referrals and the referral numbers of their peers.

Results: One hundred and one community-based dental practices from 8 states referred close to 1,900 patients to a patient education website for the self-management of smoking cessation. Based on estimates by the dental practices, the majority of patients were between the ages of 19 and 64 years, 23% of patients seen in participating practices were African American and 61% of practices saw patients with private insurance. Control and intervention practices were similar at baseline on all characteristics assessed except control practices had a higher self-reported proportion of African American patients. Based on the project coordinator comments, the ReferASmoker website was easy to use and offered useful resources to assist with tobacco control services.

Conclusions: Providers actively engaged in the program and were willing to refer patients to an online, tailored patient education website. Dental practices found the ReferASmoker tool useful and easy to implement into practice.

1The DPBRN Collaborative Group comprises practitioners, faculty and staff who contributed to this DPBRN activity. A list of these persons is at http://www.dpbrn.org/users/publications/Default.aspx

2Division of General Internal Medicine, University of Alabama at Birmingham

3Department of Quantitative Health Sciences, University of Massachusetts Medical School

4Center for Healthcare Quality, Outcomes and Economics Research, Bedford VAMC

5Division of Clinical Immunology and Rheumatology, University of Alabama at Birmingham

6Department of Preventive Medicine, University of Alabama at Birmingham

7Department of General Dental Sciences, School of Dentistry, University of Alabama at Birmingham

8Department of Health Services Administration, University of Alabama at Birmingham

Funding: This work was supported by the National Institute of Dental and Craniofacial Research, Dental PBRN Network Chair (U01-DE-16747) and the Dental PBRN Coordinating Center (U01-DE-16746)

Current Evidence For Remineralizing Therapeutics In Caries Management

J. Tim Wright, DDS, MS

Despite years of research directed at understanding the causes of dental caries and the development of preventive therapeutics for the management of dental caries, the population continues to have a substantial burden of disease. Dental caries afflicts almost the entire population by adulthood and is the most common chronic disease of childhood surpassing asthma and other common pathologies.[1] Thus the need to advance our understanding of the dental caries disease process and more effective intervention approaches remains an important undertaking. Traditional approaches to caries management include mechanical plaque control, diet modification, fluorides, antimicrobial agents, sealants and non-fluoride remineralizing therapies. The purpose of this manuscript is to briefly present our current knowledge of this latter group of therapeutics.

The caries process involves an imbalance of acid attack from the metabolic products of oral microbes during carbohydrate consumption and remineralization when the salivary pH becomes more basic and the enamel can take up new calcium and phosphate minerals to replace those lost during demineralization.[2] Saliva is a critical requisite for this process to occur. Its buffering and aqueous properties allow it to help neutralize the acids in the oral cavity and to provide the vehicle necessary to deliver critical ions to the tooth surface and to penetrate into the body of the carious lesion. Fluoride products have long been known to enhance the remineralization process and reduce caries in the population through a variety of different delivery systems.[3] Fluoride ions are highly reactive and when present in the oral cavity they will interact with partially demineralized enamel crystallites and then attract and react with calcium and phosphate ions available through the saliva and thereby stimulate remineralization. A variety of products are now commercially available that are directed at helping control dental caries by stimulating salivary production, neutralizing the biofilm pH and/or by enhancing remineralization by supplying bioavailable calcium and phosphate ions.[4] These products can be grouped into several different categories, but there can be overlap with some products using several or all of the above mentioned approaches.

Stimulating salivary flow helps reduce the risk of dental caries. This is accomplished primarily through the use of chewing gums and lozenges. There have been numerous clinical studies on the effect of chewing gum on dental caries. Gums with artificial sweeteners when chewed for 10 to 20 minutes 3 to 6 times per day results in reduction in caries compared with control groups that did not chew gum. These types of studies have been completed primarily in children and show a reduction of caries predominantly on proximal surfaces. There are several different polyol sweeteners used in gums and lozenges. There is evidence that gums with xylitol provide great caries reductions compared with sorbitol or combinations of polyols. There is currently no clinical evidence that the addition of xylitol to toothpaste or dental rinses is of any benefit in the management of dental caries.[4]

The ideal remineralizing agent will provide adequate amounts of calcium and phosphate ions to the body of the carious lesion where they are needed and will not readily precipitate on the tooth surface or increase calculus formation. A variety of compounds are currently available that are directed at fulfilling these requirements, including amorphous calcium phosphate (ACP), calcium sodium phosphosilicate and tricalcium phosphate. Most of these agents are used primarily in combination with other compounds or with fluorides and are available in toothpastes, fluoride varnishes and chewing gums. Many of these commercially available products have little or no clinical data to support their effectiveness. The most clinical data exists for ACP products and primarily in the ACP complexes that are available in some chewing gums. There is currently no clinical data showing an increased effectiveness over fluoride alone when ACP, tricalcium phosphate or calcium sodium phosphosilicate are added to fluoride varnish.[4,5] There is in-vitro data and, for some products, substantial in-situ data indicating that the addition of these remineralizing compounds can be effective.

Phosphorylated salivary proteins such as statherin are known to help enhance mineral delivery to the tooth surface and provide protection against dental caries. Research on other phosphorylated proteins, such as the milk casein phosphopeptides (CPP), suggests they could also have protective properties. These phosphorylated proteins can help bring the ions that are critical for optimal remineralization to the necessary location of the tooth surface and demineralization site. There are a number of products now available using CPP that is complexed with ACP (CPP–ACP) to enhance remineralization. The CPP-ACP complex is most commonly used in chewing gums and in a topical foam or tooth moose. The in-situ data shows the CPP-ACP complex will enhance remineralization with and without fluoride. Clinical studies are less convincing, with mostly short-term studies on white spot or early non-cavitated lesions being available at this time. Further, clinical studies are necessary to determine if the CPP-ACP products

are effective in preventing clinical caries.

Agents that modify oral pH and antimicrobial agents also are commercially available for caries management. Mouthrinse is now available with sodium hypochlorite (0.2% concentration), which is one of the most common disinfecting and bleaching agents used around the world. It also is very basic and might thus assist in neutralizing an acidic oral biofilm. The antimicrobial agent chlorhexidene is available in an oral rinse, and in the U.S. is available in a concentration of 0.12%. Other antimicrobial agents directed at controlling caries include a chlorhexidene and thymol varnish. The clinical evidence available at this time indicates that the chlorhexidene mouthrinse is not effective against dental caries, and there is no data as to additional caries prevention benefit by adding 0.2% sodium hypochlorite to a mouthrinse. There is some clinical evidence that a chlorhexidene/thymol varnish could be effective in reducing root caries in an adult population, but there is inadequate clinical data that it is effective for preventing caries in children. There are a number of products undergoing testing that will add to our knowledge of how these and new products can be used to help manage dental caries in our patient populations.

Are there risks involved with the use of any of these products? Most therapeutic agents will have some risks of adverse reactions, but for most the risks appear minimal. The elements and ions in the different remineralizing complexes are ubiquitous in the environment and quite safe if not consumed excessively. Chewing gum is not recommended for children under 4 years of age as it represents a potential choking hazard. Milk-derived peptides used in the CPP-ACP products are not recommended for individuals with a known milk allergy. Increased consumption of artificial sweeteners is associated with an increased risk of obesity and diabetes.

Incorporating caries control regimes is predicated on establishing an individual's risk for developing dental caries. There are a number of caries risk assessment tools available (e.g. American Dental Association, American Academy of Pediatric Dentistry, CAMBRA, Cariogram), all using a variety of indicators to determine an individual's risk. There is no evidence that one system is inherently superior to others, but it is critical that clinicians evaluate as objectively as possible their patients' caries risk status. Indicators such as previous dental caries, fluoride exposure, presence of enamel defects, salivary flow and consistency and dietary habits, as well as many other factors, are known to be predictive of caries risk and are thus represented in all of these caries risk assessment approaches. The current evidence shows that fluoride products are the most effective remineralizing agents. In individuals with disease that is not being controlled through more conventional approaches (e.g. hygiene, diet, fluorides, etc.), then adjunctive remineralizing approaches might be of benefit, although the clinical data to support their use is generally lacking. Some of these products could potentially be of benefit for patients who do not want to or who will not comply with prescribed fluoride therapies.

The management of dental caries remains an evolving science with new knowledge regarding the etiology of the disease, new predictive tools and new therapeutics continuing to change the landscape for the diagnosis and treatment of this highly prevalent disease. There is little question that the clinician should carefully assess each patient's risk for developing dental caries and then direct their preventive and therapeutic interventions in a targeted manner. Understanding that dental caries is an infectious and preventable disease provides the opportunity for oral health care providers to turn the tide on the dental caries epidemic by using their diagnostic skills and then selectively applying appropriate therapies directed at specific aspects of the dental caries disease process. There are numerous new agents on the market and promising new therapeutic approaches on the horizon. Clinicians are and will continue to be challenged with discerning how these agents work and the evidence to support their application in the clinical setting.

References

1. Beltran-Aguilar ED, Barker LK, 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.

2. Featherstone JD. Prevention and reversal of dental caries: role of low level fluoride. *Community Dent Oral Epidemiol*. 1999;27(1):31-40.

3. Scheifele E, Studen-Pavlovich D, Markovic N. Practitioner's guide to fluoride. *Dent Clin North Am*. 2002;46(4):831-846, xi.

4. Rethman MP B-AE, Billings R, Burne RA, et al. Nonfluoride caries preventive agents: A systematic review and evidence-based recommendations. *J Amer Dent Assoc*. 2011 (in press).

5. Cochrane NJ, Cai F, Huq NL, Burrow MF, Reynolds EC. New approaches to enhanced remineralization of tooth enamel. *J Dent Res.* 2010;89(11):1187-1197.

CAMBRA: Development and Incorporation into a Dental Hygiene Program

Diane Melrose, RDH, BS, MA, Lupe Arevalo, RDH, BS; Karen Matsumura-Lem, RDH, DDS; Donna Smith, RDHAP, BS, MSEd
Presented by: Donna Smith, RDHAP, BS, MSEd

Caries Management by Risk Assessment (CAMBRA) is becoming the standard of care in the delivery of patient care. CAMBRA is a program for managing dental decay by assessing the patient's risk category and level of caries activity to determine the most effective treatment strategies. Dental caries is treated as an infectious disease that is curable and preventable. Emphasis is on changing the behavior and attitude of patients so that they take an active role in the management of their dental decay.

With 30 years of scientific research on dental caries, Dr. John Featherstone, along with colleagues, laid the foundation for the CAMBRA guidelines and protocols.[1–3] The first guidelines were published in 2003 and are continually being evaluated and revised.[4] A Western CAMBRA Coalition was initiated in 2002 for the purpose of exchanging information about how to incorporate CAMBRA into teaching and clinical practice with representatives from 5 California schools.[5] The Coalition is continually growing to include representatives from schools across the nation, the dental products industry, the dental insurance industry, government and state licensing boards, dental research and clinical practice.

Recently, a practice-based research project for CAMBRA has been initiated. This project will begin in 2011 with a network of 17 dentists who have been calibrated on the CAMBRA guidelines and protocols. The purpose is to measure patient and provider acceptance of incorporating CAMBRA into clinical practice. The ultimate goal is to gather data to determine if there is scientific evidence to support CAMBRA as the standard of care.

Incorporating CAMBRA into dental hygiene and dental programs can be beneficial for both patients and students. By learning the scientific rationale and gaining practical clinical experience with CAMBRA, students are prepared to practice CAMBRA upon graduation.

CAMBRA Protocol Development: At the Ostrow School of Dentistry of USC, the Dean requested that CAMBRA be incorporated into the clinical program. First, a committee of 1 dental hygiene and 4 dental faculty members was formed to develop a CAMBRA protocol for use in the dental hygiene and dental program. The committee members individually read the scientific research related to CAMBRA and then met to discuss their findings. In addition, committee members attended various CAMBRA meetings and CAMBRA coalitions. Each member summarized key points that could be used to develop the school's protocol.

The committee members adopted the principle that conventional restorative treatment does little to treat the actual etiology of and risk factors leading to dental caries. The dental school will use CAMBRA to diagnose, treat and prevent dental caries from further developing. The diagnostic goals are to determine the risk level for each patient, the level of caries activity and the frequency of exams, radiographs and treatment strategies.

Once the philosophy and principle of CAMBRA were established, the next steps were to set the guidelines and protocol for incorporation into the curriculum and clinic. This included selecting the risk assessment form, determining the treatment strategies for each risk category, determining the products to be used by the patient at home and in the clinic, setting guidelines for recording the information into the computerized patient record, and guidelines for follow up.

The committee adopted a risk assessment form that is a slight variation of Featherstone's form.[3] The modifications include a different format for recording the risk factors and a very specific outline regarding the treatment strategies. Another form was developed to record patient compliance with treatment strategies. The committee made the decision to provide patients at high and extreme risk categories with a take home kit. This kit consists of 16 ounces of 0.12% chlorhexidine, 4 ounces of 1.1% NaF prescription paste, 120 xylitol gumballs, dental floss and a toothbrush. An instruction sheet is included in the kit. Patients with xerostomia are given a non-alcohol chlorhexidine rinse. For patients who have TMJ problems or inability to chew gum, xylitol mints are offered.

Another essential part of the CAMBRA program was establishing the fee, which was based on the patient population and expense of products. The CAMBRA fee includes the initial risk assessment appointment, a patient home care kit, one fluoride application, oral hygiene instructions, nutritional counseling and the first caries recall exam. Finally, the committee members determined how to educate the students and faculty.

CAMBRA Implementation: Education of the dental hygiene students included the principles and techniques for biofilm removal, nutritional counseling, fluoride and antimicrobial therapy, and patient motivation. This information is already incorporated

into the dental hygiene curriculum in various courses. In addition to these courses, the Dean, who outlined the scientific basis, provided a 1 hour lecture and general guidelines for CAMBRA and three additional hours were presented by a dental hygiene faculty member outlining the specific details of incorporation of CAMBRA into the clinical program. This education included a one-hour laboratory experience on how to conduct saliva tests.

Education of the dental hygiene faculty included 4 hours of education: a 2 hour presentation by the Dean explaining the importance, scientific evidence and an overview of the program's expectations. This was followed by a 2 hour lecture by the dental hygiene faculty committee member explaining the details of incorporating the program into the curriculum and clinic.

In addition to the educational sessions, the protocol for the program is outlined and given to each student and faculty member. Each patient treated in the dental hygiene clinic is assessed and assigned a risk category. The dental hygiene student conducts the initial assessment, which is then reviewed and approved by the faculty member. The information is recorded in the patient's electronic chart.

The following treatment strategies are followed based on the risk assessment level of the patient:

- Low Risk: oral hygiene education, biofilm control, nutritional counseling, and use of a fluoridated dentifrice 1 to 2 times per day
- Moderate Risk: all of the strategies in low risk PLUS using an over-the-counter (OTC) 0.05% NaF rinse daily, xylitol gum or mints (2 pieces 4 times per day for at least 5 minutes) and application of 5% NaF varnish (2 times per year)
- High Risk: oral hygiene education, nutritional counseling, xylitol gum, 0.12% chlorhexidine 1 time per day for 1 minute, 1 week per month, replace OTC dentifrice with a 1.1% NaF prescription dentifrice 2 times per day
- Extreme Risk: same as high risk except use of 0.12% chlorhexidine in water base, a calcium/phosphate paste and products for xerostomia, such as rinses and gels

Additional treatment strategies include saliva testing for the high and extreme high-risk categories. Initially, it was decided only to do pH testing and then eventually incorporate a saliva buffering test and bacterial culturing for use as criteria to determine the success of treatment strategies. Fluoride varnish for the high and extreme risk is recommended 3 to 4 times per year.

When needed, the patient is referred for restorative treatment after home care treatment and instructions have been provided. Radiographs are taken based on the risk assessment level: at 6 months for extreme risk, 12 months for high risk, 18 months for moderate risk and 24 months for low risk.

The goal is to move patients who are in a higher risk category to a lower risk category. Therefore, follow-up care is essential for evaluation of the patient's progress and to encourage patient compliance. For patients in the high or extreme risk category, the follow up includes a 2 to 4 week follow up appointment to evaluate compliance, a 4 month appointment to evaluate compliance and an 8 month caries recall (high risk) or 6 month caries recall (extreme risk).

Incorporating CAMBRA into a dental hygiene program does have its challenges. Key factors to success include support of the Dean, education of the students and faculty, and a patient tracking system. The biggest challenge in our program has been the follow-up care due to lack of follow through appointments with the patients. This problem is due both to patients not keeping the follow-up appointments and to students not scheduling the follow-up appointments. The committee members are meeting on a regular basis to address some of the concerns and determine solutions. Although the scientific evidence for CAMBRA is very compelling, more research on patient compliance and motivation is needed to help insure the success of CAMBRA, especially in the dental school environment.

References

1. Featherstone JD, Domejean-Orliaguet S, Jenson L, Wolff M, Young DA. Caries risk assessment in practice for age 6 through adult. *J Cal Dent Assoc*. 2007;35(10):703-713.

2. Jenson L, Budenz AW, Featherstone JD, Ramos-Gomez FJ, Spolsky VW, Young DA. Clinical protocols for caries management by risk assessment. *J Cal Dent Assoc*. 2007;35(10):714-723a.

3. Spolsky LW, Black BP, Jenson L. Old, new, and emerging. *J Cal Dent Assoc*. 2007;35:724-737.

4. Featherstone JD, Roth JR. Cariology in the new world order: moving from restoration toward prevention. *J Cal Dent Assoc*. 2003;31:129-133.

5. Young DA, Buchanan PM, Lubman RG, Badway NN. New directions in interorganizational collaboration in dentistry: the CAMBRA coalition model. *J Dent Educ*. 2007;71(5):595-600.

Abstracts for Poster Presentations

Professional Education and Development

Measuring the Short Term Effects of Incorporating Academic Service Learning Throughout a Dental Hygiene Curriculum

Melanie Simmer-Beck, RDH, MS; *Cynthia C. Gadbury-Amyot, MSDH, Ed.D; Nancy T. Keselyak, RDH, MA; Karen B. Williams, RDH, PhD; Bonnie Branson, RDH, PhD

Problem Statement: Academic dental institutions have been called upon to serve as safety nets for the underserved, and contributors to the well-being of their communities through accessible oral healthcare services. Academic Service Learning (ASL) provides the venue for dental education to take oral health care services directly into communities while at the same time promoting professional responsibility within their student bodies. **Purpose:** The purpose of this study was to quantitatively examine change in preexisting attitudes and behaviors of dental hygiene students with regard to providing oral health care to low income, unserved and/or underserved populations following the incorporation of academic service learning activities throughout a dental hygiene curriculum. **Methods:** Ninety first year dental hygiene students from the classes of 2006 to 2008 were recruited during their first semester in the program. Student participants (n=77) completed the UMKC SSIRB consent. A survey instrument developed by Shiarella, based on Schwartz's Helping Behaviors Model, was used to assess students' attitudes towards community service. Additionally, questions were developed using Shinnamon's Methods and Strategies for Assessing Service-Learning in the Health Professions. **Results:** Data were entered into SPSS software for descriptive and inferential analyses. Internal estimates using Cronbach Alpha were computed on subscales and all were above 0.8. Wilcoxon Signed Ranks Test was used to analyze change over time. Results of the study revealed enhanced learning (p=0.000), self-awareness (p=0.000), volunteerism (p=0.007), sense of individual responsibility (p=0.038) and costs (p=0.000) were statistically significant. Seriousness, connectedness, benefits, career benefits, normative helping behaviors, awareness and intentions were not statistically significant. Further investigating these domains revealed minimal to no changes in median values and interquartile range. **Conclusion:** The largest change in perceptions over time related to enhanced learning, self-awareness, and costs followed by volunteerism and sense of professional responsibility. In concert with the literature on ASL these experiences throughout the curriculum resulted in students' increased awareness of community need and their roles as oral health professionals.

National Survey of Oncology Teams' Knowledge, Education and Patient Management Regarding Oral Care in Cancer Therapy

Rebecca Tranmer RDH, BS; *Linda D. Boyd RDH, RD, EdD; Bernadette Howlette MS, PhD; Tara Johnson RDH, PhD; Denise Bowen, RDH, MS

Problem statement: Oral health professionals are largely missing from oncology teams in the U.S. The responsibility of oral health education and prevention strategies has fallen on the oncology team. **Purpose:** To describe U.S. oncology team members' (registered/oncology nurses, licensed independent practitioners [LIP], dietitians) oral health knowledge, management of oral complications and comfort level in providing oral care. **Methods:** A randomized sample (n=113) of individuals from Oncology Nursing Society (ONS) completed a cross-sectional, descriptive, web-based survey. Quantitative methods were used to assess oncology team members' knowledge/oral health education in oral complications associated with cancer care, management of oral complications during cancer care and comfort level of respondents performing oral care to cancer patients. **Results:** Frequency distributions were calculated for 5 point, Likert-type and multiple choice items on the survey questionnaire. Most respondents (89%) received oral health training in their specialty oncology education. The majority (90%) of respondents performed oral examination for high risk patients; however, 20.21% (n=23/94) used no indices to assess oral complications. The most common index used was the World Health Organization's Mucositis Index (n=66/94, 70%). The majority of respondents (n=61, 53.98%) reported less than 1 hour of oral health continuing education

in the last year. **Conclusions:** This study shows a need for continuing education to increase consistent implementation of existing evidence-based oral health protocols and to provide oral health education for oncology members without specialized oncology training.

Incorporating Oral-Systemic Evidence into Patient Care: Knowledge and Opinions of North Carolina Dental Hygienists

*Kathryn P. Bell, RDH, MS; Ceib Phillips, PhD; David W. Paquette, DMD, MPH, DMSc; Steven Offenbacher, DDS, MS, PhD; Rebecca S. Wilder, RDH, MS

Problem Statement: Although associations between periodontal and systemic health have been consistently reported, little data are available on the knowledge and attitudes of dental hygienists (DH) regarding this relationship. **Purpose:** To determine the knowledge levels of North Carolina DH regarding oral-systemic evidence, and assess their attitudes and confidence toward incorporating this evidence into practice. **Methods:** An IRB approved survey was developed, pilot tested, revised and mailed to 1,665 licensed DH in North Carolina. **Results:** After 3 mailings, the response rate was 62%, with 52% (n=859) meeting inclusion criteria. Only descriptive statistics are reported. DH most often identified "poor oral hygiene" as a risk factor for periodontitis (98%), cardiovascular disease (CVD) (75%), adverse pregnancy outcomes (62%) and diabetes (62%). Risk factors for systemic conditions were correctly identified less frequently (only 33% identified alcohol use as a risk factor for osteoporosis, and only 24% identified race as a risk factor for adverse pregnancy outcomes). Almost all (94%) agreed or strongly agreed that DH should be trained to identify risk factors for oral-systemic disease, and 78% felt that DH should be trained to actively manage patients with systemic disease. More than 75% reported being confident about discussing potential oral-systemic risks with patients who have CVD and diabetes. Far fewer were confident (36%) that they had the skills to ask patients about their alcohol consumption habits, although 48% were confident about counseling patients about the effect of alcohol on systemic health. Eighty-eight percent felt that dental and medical professionals should be taught to practice in a more collaborative way, and 75% felt that medical providers should be trained to screen patients for periodontal disease. **Conclusions:** In-depth, interprofessional and continuing education on oral-systemic health are indicated to improve DH knowledge levels and confidence in translating the evidence to patient care.

*Reprinted by permission of the Journal of Dental Education, Volume 75, Issue 2, Feb¬ruary 2011. Available from: http://www.jdentaled.org

Constructing a Dental Hygiene Education: A Survey of Educational Methods

*Marcia H. Lorentzen, RDH, MSEd, EdD

Problem Statement: Educational methods implemented in dental hygiene education impact student learning. Changes in educational methods may be necessary to address the needs of today's dental hygiene students and the society for whom they will provide care. **Purpose:** To examine the educational methods used by dental hygiene faculty and determine if methods implemented supported the construction of learning. **Methods:** A snowball purposive sample of 308 accredited dental hygiene programs was utilized. The educational methods survey was modified with permission from research conducted in nursing programs. The new electronic survey was field-tested with a convenience sample of dental hygiene educators prompting modifications addressing reading ease, fluidity of content and response selection format. All survey responses remained confidential. Descriptive statistics and Spearman's rho were used to analyze quantitative data. Qualitative data was organized and analyzed thematically. IRB approval was obtained from the University of Bridgeport. **Results:** Two–hundred and thirty educators participated in the research. Lecture was always or often used for teaching (85.1%). Case studies were sometimes or often used by 86.9%. Problem-based learning was often or sometimes used by 55.1% to reinforce or assess student learning. Cooperative learning was often or sometimes used by 72.5%. More than half (50.8%) never used concept mapping. Games and computer-assisted instruction were never used by 35.2% and 30% respectively. Metacognitive strategies were equally often, sometimes and never used (25.6% to 28.6%). There was significance between lecture and years teaching (p=.034), and nearing significance between metacognitive strategies and years teaching (p=.051). Challenges to using constructive learning methods were lack of commitment, support and training. Strategies for implementing constructive learning methods included stimulation, technology and institutional support. **Conclusions:** Faculty chose active-learning educational methods to help students construct their education. With leader encouragement, faculty development and institutional support faculty may choose to implement and maintain student-centered learning methods.

Dental Hygiene Student Service-Learning, Assessment of Future Intentions For Civic Engagement: A Pilot Study

*Brenda L. Armstrong, RDH, MDH; Kathleen J. Newell RDH, PhD

Problem Statement: Dental hygiene educators recognize the importance of preparing their students in civic and professional engagement as future members of their profession. The pedagogy of service-learning has been employed to increase the student's awareness of professional and civic responsibilities. Central for the understanding of civic engagement is reflection. Reflection promotes the program goals and helps clarify for students both social issues and personal values, while also examining their role in various communities. Although service-learning and reflection have been utilized to some extent in dental education, little has been reported in the literature on the effects both have on students' intentions for future civic engagement. **Purpose:** The intent of the study was to determine if service-learning, with reflection, was associated with dental hygiene students intended future civic engagement. **Methods:** Subjects included a convenience sample of 23 University of Minnesota senior dental hygiene students who participated in a 2 week long service-learning with reflection experience at a rural dental clinic. Data were collected using a researcher designed questionnaire including close-ended and open-ended items as well as audio-recorded discussions. A 2-sided paired t-test was used to analyze the quantitative data, along with descriptive summaries. Qualitative analysis, of written reflections and audio discussions, was utilized to help answer the research question. **Results:** There was no statistical difference from pre- to post-test; however, student written reflections and audio discussions revealed various categories and supporting themes of intent for civic engagement. **Conclusions:** In order for there to be a better understanding of civic intentions of dental hygiene students, civic engagement needs to be defined along with behaviors that exhibit engagement.

*Reprinted by permission of the Journal of Dental Education, Volume 75, Issue 2, Feb¬ruary 2011. Available from: http://www.jdentaled.org

Using the Health Sciences Reasoning Test to Assess Development of Dental Hygiene Students' Critical Thinking

*Jacqueline Freudenthal, RDH, MHE

Problem Statement: Dental hygiene programs strive to select students who possess critical thinking and reasoning skills hoping these students will further develop the skills necessary to provide comprehensive patient care; however, valid measures of critical thinking are needed. **Purpose:** The purpose of this study is to evaluate The Health Sciences Reasoning Test (HSRT) as an assessment tool to measure progress of baccalaureate dental hygiene students' critical thinking and reasoning skills from admissions through graduation and licensure examinations. **Methods:** The sample consisted of the admissions and academic records of dental hygiene applicants from 2008 to 2011. The HSRT was administered to qualified applicants (n=175) and as a posttest (n=46) to senior students one month prior to graduation. The HSRT measures 5 parameters (inductive and deductive reasoning, analysis, interpretation, inference and evaluation). A total score represents a measure of overall critical thinking skills. **Results:** Pearson Correlation indicated a moderate predictive relationship between cumulative gpa (r=0.320, p=<0.001), natural science gpa (r=0.295, p=<0.001) and the pretest HSRT score. A paired samples t-test showed dental hygiene students' (n=46) HSRT scores increased, but not significantly, (p=0.160) between admission and graduation. The HSRT score at admission was moderately predictive of the post HSRT (r=0.658, p=<0.001). Paired sample t-tests demonstrated a change in the subscale "Evaluation" from pre–test (4.54/6.00) to post–test (5.00/6.00). Significant correlations (r=0.295) were not found with pre– or post–test HSRT scores and National Board Dental Hygiene Examination scores. Other correlations were weak and non-significant (p≥0.05). **Conclusions:** The data indicate a positive change in these students' ability to evaluate the logical strength of a situation. Additional data are required to assess whether the HSRT is a reliable and predictive assessment tool.

Basic Science

Dentin Permeability of Two Commercially Available Anti-Sensitivity Dentifrices - Colgate® Sensitive Pro-Relief™ Vs. Sensodyne® Rapid Relief

*Rahul Patel, Suman Chopra, Diane Cummins, Mark Vandeven, Rishabh Shah

Purpose: The in-vitro effects of 2 commercial sensitivity relief toothpastes, one containing 8.0% arginine and an insoluble calcium compound (Colgate® Sensitive Pro-Relief™) and 1 containing 8% strontium acetate (Sensodyne® Rapid Relief) in occluding dentin tubules and reducing fluid flow were compared using hydraulic conductance (Flodec). **Method:** Human dentin segments were cut from extracted molars, mounted on acrylic blocks, etched

and connected to a Flodec to measure hydraulic conductance. Segments were divided into 2 groups (n=6) and treated with either the arginine/calcium carbonate or strontium-containing toothpastes. The blocks were rinsed and conductance was measured. Between treatments, blocks were rinsed and incubated in PBS for at least 2 hours. There were a total of 3 one minute treatments (first finger-tip and next 2 using toothbrush). After third treatment, blocks were incubated in PBS for overnight and conductance was measured. The 2 groups were further divided into 3 sets of 2 segments each, which were challenged for 1 minute with either 6% citric acid, Orange Juice or Grapefruit Juice. **Results:** This study showed that the toothpaste containing arginine/calcium carbonate provided a significantly higher percent reduction in fluid flow immediately after finger-tip application, as well as after 2 brushing cycles compared to the strontium-containing toothpaste ($p<0.05$ in all cases). Even after acid challenges, the percent reduction in fluid flow of dentin treated with the arginine/calcium carbonate containing toothpaste was significantly higher than the strontium-containing toothpaste. This is consistent with results from a clinical study which showed that the arginine-containing toothpaste provided instant relief of dentin hypersensitivity, whereas the strontium-containing toothpaste did not. **Conclusions:** Based on this in-vitro hydraulic conductance study, toothpaste containing arginine/calcium carbonate and an insoluble calcium compound is significantly more effective in occluding dentin tubules than toothpaste containing strontium acetate. Further, the superior occlusion obtained with the arginine toothpaste is resistant to acid challenge.

This project was sponsored by the Colgate-Palmolive Company.

Reprinted by permission of the Journal of Dental Research, Issue 90(A), 2011 (www.dentalresearch.org).

The Effect of 5000 PPM Fluoride Dentifrices With and Without KNO_3 Providing Resistance to Acid Exposure

*Marilou.T. Joziak, A.M. Morgan, M. Prencipe

Purpose: Determine the calcium loss from acid exposure to hydroxyapatite disks (HAP) treated with 5,000 ppm and 1,450 ppm fluoride dentifrices with and without KNO_3. Determine the resistance to pH change of 5,000 ppm and 1,450 ppm fluoride dentifrices from addition of an acid solution. **Methods:** HAP disk acid treatment - Saliva coated hydroxyapatite disks were treated with a dentifrice slurry consisting of 1 part dentifrice, 2 part water and rinsed 2 times with 5 mL deionized water. Disks were then exposed to acetic acid at pH 2.4 for 30 minutes and the acid solutions analyzed for total calcium using atomic absorption spectroscopy. The test dentifrices were: a) 5,000 ppm fluoride + 5% KNO_3, b) 5,000 ppm fluoride, c) 1,450 ppm fluoride + 5% KNO_3 and d) water control. Three replicates of each were tested. Resistance to pH change from acid addition - A slurry consisting of 1 part dentifrice, 2 part water was prepared. A solution of 0.1 NHCl was added until the pH of the slurry reached approximately 3.5. **Results:** HAP disk acid treatment: The calcium data indicated that the 5,000 ppm fluoride dentifrices released statistically significantly less calcium into the acid solution indicating greater acid resistance ($a=b>c>d$; $p<0.05$). Additionally, the presence of 5% KNO_3 in the 5,000 ppm fluoride dentifrices did not significantly affect its acid resistance ability. Resistance to pH change: A greater volume of acid was required to lower the pH for the 5,000 ppm fluoride formulas indicating greater acid resistance than the 1,450 ppm fluoride dentifrice. **Conclusions:** These experiments suggest that 5,000 ppm fluoride formulas provide superior resistance to acid challenge than a 1,450 ppm fluoride + 5% KNO_3 formula. The addition of 5% KNO_3 to a 5,000 ppm fluoride formula did not impact its acid resistance properties.

This project was sponsored by the Colgate-Palmolive Company.

Reprinted by permission of the Journal of Dental Research, Issue 90(A), 2011 (www.dentalresearch.org).

Access to Care/Health Disparities

Dental Hygienist Attitudes toward Willingness to Volunteer Care for the Underserved Population

*Lynn A. Marsh, RDH, EdD

Problem Statement: The social responsibility of oral health care providers regarding care for the underserved population has become an area of growing awareness and importance relative to its impact on communities and personal welfare. **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 which addressed social responsibility, spirituality, community service, sensitivity to patient needs, job satisfaction, and volunteerism. All items on the survey instrument were subjected to a factor analysis in SPSS version 19.0 utilizing 109 surveys to acquire distinct variables. Based on the factor analysis, the six original variables were reduced to three variables which included job satisfaction, attitude toward community

service and sensitivity to patient needs. **Results:** Results of this research study indicated that for registered dental hygienists their level of education, membership in their professional association, attitude toward community service and sensitivity to patient 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. **Conclusions:** 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 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.

Developing an Oral Health Education Program for Personal Care-Providers Using an Interactive Consultative Approach

*Janet Munn, Karen McNeil, Mary McNally, Sandra Crowell

Problem Statement: Oral health directly impacts the health and well being of many seniors living in long-term care, but there continues to be an issue of access to care in many rural areas. There are no comprehensive oral care policies established, which makes providing care in rural areas extremely challenging. Purpose: To establish an education program for personal care providers that includes support, tracking and evaluation strategies. This knowledge translation/exchange initiative is part of an ongoing interdisciplinary community based research project in Nova Scotia, Oral Care in Continuing Care Settings: Collaborating to improve policies and practices. In January 2010, dental hygienists as part of a research team developed materials to provide education, training, policy change and evaluation to support personal daily mouth care practices for frail older adults living in three long-term care facilities. Methodology: Using an interactive consultative process, personal care providers were engaged in focus groups, an action planning workshop and informal discussions to establish relevant education topics and special support required to enhance the provision of personal daily mouth care. Ideas were modified with direct feedback from end users. Evaluation forms and periodic diary studies were collected. Results: Educational topics were established and dental hygienists presented four oral health education topics at each site: 1) Oral Health: The Basics; 2) Caring for Adults with Dementia; 3) Palliative care –oral care and 4) Oral Hygiene Tools and techniques. An oral health toolkit prototype was developed that includes a process for individualizing patient requirements using detailed, color-coded "care cards". Evaluation of the program was positive. Conclusions: Relevant knowledge translation products were developed that include: oral health education modules (Power Point presentation and DVD) for each education topic; direct messaging posters; individualized oral health tool kits for each resident; a comprehensive program resource binder and website. "This research is funded by the Nova Scotia Health Research Foundation."

Visits to U.S. Emergency Departments for Oral Health Problems

*Becky DeSpain Eden, RDH, MEd, MPH(c)

Problem Statement: People with limited access to oral health care seek routine and urgent dental care in hospital emergency departments, despite the high cost of care in these facilities, inadequacy of most to provide appropriate treatment and the recognized issue of overcrowding. **Purpose:** This study determined the relationship between emergency department visits (EDV) for oral health problems (DV) and characteristics in 3 domains associated with EDV: demographics, source of payment and visit features. **Methods:** Data from the ED component of the National Hospital Ambulatory Medical Care Survey (NHAMCS), which uses a nationally representative probability sample, were analyzed using Stata 11. Descriptive statistics were tabulated and variables meeting National Center for Health Statistics criteria for reliability were retained. Explanatory variables for DV were identified by Pearson $\chi 2$ (p value<0.05). **Results:** NHAMCS recorded 142 799 EDV between 2002 and 2005, representing 448.5 million EDV nationwide. Analysis shows that DV accounted for 2.24% of all EDV (n=3313) or an annual average of 2.5 million visits. Adults 18 to 64 years made 80% of DV and 57% of all complaints were for toothache or abscess. DV differed significantly from non-dental EDV for variables of age, race, ethnicity, institution resident, payment source, visit day, injury related and receiving medications (p value<0.01). **Conclusions:** Results suggest inefficient use of ED for oral health problems. Adults with toothache or abscess receive medications but few procedures, indicating lack of definitive treatment for complaints. Solutions to this problem are

needed and may include new programs that provide urgent dental care outside of ED and increase adults' access to preventive oral healthcare. Further analysis is needed to determine interactions of independent variables.

The University of North Texas Health Science Center-Fort Worth IRB exempted this study from review. This investigation supports ADHA research priorities A.4, A.6, and B.1.

Clinical Dental Hygiene Practice

Expanding HIV Rapid Testing In the Dental Setting: HIV Knowledge and Attitudes Among Senior Dental Hygiene Students

Anthony Santella, DrPH, MPH; Bhuma Krishnamachari, PhD, MS, CGC; Janet Tuthill, RDH, MA; Marilyn Cortell, RDH, MS, FAADH; *Winnie Furnari, RDH, MS, FAADH; Susan Davide, RDH, MS, MSEd

Problem Statement: In the U.S., an estimated 25% of people living with HIV/AIDS do not know their positive HIV status. Expanding HIV rapid testing in the dental setting may increase the number of people who know their HIV status and can begin appropriate treatment early. The dental hygienist, with proper knowledge and training, may fill this potential role. **Purpose:** The purpose of this pilot study was to explore the hypothesis that senior dental hygiene students with high knowledge about HIV should have more favorable attitudes toward caring and educating HIV-infected persons. **Methods:** Cross-sectional survey data were collected via convenience sampling from 148 senior dental hygiene students attending accredited dental hygiene programs in New York City using a modified survey from previously validated instruments. Individuals with high knowledge (scores above 80%) were compared with those with lower knowledge. Unconditional logistic regression was used to calculate age, gender and race adjusted odds ratios evaluating the relationship between knowledge level and stigma/attitude. **Results:** Out of a total test score of 18, the high knowledge group had a mean test score of 16.4 and the lower knowledge group had a mean score of 11.9. Those with a high knowledge score were less likely to indicate that they would refer HIV infected patients elsewhere, if they could do so without professional recrimination (OR=0.33, 95% CI 0.13, 0.85). Those with high knowledge scores were also more likely to be comfortable interacting on a social level with an HIV infected individual (OR=4.54, 95% CI=1.46, 14.18). **Conclusions:** High knowledge about HIV was associated with a willingness to interact with HIV-infected persons in a professional and social content. Thus, senior dental hygiene students with required training may be willing and able to conduct HIV rapid tests. Additional research is needed to explore willingness to conduct rapid HIV testing.

Patient Related Outcomes of Initial Periodontal Treatment

*Kerstin Öhrn, PhD, RDH; Birgitta Jönsson, PhD, RDH

Problem Statement: Dental hygiene treatment often results in improvement in periodontal status, but very little is known if patients are of the opinion that there is an improvement. **Purpose:** The objective with the present study was to evaluate patients' perspective of initial periodontal treatment (information, instruction, scaling and root planing). **Methods:** A total of 97 of 113 patients (86%) with periodontal disease completed the UK oral health-related quality if life questionnaire (OHRQoL-UK) and a check list of questions on their rating and satisfaction with general and oral health before and after initial periodontal treatment. The OHRQoL-UK is a 16 item questionnaire. Scoring uses a 5 point Likert scale from very bad (1) to very good (5). The differences were analyzed with paired t-test. **Results:** After completion of the initial periodontal treatment, the patients´ reported an overall improvement in their OHRQoL (57.0 vs 52.5, $p<0.001$) indicating that initial periodontal treatment provided by dental hygienists is effective as assessed by the patients. There was a significant improvement in scores for 10 out of the 16 questions. In addition, patients rated their oral health as better after treatment, and they were more satisfied with their general health and their teeth after the treatment. **Conclusion:** Initial periodontal treatment improved OHRQoL and patient satisfaction with general and oral health, indicating initial periodontal treatment provided by dental hygienists is effective as assessed by patients. The abstract was submitted and accepted to the IFDH symposium in Glasgow 2011 and the poster was shown.

Endoscopic vs. Tactile Evaluation of Subgingival Calculus: A Calibration Trial

*Joy B. Osborn, RDH, MA; Pat A. Lenton, RDH, MS; Christine M. Blue, RDH, MS; Scott Lunos, MS

Problem statement: Endoscopic technology has been developed to facilitate subgingival imagery for diagnostic and therapeutic phases of periodontal care. However, no research could be found on training and calibration using this technology. **Purpose:** The purpose of this study was to compare the reproducibility levels of 2 clinical examiners to detect subgingival calculus, using both tactile (manual explorer) and endoscopic methodology. **Methods:** Two dental hygienists underwent training for using endoscopic technology (Perioscope™). Training activities reinforced the required two-handed technique, acclimated examiners to subgingival images at 24-48x magnification and allowed practice with periodontal patients. A convenience sample of 6 subjects with periodontitis and subgingival calculus were recruited from the University of Minnesota School of Dentistry. A calculus index (0 to 3) was used for both the Perioscope™ and tactile evaluations. Intra- and inter-examiner agreements were determined by using a weighted kappa statistic as well as percent agreement. **Results:** The within-examiner Kappa statistic for the 2 examiners was 0.71 and 0.64 using tactile and Perioscope™ methods, respectively. The between-examiner Kappa statistic for the 2 examiners was 0.48 and 0.38 using tactile and Perioscope™ methods, respectively. Percent inter-examiner agreement (+1) for repeated tactile measures ranged from 96.1% to 96.7%, and 92.2% to 93.2% for repeated perioscope measures. These were not significantly different (GEE model; p=0.19). **Conclusions:** A high percent of agreement within and between examiners was achieved for both tactile and Perioscope™ calculus detection methodologies. These are comparable to generally accepted levels for periodontal calibration studies in the literature.

This project was funded through the Oral Health Clinical Research Center, University of Minnesota.

Plaque Removal by Two Different Power Brush Heads

*Rebecca VanHorn, RDH, BA; Malgorzata A. Klukowska, DDS, PhD; Julie M Grender, PhD

Problem Statement: There is a need to understand whether there are differences in performance of store brand (Private Label (PL)) power brush heads versus branded power brush heads. **Purpose:** The purpose of this study was to evaluate the plaque removal efficacy of 2 power brush heads after 6 weeks of wear. **Methods:** A randomized, examiner-blind, crossover design study with 2 study parts (home wear phase and single-use crossover phase) was conducted. During the first phase subjects used each of 2 power brush heads (PL or Oral-B Precision Clean (OPC)) with the same Professional Care Series handle for 6 weeks at home. During the second phase subjects reported to the clinic and plaque removal of both brush heads after 6 weeks use were examined in a randomized four period crossover design. Plaque was scored before and after brushing using the Modified Quigley-Hein Plaque Index. **Results:** Forty-eight subjects were enrolled and 47 subjects completed both phases. Baseline whole mouth plaque scores were 2.157 and 2.120 for the branded brush head and store brand treatments, respectively, and did not differ significantly from each other (p=0.074). The adjusted mean plaque reduction (baseline minus post-brushing) was 1.022 (47.4% reduction vs. baseline) for the OPC and 0.828 (39.1%) for the PL brush head. An analysis of covariance showed that the OPC brush head provided statistically significantly higher plaque reduction for the whole mouth (23.4%), approximal (30.1%) and in mid-tooth regions (13.0%) than the PL brush head (p<0.001). **Conclusions:** The branded power brush head removed statistically significantly more plaque (whole mouth, approximal and mid-tooth) as compared to a store brand product after 6 weeks of wear. Both brushes were well tolerated.

Funding was provided by P&G.

Multi-Factorial Predictive Research to Assess Daytime Plaque Levels of Dental Professionals

*J. Leslie Winston, DDS, PhD; Matthew L. Barker, PhD; Amy A. Walanski, BS

Problem Statement: Dental professionals are viewed as oral hygiene experts by their patients. Given their high expectations this study was designed to examine whether there was homogeneity in plaque levels amongst dental professionals and the impact of demographic characteristics. **Purpose:** The purpose of this study was to assess the relationship between daytime plaque levels relative to time since brushing, age, gender, geographic location and profession type. **Methods:** Dental professional volunteers from 6 dental conventions were given IRB approved consent prior to completing a brief survey and digital image. The survey questions determined location of meeting, dental profession type, age, gender and time since last brushing. After completing the survey, subjects

swished with 5 mL of a 1,000 ppm fluorescein rinse to disclose plaque and a digital image was collected using standardized lighting by a trained digital imaging technician. The images were remotely masked and analyzed. Multiple regression analysis was performed to determine which survey factors were related to the daytime plaque area coverage. **Results:** The mean (SD) age of 454 subjects was 39.8 (12.3) years ranging from 18 to 74, and 76% were female. Sample size per meeting varied from 69 to 88 subjects. Daytime plaque area % ranged from 0.3 to 59.0, with a mean of 11.4 (SD=9.6). Time since last brushing ranged from a few minutes to 18 hours, with a median of 4 hours. Significant ($p<0.05$) predictors of plaque area were gender (males higher), age (slope=0.076, SE=0.038), time since last brushing (slope=0.33, SE=0.14), and meeting location (location #2 had more plaque). Profession type was not a significant factor in the model (directionally hygienists lowest, dentists highest). **Conclusions:** This research demonstrates that daytime plaque levels of dental professionals were related to gender, age and geographic location more than profession type. The results indicate heterogeneity in plaque control and opportunities to set a better example for patients.

Funding was provided by P&G.

Reprinted by permission of the Journal of Dental Research, Issue 90(A), 2011 (www.dentalresearch.org).

Effect of Light on Tooth Whitening: A Split Mouth Design

*Rachel K. Henry, RDH, MS; Susan M. Bauchmoyer, RDH, EFDA, MS; Wendy M. Moore, RDH, EFDA,MSA; Robert Rashid, DDS, MS

Problem Statement: Tooth whitening is a popular clinical procedure in dental offices. Current research on whitening with the use of a light is conflicting and previous studies often use small patient numbers. With the many choices of whitening materials and procedures it is important for the clinician to know the benefits and risks of whitening with a light. **Purpose:** The purpose of this study was to determine if the use of a sodium arc bulb lamp during in-office whitening affected the whiteness of teeth or the length of time the teeth maintained their shade. **Methods:** This randomized split-mouth design study utilized a sample of 49 subjects who responded to the study advertisement and met established criteria. Subjects received an in-office whitening treatment on anterior teeth with 25% hydrogen peroxide and were randomly assigned to receive whitening with the light on the right or left side of the mouth. The shades of the teeth were evaluated with the Vita Easyshade. Shades were recorded during the screening visit, immediately before whitening, immediately after whitening, 1 week after whitening, and 2 weeks after whitening. Ordinal values were assigned to recorded shades. Values will be analyzed using SAS software using ANOVA, paired t-test, and Wilcoxon signed rank tests at the 0.05 level of significance. Approval was obtained from the IRB at the Ohio State University. **Results:** While statistical analysis has yet to be completed, preliminary clinical results show no difference with or without use of the light in shade or duration that shade was maintained. **Conclusions:** While this project is currently in progress, the preliminary results lead us to currently conclude that whitening with a light may not clinically be different than whitening without a light. Therefore helping clinicians make evidence based choices about what whitening treatment they offer to their patients.

Funding for this project was provided by the OSU Dental Hygiene Department. Whitening supplies were provided by Discus Dental, Inc. (Culver City, CA).

Accuracy of Specific Digital Arm and Wrist Momanometers

*Danielle Furgeson, RDH, MS; Nancy Foster, RDH, EdM

Problem Statement: Digital manometers are a standard of care in dental hygiene education clinics as part of the medical history assessment. Increased reliance on aneroid and digital manometers makes it imperative to ensure accurate blood pressure measurements. **Purpose:** The purpose of this study was to determine the accuracy of the automated digital arm and wrist cuffs utilized by students. **Methods:** 121 subjects were recruited from the clinic patient population. Patients were randomized into the test modalities upon check-in. Initial blood pressure measurements were taken with an aneroid control device by a principal investigator (PI) followed by a second measurement taken with the assigned arm or wrist manometer 5 minutes later. The control device was calibrated before and after data collection at Eastern Maine Medical Center. All readings were taken according to manufacturers' instructions to ensure technique consistency. Analysis will include descriptive statistics, chi-square and t-tests. IRB approval was obtained from UMA. **Results:** Initial results indicate a difference >5 mmHg for each modality, with p=<0.000 for the wrist modality and p=<.019 for the arm modality. Initial results also indicate a difference between the mean PI control systolic and diastolic readings that may be related to number of hypertensive (HTN) patients, 18% versus 33% with a HTN diagnosis. **Conclusions:** Based on initial analysis and the British Hy-

pertension Society guidelines of mean difference of <5mmHg, these automated digital manometers should be used with caution as a screening tool in the dental setting, particularly in situations where administration of pharmacological agents such as local anesthesia may be used during the course of treatment.

"Funding for this project was provided by a University of Maine at Augusta Presidential Research Grant."

Efficacy of A Combined In-Office and At-Home Treatment Program For Dentin Hypersentivity Relief

D. Hamlin, L.R. Mateo, *E. Delgado, Y.P. Zhang, W. DeVizio

Purpose: This double-blind clinical study evaluated the efficacy for the reduction of dentin hypersensitivity following dental scaling with sustained relief for 24 weeks from a treatment regimen consisting of a professionally applied 8.0% arginine and calcium carbonate desensitizing paste and daily brushing with an 8.0% arginine and calcium carbonate toothpaste and a sensitive toothbrush. **Methods:** One hundred adults with confirmed air blast and tactile-induced dentin hypersensitivity were randomly assigned to receive a rotary-cup-applied single treatment with one of two in-office pastes as the final polishing step to a dental scaling: Colgate® Sensitive Pro-Relief™ desensitizing paste (test regimen) or Nupro-M® pumice prophylaxis paste (negative control). Hypersensitivity was re-examined immediately after product application and after 8 and 24 weeks of brushing twice daily with Colgate Sensitive Pro-Relief Toothpaste and Colgate® 360º Sensitive Pro-Relief™ toothbrush (test regimen), or with a calcium carbonate toothpaste and Oral-B® Indicator® toothbrush (negative control). **Results:** A total of 95 subjects completed the study. No statistically significant differences in tactile or air blast hypersensitivity scores were indicated at baseline between the 2 groups. Immediately after professional product application, and after subsequent twice daily brushing for 8 and 24 weeks, subjects assigned to the test regimen treatment demonstrated statistically significant improvements in dentin hypersensitivity compared to subjects assigned to the control regimen treatment in tactile (49.8%, 57.5% and 32.9%, respectively) and air blast (26.0%, 38.4% and 34.3%, respectively) sensitivity scores. **Conclusions:** The professionally applied 8.0% arginine and calcium carbonate desensitizing paste provided a statistically significant reduction in dentin hypersensitivity as compared to the control prophylaxis paste immediately after a single treatment following a dental scaling. The instant sensitivity relief afforded by the professional application was maintained by twice daily brushing with the 8.0% arginine and calcium carbonate toothpaste and the specified sensitive toothbrush for at least 24 weeks.

This project was sponsored by the Colgate-Palmolive Company.

Reprinted by permission of the Journal of Dental Research, Issue 90(A), 2011 (www.dentalresearch.org).

The Oral Hygiene of Patients with Cerebrovascular Diseases at an Emergency Hospital

*Takafumi Ooka, DDS, PhD; Shoko Ooka, DH; Naoko Kimura, DH; Kunie Hiyama, DH; Yoshitaka Kii, MD; Masahiro Watanabe, DDS, PhD; Yoshiharu Mukai DDS, PhD

Problem Statement: Many patients are ventilated mechanically and cannot be fed via oral cavities, and these conditions could make oral hygiene worse in the acute and subacute stage of cerebrovascular diseases (CVD). **Purpose:** The aim of this study was to compare the oral condition of patients with acute CVD admitted to an ER setting to patients in the general ward in order to establish a standardized protocol for oral health care. **Methods:** 85 patients (49 males and 36 females) who were placed in an emergency hospital participated in the study. All of them had CVD and the oral health care team including some dentists, dental hygienists, nurses and medical doctors had intervened in the oral health care activity on the ward. The actual oral conditions of the participants were evaluated by the team. Then, findings such as oral dryness, sticking sputum, tongue coat and oral mucosal problems were added up and analyzed after finishing the series of interventions of the dental staff. **Results:** Approximately forty percent of patients who were in the emergency room indicated some distinguished problems such as oral dryness, sticking sputum and tongue coat. In contrast, patients in the general ward showed higher incidences of these symptoms, with 50% having oral dryness and 70% having tongue coat. Additionally, the oral hygiene condition was worse in participants who were fed via nasogastric or gastric tube than participants who were fed orally. **Conclusions:** These results suggested that the patients with CVD in acute stage presented with a variety of oral hygiene problems, and symptoms differed and depended on the ward and feeding condition. It may be essential to establish a consistent and standardized protocol in oral health care.

Oral Condition and Effectiveness of Dental Interventions in the ICU

*Shoko Ooka, DH; Takafumi Ooka, DDS, PhD; Shino Murata, DDS, PhD; Yoshitomo Rikukawa, DDS

Problem Statement: It is known that oral care effectively prevents pre-operative medical complications such as aspiration pneumonia and ventilator-associated pneumonia (VAP). Critically, patients in Intensive Care Units (ICU) have many needs regarding oral hygiene. **Purpose:** The purpose of this research was to test the effectiveness of professional oral care in relation to the cleanliness of the oral mucous membrane sponges of patients in ICU. **Methods:** The effectiveness of the cleaning was tested by taking plaque samples from the buccal mucosa, tongue and pharynges of each patient before and after oral care. These plaque samples were transferred to glass plates. After they were dried, the plates were placed in a plaque disclosing solution. Differences between the amounts of plaque present were compared at this stage. Dental plaque samples containing bacteria collected from the oral mucosa were compared using blood agar colony. This was to determine whether there was change in the concentration of bacteria in the dental plaque. They were divided into 3 categories: reacted only slightly, reacted owing to a large amount of plaque being present and reacted strongly to the solution. **Results:** Changes in oral care before and after dyeing concentration were from 2.0 to 0.45 in the buccal mucosa, from 2.2 to 1.0 in the tongue and from 2.2 to 1.68 in the pharynx. The mean of the plaque score was significantly lower in each category. The mean of the results of the category in patients who received professional oral health care became significantly lower in all points of the oral cavity. The majority of samples, which had been taken after oral care, reacted much less than those taken before it. However, the results show that it is impossible for ICU patients to demonstrate cough up and swallowing reflex. Additionally the bacteria after cleaning are expected to stagnate in the throat area. **Conclusions:** Oral care removes plaque for certain categories of patients in ICU. Early dental intervention is essential to prevent complications.

New Program

Incorporation of Caries Management by Risk Assessment (CAMBRA) Into a Dental Hygiene Program

M. Diane Melrose, MA, BSDH; Lupe Arevalo, RDH, BS; Karen Matsumura- Lem, DDS, BSDH; *Donna M. Smith, MSEd, BSDH, RDHAP

Purpose/Goals: The purpose of this project is to describe how Caries Management by Risk Assessment, CAMBRA, is incorporated into a dental hygiene program. **Significance:** CAMBRA is a program designed to diagnose, treat and prevent the progression of caries by assessing the patient's risk level and level of caries activity to determine appropriate treatment strategies. CAMBRA is based on the principle that conventional restorative treatment is ineffective to treat the etiology and risk factors of caries. The goal is for patients to take an active role in the prevention and management of dental decay. The second goal is to prepare students to use this approach in clinical practice. **Approach/Key Features:** During the data collection appointment all patients complete a Caries Risk Assessment Form resulting in identifying their caries risk level: low, medium, high or very high. If the patient is at high risk, a salivary test may be conducted to determine flow rate and pH. For patients with inadequate salivary flow, their CAMBRA risk increases to very high. Patients who are in the high and very high risk categories are offered enrollment in the program and receive a specifically designed CAMBRA kit, including 1.1% NaF toothpaste, xylitol mints or gum, 0.12% CHX mouth rinse, dental floss and a toothbrush. Patients receive home care instructions, nutritional counseling and are placed on a 3 to 4 week evaluation schedule to assess their progress and adherence to the program. **Evaluation:** The program was implemented January 2011 and has enrolled approximately 140 of 500 patients who were identified to be at high risk. Program evaluation will initially include a 2 week, 4 month and 8 month follow up. Assessment of patient compliance and the reduction of risk factors will be determined at these intervals.

Occupational Health and Safety

Interprofessional Education in Clinical Ergonomics: Collaboration of Dental Hygiene and Occupational Therapy

*Colleen Whitt, RDH, MS; Marilynn Heyde, RDH, MPH

Problem Statement: Throughout their careers, dental hygienists encounter problems due to cumulative traumatic disorders (CTDs) and musculoskeletal disorders (MSDs). CTDs and MSDs impact dental hygienists (DHs) on physical, emotional and financial levels. **Purpose:** The purpose of this study is to increase student awareness of factors associated with MSD and CTD symptoms and to identify factors which affect ergonomics in the clinical setting. **Methods:** A review of the literature substantiated the need to focus on the importance of ergonomic education in the dental hygiene clinical setting. The study began with a Likert-type survey assessing 42 students' knowledge of ergonomics. The written survey contained 5 questions with closed-ended responses and an opportunity to comment. This single-blinded study ultimately utilized 21 students who were unsuspectingly evaluated and photographed by occupational therapy (OT) students during a clinic session. All students at Loma Linda University sign a waiver allowing them to be photographed during their time at the school. The OT students were able to evaluate the DH students' ergonomics including the seating, head and neck, and hand/wrist positions. A month after the clinic session, an OT educator hosted a seminar with the photographs of the DH students in "compromised positions" which opened the door for further education and research between the disciplines of dental hygiene and occupational therapy. Each DH student received an "Ergonomic Evaluation Worksheet" composed by OT students. **Results:** Individualized ergonomic evaluations are an invaluable learning tool for both OT and DH students and their instructors. Many factors associated with CTDs and MSDs can be reduced, modified, or eliminated when new habits are learned, encouraged, and acquired. **Conclusion:** DH educators and students acknowledge the need for seminar-style programs encouraging collaboration between OTs and DHs where we can learn to recognize, intercept, and reduce risks for student MSDs and CTDs.

Technology

Evaluation of a Colorimetric Assay Strip's Ability to Detect Periodontitis

*Patricia A. Lenton, RDH, MA; Maureen C. Leesman, Pharm D; Scott W. Lunos, MS

Problem Statement: Colorimetric assay strips have the demonstrated ability to detect cytotoxic volatile and non-volatile thiol compounds in oral fluids. These strips demonstrated good correlations between strip value and the presence of periodontal pockets in a dog study ($p<0.001$). It is not known if these strips are able to assess gingival status in humans. It is important to determine the utility of these strips to be used as a potential screening device by health professionals. **Purpose:** To determine the assay strip color scores ability to differentiate human subjects with periodontitis vs. gingivitis. **Methods:** This single-blind study used a convenience sample of 85 patients from the University of Minnesota Dental School who responded to posted study flyers. A calibrated examiner recorded full-mouth periodontal measures. Using criteria developed a priori, 14 were classified as having gingival health, 21 with gingivitis and 25 with periodontitis. Thiol levels were measured using assay strips sampled at 3 locations: facial maxillary gingiva, facial mandibular gingiva and sublingual mucosa. A blinded examiner rated strip scores. The Student's t-test compared mean scores among classifications. **Results:** Mean color scores for the periodontitis and gingivitis groups did not differ significantly at any of the sampling sites: maxillary (mean (SD): 3.6 (1.5) vs. 4.3 (1.9), $p=0.15$), mandibular (4.0 (1.5) vs. 4.3 (1.8), $p=0.62$) or sublingual (1.6 (1.0) vs. 2.2 (1.6), $p=0.14$). **Conclusion:** Further assessment of variables such as smoking and salivary pH levels, that might affect strip results, are being investigated to improve the performance of the test strips in evaluating gingival health in humans.

Study funding was provided by ALT BioScience, Lexington, KY, USA.

Clinical Efficacy And Safety Of A Novel Interproximal Cleaning Device

M. de Jager, PhD; P. Schmitt PhD; M.L. Delaurenti, RDH, RAC; W. Jenkins, BA; *J. Strate, DMD; J.L. Milleman, DDS, MPA; K.R. Milleman, RDH, BSEd, MS; M.S. Putt, BSC, MSD, PhD

Problem statement: Interproximal cleaning is an important aspect of daily oral hygiene that many patients continue to struggle with. **Purpose:** The objective of this IRB-approved study was to evaluate the safety and efficacy of a novel interproximal cleaning device (ICD) on interproximal plaque removal and gingivitis reduction. **Methods:** 148 adults (98 female, 50 male, mean age: 39.5 years) with moderate gingivitis were enrolled in this single-blind, 4 week, parallel, randomized controlled clinical trial. Subjects were randomized to manual toothbrush (MTB, 2 minutes, twice a day) with or without adjunctive use of ICD (once daily, evening). Safety was assessed through oral examination, prior to other assessments at baseline, 2 weeks and 4 weeks. Gingivitis was measured with Modified Gingival Index (MGI) and Gingival Bleeding Index (GBI). The amount of interproximal plaque was evaluated by analyzing the protein concentration of plaque samples collected from 4 posterior sites and 2 anterior sextants. At week 2, plaque removal efficacy was assessed by collecting plaque samples directly after subjects used their assigned treatment regimen. **Results:** While both regimens reduced gingival inflammation, ICD resulted in a significantly greater reduction in MGI, GBI and number of bleeding sites after 2 and 4 weeks of use ($p<0.01$). Interproximal plaque evaluated after single-use showed that ICD removed significantly more interproximal plaque than MTB alone ($p<0.01$). Both products were safe to use. **Conclusions:** The novel interproximal cleaning device was safe to use, removed more interproximal plaque, and resulted in significantly greater reductions in gingivitis over 4 weeks of use.

Reprinted by permission of the Journal of Dental Research, Issue 90(A), 2011 (www.dentalresearch.org).

Clinical Monitoring of White Spot Lesions in Children: 18-Month Data

A George K. Stookey, PhD; Roger L. Isaacs, DDS; Valerie A. White, DDS; *Amy J. Nuñez, BSDH; Bart D. Collins, BS; Justin S. Williams, BS; Susan Ofner, MS; Barry P. Katz, PhD; James S. Wefel, PhD; John D. Hennette, DDS

Problem Statement: Traditional methods for detecting caries (visual, tactile and radiographic) cannot detect early (non-cavitated) caries. Once discovered, lesion reversal is impossible. Consequently, there is a need to detect early stages of demineralization, because non-cavitated lesions are completely reversible. **Purpose:** The study purpose is to determine the ability of visual and instrumental procedures to monitor changes in white spot lesions in children. **Methods:** Following IRB approval, 121 children (aged 7 to 17) presenting with two white spot lesions were recruited from a pediatric dental practice. Subjects were provided with fluoride dentifrice (Crest®) to use twice-daily. Evaluations of white spot lesion activity have occurred at all study visits both visually (using the ICDAS method) and instrumentally using light fluorescence (QLF/ Inspektor™ Pro; FluoreCam®). Beginning with the 6 month visit, subjects received fluoride varnish (Vanish™, 3M ESPE) at each visit. To date, subjects were seen at 0, 3, 6, 12 and 18 months. Subjects will be seen again at months 24 and 30. **Results:** At months 3, 6, 12 and 18, mean ICDAS indicated that lesions were not changing in severity but were decreasing in activity. Mean Inspektor™ Pro/QLF fluorescence measurements at 0, 3, 6, 12 and 18 months were 12.49, 12.07, 10.64, 10.79 and 9.45 with remineralization between month 0 to 6, 12 and 18 statistically significant. Mean FluoreCam® measurements were 11.22, 10.84, 10.11, 9.32 and 9.02 with remineralization between month 0 to 12 and 18 statistically significant. Plots of means revealed that FluoreCam® was more consistent in direction than Inspektor™. **Conclusions:** These preliminary data suggest that both fluorescence instruments are able to monitor early enamel changes, with Inspektor™ on average demonstrating more variation in direction than FluoreCam®.

Funding source: NIH/NIDCR Grant No. R01-DE017875.

In Vitro Efficacy of an Alcohol-Free Essential Oil Containing Mouthrinse

Donna Ilg; James Anthony McGuire, MS; Carolyn J. Mordas, PhD; Daniel Queiroz, Tara Fourre, *Sylvia L. Santos, RDH, MS

Problem Statement: Oral biofilm are difficult to control because of their diversity and variability on oral surfaces. Laboratory and clinical testing provides evidence of the broad spectrum activity of LISTERINE® Antiseptic. The aim of this study was to evaluate the germ kill potential of a new alcohol-free essential oil-containing mouthwash. **Purpose:** The purpose of this study was to evaluate the antimicrobial potential of an alcohol-free, essential oil mouthwash (AFEO) when tested versus human pooled saliva and against oral microorganisms using critical kill time (CKT) and an established multi-treatment biofilm model (MTBM).

Methods: CKT: Inoculum was exposed to commercially available alcohol-free (CAAF) rinses, such as LISTERINE® ZERO™, Meridol® and Crest® Pro-Health™, according to usage instructions. An aliquot was removed, neutralized, and plated on OOPs III agar or TSAB +HK to determine volatile sulfur compound (VSC) producing colony forming units (CFU/ml) or total organisms. CFU/ml from the AFEO mouthrinse were compared to a negative control for percent reduction. MTBM: Stimulated saliva was collected from donors, pooled, homogenized and dispensed into a 12-channel bio-cassette. A 96 peg lid was placed in the bio-cassette, media was added to the system, and biofilm formed on the pegs under continuous flow. The MTBM consisted of 5 30 second treatments with the CAAF rinses over the course of 60 hours. Biofilm were harvested by sonication, and analyzed for ATP-bioluminescence. Results were reported as mean log10 relative light units (RLU). Plating was performed using OOPs III agar to enumerate VSC-producing colonies. **Results:** CKT:The AFEO rinse showed 99.9% reduction versus control for all organisms tested. MTBM: Calculated log10 RLU for AFEO mouthrinse were not statistically significantly different than the CAAF mouthrinses tested. **Conclusion:** These results show that LISTERINE® ZERO™ was as efficacious as other alcohol-free mouthwashes tested in these models.

Funding for this project through Johnson & Johnson Consumer & Personal Products Worldwide, Division of Johnson & Johnson Consumer Companies Inc., Morris Plains, NJ, USA.

Reprinted by permission of the Journal of Dental Research, Issue 90(A), 2011 (www.dentalresearch.org).

In Vivo Efficacy of an Alcohol-Free Essential Oil Containing Mouthrinse

Donna Ilg; Lauren Junker, PhD; James Anthony McGuire; Carolyn J. Mordas, PhD; Daniel Queiroz; Danette Ricci-Nittel, MS; *Christine Charles, RDH

Problem Statement: A novel in vivo germ kill model was used to examine the antimicrobial activity of an alcohol-free, essential-oil (AFEO) mouthrinse on total microorganisms and malodor associated volatile sulfur compound (VSC) producing microorganisms. **Purpose:** The purpose of this study was to determine the potential of LISTERINE® ZERO™, an AFEO mouthrinse, to reduce the number of total and VSC microorganisms in the mouth after a single use. **Methods:** This IRB-approved, single-use, randomized, observer-blind, supervised, controlled, parallel-design, clinical trial assessed the in vivo germ kill of an AFEO mouthrinse versus a brushing control. Thirty-seven subjects meeting inclusion/exclusion criteria entered a normalization period for 5 to 7 days of brushing with an assigned toothbrush and ADA accepted fluoride toothpaste, twice daily. Subjects were randomized into a brush group or a brush and rinse group. At baseline, subjects rinsed with 5 mL of water for 10 seconds and collected expectorant plus 1 mL unstimulated saliva in a sterile tube. Subjects brushed their teeth with fluoride toothpaste for 1 minute and expectorated. Subjects rinsed with 5 mL of water for 10 seconds and collected the expectorant in a sterile tube. Subjects in the rinse group then rinsed with 20 mL of test product for 30 seconds and collected the expectorant. All expectorant samples were analyzed for total microorganisms and VSC organisms by spiral plating on TSA with blood and OOPs III agar. The CFU/mL from the AFEO mouthrinse were compared to baseline to quantify reduction. **Results:** The AFEO mouthrinse reduced total microorganisms by >99.9% and VSC producing organisms by >99.9% versus baseline. The brush group reduced total microorganisms by 65.3% and VSC producing organisms by 93% versus baseline. **Conclusions:** The results of this study demonstrate that the AFEO mouthrinse, when used as an adjunct to brushing, kills total and VSC microorganisms by millions (>99.9%) on contact.

Funding for this project through Johnson & Johnson Consumer & Personal Products Worldwide, Division of Johnson & Johnson Consumer Companies Inc., Morris Plains, NJ, USA.

Reprinted by permission of the Journal of Dental Research, Issue 90(A), 2011 (www.dentalresearch.org).

Health Literacy/Cultural Competency

Identification of Cultural Barriers to Care among a Population of Central American Women Seeking Care at a Public Health Dental Clinic

*Beth E. McKinney, RDH, MS

Problem Statement: Cultural barriers to accessing care have recently become a focus of dental research. This study attempted to identify existing barriers among a group of 1,496 female immigrants aged 18 to 39 from Central American countries who sought dental care through a pregnancy program at a local health department. **Purpose:** The purpose of this study was to gather data which might be used to improve the program to make access to dental care easier for this population. **Methods:** A single reviewer looked at 1,496 dental records to ascertain patients dental health status at initial presentation. Data was collected regarding health history, dental history, missing teeth, caries, DMF and cultural dental procedures, and tabulated using an Excel spreadsheet. Periodontal disease was not looked at in regard to this study. Main **Results:**

Five areas of possible barriers to care were identified based on the chart review. They were: low basic literacy at a second grade reading level or less in their primary language (27%), caries management by extraction as evidenced by multiple missing teeth (70% of sample), the presence of active caries (80% of sample) and lack of prior restorations (32%), a cultural dental practice of open-faced gold jackets on upper anterior teeth for cosmetic reasons (14%), a cultural dietary practice of adding strawberry syrup to milk given to babies and the observation of one religious practice involving bracelets of red beads placed on the infants after birth. **Conclusions:** A number of possible cultural barriers to accessing and following through with recommended dental care and advice were identified in this study. The results will be used to educate county staff on cultural and health literacy issues in this population and to empower the dental program to better provide needed care to this group.

Health Behaviors

Two-Week Clinical Evaluation of Stannous Fluoride Dentifrice on Dentinal Hypersensitivity

*Lois Barber, RDH, BSEd; Matthew L. Barker, PhD; Tao He, DDS, PhD; Naresh C. Sharma, DDS; Aaron R. Biesbrock, DMD, MS, PhD

Problem Statement: Patients desire short term benefits from the use of sensitivity toothpastes and there is limited data available to address their concerns. **Purpose:** To measure the desensitizing benefits of stannous fluoride (SnF2) dentifrice versus a sodium fluoride negative control over a 2 week period. **Methods:** This study was a randomized, parallel group, negative-controlled, 2 week clinical trial. Subjects reporting moderate dentinal hypersensitivity on 2 teeth were enrolled and randomized to either the 0.454% SnF_2 dentifrice or negative control used twice daily for 2 weeks. Subjects followed manufacturers' instructions for use. Thermal cold air assessments for the Schiff Index (examiner) and separately Visual Analog Scale (VAS, 0 low to 100 high, subject) were performed at baseline immediately after the first product use, day 3 and week 2. Treatment comparisons utilized ANCOVA. Tactile Yeaple probe assessments were performed at baseline, day 3 and week 2, and treatments were compared using ANOVA. **Results:** One hundred eleven subjects participated in the research with a mean age of 44 years and baseline mean scores of 2.83 Schiff, 77.8 VAS and 10 Yeaple. Relative to negative control, the SnF_2 dentifrice demonstrated significant ($p<0.0001$) mean reductions in Schiff Index of 13.8% immediately after the use, 31.8% by day 3, and 61.3% by week 2. For subject-assessed VAS, significant ($p<0.0001$) mean reductions for the SnF2 dentifrice relative to negative control attained 14.6% at immediate, 34.8% at day 3, and 66.6% at week 2. Significant ($p<0.0001$) mean improvements for Yeaple Probe were observed for the SnF2 dentifrice versus control at day 3 and week 2. **Conclusions:** The stannous fluoride dentifrice provided instant and rapid relief in dentinal hypersensitivity versus a negative control.

Funding for this project was provided by P&G.

Reprinted by permission of the Journal of Dental Research, Issue 90(A), 2011 (www.dentalresearch.org).

Other

In-Home Use Test to Evaluate Ease of Use and Assess Compliance of Philips Sonicare Airfloss

*A.S. Master, BDS; S. Krell, BS; A. Kaler, BS, MBA; J. Wei. Philips

Problem Statement: Interproximal cleaning is an important aspect of daily oral hygiene in addition to the regular use of a toothbrush. Dental floss presents patients with significant handling challenges resulting in infrequent use or complete omission. **Purpose:** To assess ease of use and compliance of Philips Sonicare AirFloss (PSAF) in a sample of irregular flossers after using the device at home. **Methods:** Two independent studies were conducted for ease of use and compliance, for 3 weeks and 1 month, respectively. Eligible participants included 115 adult irregular flossers. Compliance study (56 participants) - All received the PSAF, a daily-usage diary and product instructions. Participants reported frequency of usage of the product in the diary every day. In addition, feedback was recorded using an online questionnaire at the end of the month. Preference Study (59 participants) - A 3 period, randomized crossover study using 3 interproximal cleaning devices, PSAF, string floss and an oral irrigator. Participants reported to the clinic weekly to receive an alternate device to use at home. At Visit 4, an online survey link was sent to subjects to report their feedback for each product used. **Results:** On average, irregular flossers used PSAF 1.3 times a day, 96.1% of the participants used PSAF 4 or more days/week, 86% and 69% of study participants reported PSAF as easier to use than string floss or an oral irrigator, respectively, while 78% and 81% reported PSAF as being more gentle teeth and gums and providing better access to the back of the mouth than string floss, respectively. **Conclusions:** Among a sample of irregular flossers, Sonicare AirFloss significantly improved compliance and was reported to be a preferred alternative for interproximal cleaning,

relative to other commonly used modalities.

This research was supported by Philips Oral HealthCare.

Reprinted by permission of the Journal of Dental Research, Issue 90(A), 2011 (www.dentalresearch.org).

Systematic Reviews

Safety of Oscillating-Rotating Powered Brushes Compared To Manual Toothbrushes: A Systematic Review

Fridus A. Van der Weijden, DDS, PhD; Wendy Bebey, RDH, BS; *Andrea Johnson, RDH, BS; Shelly L. Campbell, RDH, MPH; Christian E. Dorfer, DDS, PhD; Carlos C. Gonzalez, DDS, MSD, PhD; Dagmar E. Slot, MsC, RDH

Problem Statement: Oscillating-rotating (O/R) power toothbrushes have been proven clinically efficacious. A comprehensive review of all clinical and laboratory investigations solely comparing the safety of these toothbrushes to the standard of care have not been documented. **Purpose:** The aim of this systematic review was to examine the literature concerning the relative soft and/or hard tissue safety outcomes with the use of O/R toothbrushes compared to manual toothbrushes. **Methods:** Electronic databases of PubMed-MEDLINE, Cochrane-CENTRAL and Excerpta Medical Database (EMBASE), were searched for in vivo and in vitro trials through May 2010 to identify appropriate studies that evaluated the safety effects of an O/R toothbrush compared to a manual toothbrush. Eligible trials incorporated a safety evaluation as a primary or secondary outcome parameter or used a surrogate parameter. Data extraction for the safety studies and a meta-analysis of the gingival recession data were performed. **Results:** Independent screening of 697 PubMed-MEDLINE, 436 Cochrane and 664 EMBASE papers resulted in 35 publications that met eligibility criteria. The mean change in gingival recession was not significantly different among groups in the two trials with safety as a primary outcome (weighted mean difference: 0.03). A meta-analysis of the 5 trials that evaluated safety with a surrogate parameter was not possible; however, there were no significant between-group differences at the study end in any trial. A descriptive analysis of the 24 selected studies assessing safety as a secondary outcome revealed few brushing-related adverse events. The heterogeneity in objectives and methodology of the four in vitro trials that met the eligibility criteria precluded generalization of the results. **Conclusions:** A large body of published research has consistently shown oscillating-rotating toothbrushes to be safe compared to manual toothbrushes, demonstrating that these power toothbrushes do not pose a clinically relevant concern to hard or soft tissues.

Funding was provided by P&G.

Repro¬duced with permission from the American Academy of Periodontology. J Periodontol 2011;82:5-24

Association Between Obesity and Periodontitis: A Systematic Review

*Jean Suvan; Francesco D'Aiuto; David R. Moles; Aviva Petrie; Nikos Donos

Objectives: Obesity and overweight have been suggested to be associated with periodontitis. Numerous studies investigating this association, with varying results, have been published. A number of narrative reviews have attempted to provide summaries of studies. This project presents results of a systematic review investigating the association between obesity or overweight (as defined by the WHO) and periodontitis in adults. **Search Strategy/Selection Criteria:** Search strategy included electronic and hand searching. Ovid MEDLINE, EMBASE, LILACS, and SIGLE (no year/language restrictions) were searched. RCTs, Cohort, Case Control and Cross Sectional study designs that included measures of periodontal disease and body composition were eligible. **Data Collection and Analyses:** Screening and data abstraction (including bias protection assessment) were performed independently, in duplicate. Meta-analyses were performed when appropriate using random effects models. **Main Results:** Five hundred and twenty-six titles and abstracts were screened, resulting in 61 full text articles and abstracts assessed for eligibility with 34 being included. Nineteen studies investigating the association between prevalence of periodontitis and body mass index (BMI) provided sufficient information for inclusion in meta-analyses. Meta-analyses indicated a statistically significant association between presence of periodontitis and BMI category obese OR 1.81(1.42, 2.30), overweight OR 1.27(1.06, 1.51) and obese and overweight combined OR 2.13(1.40, 3.26). **Conclusions:** This research supports the hypothesis of an association between body mass index categories overweight and obese and periodontitis although unclear as to the magnitude. Further prospective studies designed to quantify, and/or understand the mechanisms, of this association are merited. There is currently insufficient evidence to provide guidelines to clinicians on the clinical management of periodontitis in overweight and obese individuals. **Acknowledgements:** work was undertaken at UCLH/UCL who received a proportion of funding from the Department of Health's NIHR Biomedical Research Centres funding scheme. This project was supported in part by an educational grant provided by Johnson & Johnson Consumer Services EAME Limited.

Reprinted by permission of the Journal of Dental Research, Issue 89(B), 2011 (www.dentalresearch.org).

Abstracts for Oral Free Papers

Self-Perception of Transformational Leadership Practices of American Dental Hygiene Program Administrators

*Wendy M. Garcia, RDH, EdD

Problem Statement: Changes in oral health care delivery have resulted in the need of new workforce models leading to changes in the roles and responsibilities of the dental hygienist thus necessitating changes in the educational curriculum. Educational programs are shaped by program administrators. **Purpose:** The purpose of this study was to investigate self-perceived transformational leadership practices of American dental hygiene program administrators. **Methods:** Quantitative, descriptive, survey research design was employed. Quantitative data were collected using the 30 statement Leadership Practice Inventory-Self developed by Kouzes and Posner and an 8 question researcher designed survey collecting demographic data. Linear regressions were employed testing the hypothesis. Permission for use of the LPI-Self was obtained from Kouzes and Posner International and IRB approval from the UB IRB. The invited sample consisted of 304 dental hygiene program administrators. The responding sample was 177 (58.2%) and the data generating sample was 176 (57.8%). **Results:** A consistent factor for all 5 Practices of Exemplary Leadership was the standard deviations for the dental hygiene program administrator means, were less, although still high, when compared to those of middle management, education, and medical/healthcare. Dental hygiene program administrators had the highest means in all 5 Practices of Exemplary Leadership except "Inspire a Shared Vision" and middle management had the lowest means for all the leadership descriptors. The number of years in dental hygiene academia showed a significance level of 0.048 for Enable Others to Act making it statistically significant. **Conclusions:** Dental hygiene program administrators poses the transformational leadership characteristics necessary for development of new workforce models that will meet the demand for and changes in oral healthcare delivery.

Legislative Advocacy Education in Dental Hygiene

*Ellen J. Rogo, RDH, PhD

Purpose: The intent of this investigation was to determine the effect of a legislative advocacy project on knowledge, values, and actions of undergraduate and graduate dental hygiene students. **Methods:** Approval was granted by the IRB at Idaho State University. A quasi-experimental design was employed with a convenience sample of 21 undergraduate and 17 graduate students. A data collection instrument was designed by the researchers based on several instruments in the nursing literature and content of the advocacy project. The legislative advocacy instrument was developed with three subscales (knowledge, values and actions) and a section on barriers to future legislative advocacy actions scored using 7 point Likert scales. Content validity of the instrument was established based on a literature review and use of a content validity index with a small number of current and previously enrolled students. The survey was administered using an online survey tool. Students scored their pre-project and post-project status on the three subscales. **Results:** Cronbach's alpha revealed internal consistency of the knowledge, values and actions subscales at 0.95 or higher. Pre-project scores and post-project scores were analyzed by Mann Whitney U test. Knowledge, values, and actions statements were statistically significant with Bonferonni corrected p levels at 0.001 to 0.003; however, actions were rated lower than the other 2 subscales. The 4 barriers for future advocacy actions rated the highest were lack of time, lack of comfort testifying before legislators, lack of comfort speaking personally with legislators and lack of priority for involvement with advocacy endeavors. **Conclusions:** Implementation of a legislative advocacy project in an undergraduate and graduate dental hygiene program can positively influence the development of advocacy knowledge, values and actions. Educators and mentors in the professional association need to provide experiences to assist students and practitioners in overcoming barriers to becoming involved with legislative advocacy activities.

Professional Role Changes of Graduates from an Online Bachelor Degree Completion Program Based in Dental Hygiene

*Kristin Minihan-Anderson, RDH, MSDH

Problem Statement: The overwhelming majority of dental hygienists practice as clinicians in private dental offices and have associate degrees. In order to pursue alternative career roles, a baccalaureate degree may be required. Online degree completion programs offer a mechanism to obtain this degree in preparation for these roles. **Purpose:** The purpose of this research is twofold: 1) to determine if graduates from online degree completion programs based in dental hygiene pursue different professional roles and 2) to assess if there is a relationship between completing an internship and experiencing a role change. **Methods:** Two confidential electronic surveys with open and close-ended questions were used to obtain data from the sample populations: 93 online bachelor degree completion graduates and 17 online program directors. Descriptive statistics were employed, chi-square and Kolmogorov-Smirnov tests compared differences, and Spearman's rho demonstrated relationships between variables. **Results:** There was a statistically significant difference (p=0.000) between the professional role of a graduate before and after an online degree completion program. Of the 93 graduates, 28% (n=26) changed roles and 71% (n=66) completed an internship. Regarding role changes, 26% (n=7) of graduates not completing an internship changed roles, 74% (n=20) did not, 29% (n=19) of graduates completing an internship changed roles and 71% (n=47) did not. No statistically significant relationship (p=0.451) existed between completing an internship and a role change. When graduates who completed an internship (n=66) were asked if the objective of the internship was working or learning, responses revealed: 90% (n=18) of graduates who changed roles (n=20) stated learning and 65% (n=30) of graduates who did not change roles (n=46) stated learning. **Conclusion:** A majority of graduates from online degree completion programs based in dental hygiene did not change roles. Internships structured to focus on student learning resulted in a higher frequency of professional role change by these graduates.

Health Profession Students' Perceptions of Travel Service Learning on Their Development as Culturally Competent Interprofessional Health Care Providers

*Aditi Puri, PhD, RDH; Mahmoud Kaddoura, PhD, RN; Christine Dominick, MEd, RDH

Problem: Literature lacks evidence about the effectiveness of travel service learning in preparing students to provide health care in culturally diverse interprofessional environment. **Purpose:** The purpose of this study is to understand health profession students' perception of travel service learning on their growth as culturally competent interprofessional health care providers. **Methods:** This qualitative study utilized semi-structured open-ended interviews to explore the perceptions of health profession students with regard to the provision of culturally competent care to underserved populations. Nine students from two health professions institutions who travelled to Morocco to provide dental hygiene and nursing services were interviewed for this study. The interviews recorded were transcribed verbatim to generate inductive and deductive codes that will constitute the major themes of the data analysis. Thereafter NVIVO 8 will be utilized to determine the frequency of applied codes rapidly. The authors will compare the codes and themes to establish interpretive validity. Codes and themes will be initially determined independently by co-authors and applied to the data thereafter. Furthermore, the authors will compare the applied codes to establish agreement about reliability. **Results:** Initial data analysis reveals that students gained confidence in providing interprofessional care to the underserved populations in Morocco. The initial education and training at the Forsyth School of Dental Hygiene clinic enabled nursing students to provide fluoride varnish and oral hygiene instructions to those who lacked access to care. Their interactions with ethnically diverse patients and varied health professionals in international settings increased their appreciation for diversity and promoted cultural competence. **Conclusion:** The findings of this study will reveal that travel service learning experience can prepare students to provide effective interprofessional care to culturally diverse and underserved populations.

For Better or Worse Facebook Weds Professional and Personal Identities: A Study of Facebook Use Among Early Career Health Professionals

*Cynthia A. Weijs, RDH, MPH; Jason B. Coe DVM, PhD

Problem Statement: Early career health professionals are frequent users of Facebook, which promotes the blending of personal and professional identities. It is important that dental health care professionals understand the impact this has on their own image and that of their profession. **Purpose:** To explore the nature and content of information publicly posted to Facebook by early career health professionals. **Methods:** This was a cross-sectional descriptive study involving 494 early career veterinarians registered with the College of Veterinarians of Ontario. We searched for their publicly available Facebook profiles and evaluated the frequency of various pieces of information veterinarians posted, including photos, personal information, and education information. Profiles were categorized as having low, medium or high exposure of publicly available information. Using content analysis, high exposure profiles were further analyzed to assess for content that may pose risks to an individual's and the profession's public image. **Results:** Facebook profiles for 352 (71.2%) early career veterinarians were found. One quarter (24.7%) were categorized as low exposure, 54% as medium exposure and 21.3% as high exposure profiles. Content analysis revealed publicly posted breaches of client confidentiality, evidence of substance abuse, and demeaning comments toward others. **Conclusions:** A significant number of profiles were found with content that could create risks to professional boundaries, including client confidentiality. This is especially important where trust is vital to client care. Dental health professionals should be educated in the appropriate use of social media such that risks associated with blurring of private and professional identities are mitigated.

Funding for this project was provided by the Social Sciences and Humanities Research Council of Canada.

Integrating Service-Learning into the Curriculum

*Michelle Gross-Panico, RDH, MA

Purpose/Goals: Dentistry in the Community is a service-learning module with the purpose of developing culturally competent public health leaders and community responsive dentists. The goal is to teach public health concepts that prepare students to be public health clinicians who are informed about community needs and serve in underserved areas. **Significance:** Today's dental and dental hygiene schools face the challenge of modifying curricula to graduate culturally competent clinicians who will address oral health needs in America's communities. In light of the current status of oral health in America, modern dental professionals need to be clinically competent, but also informed about community health and act with a sense of social responsibility. **Approach/Key Features:** Dentistry in the Community is a module that spans the second, third and fourth years of dental education at the Arizona School of Dentistry and Oral Health. The module is structured to educate students about planning, implementing and evaluating community projects, building community partnerships, assessing community needs, and understanding diverse cultures. The module includes 48 hours of lecture and group activities, participation in community oral health activities, and leadership in a community oral health project. The project and participation activities include non-clinical and clinical activities with over 60 not- for-profit and social service community partners. **Evaluation:** Assessment of project and participation experiences involves self-evaluation, reflection and project application assignments. Further evaluation is completed with a survey to determine whether the module develops community responsive dentists. In 2010, of the 54 senior dental student respondents, 91% strongly agree or agree the module increased their ability to apply principles of public health, 81% strongly agree or agree the module increased their desire to improve community health and 83% strongly agree or agree the module influenced their ability to serve as a resource in their community for dental public health issues.

Development of an Introductory Evidence-Based Decision Making Educational Module for Dental Hygiene Students

*Jodie C. Condon, RDH, BSDH; Linda Susan Taichman, RDH, MS, MPH, PhD; Stephanie Markwardt, RDH, MS

Purpose/Goals: The goal of this project was to develop and implement an introductory Evidence-Based Decision Making (EBDM) educational module for first year dental hygiene students at Oakland Community College (OCC). The content of the program focused on developing the fundamental skills of EBDM. **Significance:** For evidence-based practice to become the standard of care within the dental hygiene profession, it must be present in educa-

tional programs. Placing evidence-based principles into dental hygiene curricula will prepare graduates to become self-directed problem solvers, facilitate patient-centered high quality oral health care decisions and develop skills necessary for graduates to become lifelong learners. **Approach/Key Features:** The program consisted of 3 phases: an assessment, an intervention and evaluation. A prospective study was developed to gather data on the knowledge of Evidence-Based Practice, attitudes and skills in critical appraisal and literature searching of first year dental hygiene students. Specifically, a pre-test/post–test non-equivalent study design was utilized. The second phase involved the development and presentation of 3 educational sessions. The introductory EBDM lesson content was designed to introduce EBDM principles, highlight the 5 steps and skills necessary to perform EBDM and increase knowledge and understanding of EBDM. There were 5 learning objectives developed and evaluated. The learning activities associated with each lesson plan facilitated the development of critical thinking and problem solving skills. **Evaluation:** The third and final step was the evaluation phase. The evaluation phase has an essential role within both the scientific method and EBDM principles. The post-test results provided comprehensive assessment to the growth in student's knowledge and understanding of the EBDM process along with evaluation of learning objectives. Survey results illustrate that placing an introductory EBDM educational module improved the knowledge and understanding of EBDM principles. Further studies are needed, however, to determine if this knowledge is retained long-term.

Pilot Study of Oncogenic HPVS in Oral Lavage Samples From HIV Positive Senegal Women

*Juliet Dang, BS, RDH, MS, PhDc; Stephen Hawes, PhD; Qinghua Feng, PhD; Nancy Kiviat, MD

Problem Statement: Although HPV infection plays an etiological role in a subset of oral cancer, little is known about transmission and the natural history of oral HPV infection in individualswithout cancer, nor the optimal methods to detect oncogenic HPVs. **Purpose:** In this pilot study, we determined whether HPV 16 and 18 can be detected in 19 oral lavage samples collected from 15 HIV positive women in Senegal using a real time PCR based assay. **Methods:** All patients attended an outpatient infectious disease clinic in Dakar and were part of a longitudinal study assessing HPV, HIV and the development of high-grade cervical lesions. Of these 15 women, 11 (73%) were positive for HIV-1, 4 (27%) were positive for HIV-2. Of matched cervical swab samples, 8 were positive for HPV 16, 1 was positive for HPV 18 and 10 were negative for both HPV 16 and 18. Of the 15 women there were 4 patients that contributed 2 samples each. The presence of HPV 16 and 18 in oral lavage samples was determined using quantitative Taqman real time PCR assays. All samples were sufficient for HPV detection. **Results:** We found that none of 19 oral lavage samples was positive for HPV 16 and only one oral lavage sample was positive for HPV 18. The corresponding cervical swab sample from the same patient was positive for HPV, though it was not positive for HPV 16 or 18. The oral HPV-18 positive patient was HIV-1 positive with a low viral load (541). **Conclusions:** We concluded that oncogenic HPVs can be detected among cancer-free individuals using quantitative Taqman assays, HPVs though the frequency is low even among HIV positive individuals.

Describe Facilitators and Barriers To and Parent Satisfaction with Co-Location of Registered Dental Hygienists into Colorado Medical Practices

Patricia A. Braun, MD, MPH; *Shelby L. Kahl, RDH; Katina Widmer, MA; Misoo Ellison, PhD; Matthew F. Daley, MD

Problem Statement: Five Dental Hygienists (RDHs) were Co-located into 5 Colorado medical practices to provide preventive dental care (PDC) to low-income, young children. Little is known about how hygienists, staff and parents view this approach. **Purpose:** The purpose was to investigate the factors that both facilitate and create barriers to co-location and parent satisfaction with co-location of RDHs in medical practices. **Methods:** Qualitative, semi-structured key informant interviews (KII) were conducted with co-location participants identified as those who had knowledge of system changes at participating practices. The 20 to 40 minute telephone interviews were recorded, transcribed, reviewed for recurring themes and thematically categorized using Atlas.ti. Parent/caregiver attitudes were measured with a 26 questionnaire, English/Spanish, hand written survey constructed using the Health Belief Model, piloted and administered 12 months after parent's first RDH encounter. **Results:** Co-located PDC was provided to 2071 children. KII was conducted with 3 medical directors, 4 medical providers, 5 RDHs and 3 office managers. KII responses revealed factors that facilitate co-location, including recognition of unmet dental needs of population served, desire to build comprehensive medical home and funding support. Revealed barriers included finding office space for RDHs, finding time

for RDHs to occupy the space, obtaining buy-in from medical staff and establishing effective referral systems. Forty-nine parents/caregivers completed survey. They reported they really like (71%) and like (24%) having their child see the RDH in the office, would recommend the co-located office to others because of the co-located services (86%) and plan on taking their child to the co-located RDH in the future (86%). **Conclusions:** Co-locating RDHs into medical practices is a novel way to improve access to PDC for underserved children and expands the concept of medical home. Identified barriers must be overcome to facilitate future co-location projects. Surveyed parents favor co-location.

Funding for this project was provided in part by Delta Dental of Colorado Foundation.

An Intervention to Improve Oral Health of Residents of Long Term Care Facilities

*Carol K. Amerine, RDH, BS; Linda D. Boyd, RDH, RD, EdD; Denise M. Bowen, RDH,MS; Karen Neill, PhD, RN; Tara Johnson, RDH, PhD

Problem Statement: Residents of LTC/NH institutions are among society's most dentally-neglected members and need effective oral health care. Today's dental workforce model cannot meet this demand. Alternative models of providing oral care for underserved populations are necessary. **Purpose:** The purpose of this study was to examine the impact of onsite support by a dental hygiene champion on oral health status and quality of life of Long Term Care (LTC)/Nursing Home (NH) residents. **Methods:** A quasi-experimental, pre-test/post-test non-equivalent group controlled pilot study was designed to measure changes in oral health status and quality of life in residents following oral health interventions with Certified Nursing Assistants (CNAs) providing residents with activities of daily living. Three facilities served as study sites. A dental hygiene champion provided educational and onsite support to caregivers in Facility A for 2 months. Facility B received education alone. Facility C served as the control. The Oral Health Assessment Tool and the Geriatric Oral Health Assessment Index were used to measure oral health status and self-perceived quality of life pre- and post-intervention. **Results:** Provision of CNA training and onsite support resulted in statistically significant improvements for tongue ($p = 0.2$) and pain evaluations ($p = 0.04$). While not statistically significant, Facility A demonstrated greater improvement trends in gums and tissue status ($p = 0.10$) and in self-perceived quality of life ($p = 0.10$) than Facility C. **Conclusions:** Findings suggest a dental hygiene champion providing support onsite in LTC/NH facilities has potential to positively impact oral health status and quality of life in LTC/NH residents.

ElderSMILES – Integrating Dental Hygiene Students into Long-Term Care Settings

*Sharon M Compton, PhD, DipDH; Sandra J Cobban, PhDc, DipDH

Purpose/Goals: The need exists for improved oral health (OH) care for residents of long-term care (LTC) facilities. The purpose of this new program is to improve mouthcare programs with LTC facilities, thus improving residents' oral health. A further purpose is socialization of dental hygiene students into a LTC environment, which may influence their employment choices after graduation. **Significance:** Studies have demonstrated the need for improved OH for LTC residents, yet oral health professionals rarely form part of the staff in LTC, and facility staff are under-prepared in provision of daily mouthcare. **Approach/Key Features:** Eight dental hygiene students and two instructors visited two LTC facilities one full day per week for 13 weeks. Students worked in pairs to provide OH assessments and client-focused mouthcare instruction to the resident and health care aide (where possible). Essential components included collecting OH indicators, the ability to incorporate mouthcare into daily schedules, and identification of barriers that may impede OH care. A modified version of Chalmers' Oral Health Assessment Tool (OHAT) was used to collect data on health of the lips, tongue, gingival tissues, saliva, dentition or dentures, oral cleanliness, and presence of pain. Neither facility had an existing specific mouthcare program. **Evaluation:** Four qualitative evaluation components are underway: focus groups with students examining their experiences, individual interviews with Health Care Aides, registered nurses and nurse educators regarding their perceptions of the program and interviews with LTC administrators regarding the value and fit of the program. Themes emerging from the data include: communication challenges between students and staff, and students and residents, uncertainty about follow-up to student recommendations, barriers to provision of daily mouthcare, uneasiness of students in the LTC environment and impacts of dental hygiene repeat visits to residents.

Funding for this project provided from the Canadian Fund for Dental Hygiene Research and Education and the Fund for Dentistry, Faculty of Medicine and Dentistry, University of Alberta.

Patient Education Techniques Utilized By Practicing Dental Hygienists

*Carolyn Ray, RDH, MEd; Amber Cantrell, RDH, BS

Problem: There is a lack of publications that report current techniques used by dental hygienists concerning patient education on oral health promotion or identifies hygienists' perception of the importance of patient education. This information can provide insight to all dental hygienists on how and what to include during patient education. **Purpose:** The purpose of this study was to investigate techniques utilized by active, licensed dental hygienists when providing instruction on oral self-care to their patients and to identify the importance of patient education in the dental hygiene process of care. **Methods:** Selectsurvey.net was used to deliver a self-administered questionnaire to active members of the American Dental Hygienists Association (ADHA) in District IX (New Mexico, Oklahoma and Texas). This sample of convenience was sent to those members who had email addresses on the ADHA listserv (n=1,039). The 15 item survey included questions regarding the dental hygienist's educational background, current practice setting and Likert-scaled responses concerning techniques used to teach oral self-care to patients. Quantitative analysis utilized descriptive statistics. All open-ended questions were reviewed. **Results:** The response rate was 14% (n=147), with 93% (n=137) of respondents indicating that they saw an average of 31 patients per week with 76% (n=102) in general dental practice settings. Sixty-nine percent (n=101) reported having a bachelor's or higher degree. Respondents reported spending a mean of 8.84 minutes providing patient education during their appointments. Commonly used techniques included: assessment of current self-care practices, use of hand mirror, explanation of plaque and consequences of inadequate plaque removal, brushing and flossing demonstration and recommendations for appropriate dental products. Sixty-seven percent (n=99) utilized the "tell-show-do" model and 46% (n=68) used brochures. **Conclusion:** Results indicate that dental hygienists identify scaling, root planing and plaque removal as the most important therapy they provide. However, they acknowledge the importance of patient education. Direct one on one questions with the patient, demonstrating proper brushing techniques, stressing the oral systemic link, and positive reinforcement appear to be the choice of most practicing hygienists.

Funding for this project: University of Oklahoma J.D. Robertson Fund OUHSC IRB Number 15362

Comparison of Tooth Loss after Conventional and Intensity-Modulated Radiation Therapy for Head and Neck Cancer

*Richelle Beesley, RDH, BSc; Sharon Compton, RDH, PhD; Jana Rieger, PhD; Matthew B. Parliament, MD; Hadi Seikaly, MD; Johan Wolfaardt, DMD, PhD

Problem Statement: With the advent of advanced radiation therapy (intensity-modulated radiotherapy, IMRT) and the use of chemoradiation to treat head and neck cancer (HNC), there is potential for oral and dental complications. It is important for dental hygienists to understand the life-long changes after radiation therapy (RT) and to establish collaborative treatment programs to minimize oral and dental sequelae. **Purpose:** This exploratory study aimed to understand the status of dental health by comparing tooth loss up to 10 years after IMRT and non-IMRT (± surgery, ± chemotherapy) treatment. **Methods:** Eighty-six subjects (44 IMRT, 42 non-IMRT) were selected for this study. Data on tooth loss were obtained from archival records and clinical photographs. Data were compared between RT groups by one examiner before and up to 10 years after RT. Health Research Ethics Board (HREB) approval was obtained from the University of Alberta. **Results:** After adjusting for gender and baseline number of teeth, the difference in tooth loss over time between RT groups was not significantly different ($p > 05$) from the baseline data using repeated measures analysis of covariance. One-year after RT yielded the most data (n = 82). Due to the paucity of data available past the second year after initiation of RT, data points from the third year onward were not included in the final analysis using RM-ANCOVA. **Conclusions:** The findings from this project will provide a greater understanding of the effects RT has on dentition. This knowledge will assist oral health professionals to collaborate with oncologists to establish preventive dental care protocols to minimize oral and dental complications in the HNC survivor. Radiation-related changes to the dentition such as tooth loss may occur years after RT; therefore, longer follow-up data are required to assess to what extent dentition is retained. This project was presented at the International College of Prosthodontists Conference 2011.

Funding for this project was provided by Covenant Health.

Associations of Periodontal Micro-Organisms with Salivary Proteins and MMP-8 in Gingival Crevicular Fluid

*Maha Yakob, MB, RDH; Kirsti Kari, MSc; Taina Tervahartiala, PhD, DDS; Timo Sorsa, PhD, DDS; Per-Östen Söder, PhD, DDS; Jukka H. Meurman, MD, DDS, PhD; Birgitta Söder, PhD, RDH

Problem statement: Periodontal pathogens can trigger inflammatory response and influence the local host immunity. **Purpose:** We investigated the levels of certain salivary proteins and matrix metalloproteinase-8 (MMP-8) in gingival crevicular fluid (GCF), in relation to the presence of specific periodontal pathogens. **Methods:** Clinical parameters were recorded at baseline in 1985, and in 2009, from 99 subjects; 55 with 44 without periodontitis (mean age 60.2±SD 2.9). Saliva samples collected in 2009 were analyzed for salivary albumin, total protein, and immunoglobulins A, G and M. GCF was collected for analysis of MMP-8 levels and for the PCR-analysis of the micro-organisms A. actinomycetemcomitans, P. gingivalis, P. intermedia, T. denticola and T. forsythia. The study was approved by Ethics Committee, Karolinska University Hospital, Huddinge. **Results:** Periodontitis patients were more often infected by P. gingivalis ($p<0.01$), P. intermedia and T. denticola ($p=0.01$) than controls. Salivary albumin and protein concentrations were significantly higher in subjects with T. denticola ($p<0.05$). MMP-8 levels were significantly higher in subjects with T. denticola ($p<0.001$) and T. forsythia ($p<0.01$). **Conclusion:** The presence of T. denticola seemed to increase salivary albumin and total protein concentrations, and GCF levels of MMP-8. Both T. denticola and T. forsythia seemed to induce a cascade of host response with increased MMP-8 in GCF.

Supported by Karolinska Institutet, Sweden, TePe Oral Health Care, Sweden, The Academy of Finland, EVO-funding from the Helsinki University Central Hospital, The Medical Society of Finland.

Dental Plaque Associates with MMP-9 and TIMP-1 in Blood from Subjects with and Without Chronic Periodontitis

*Birgitta Söder, PhD, RDH; Maha Yakob MB, RDH

Problem Statement: The bacterial biofilm on the teeth trigger an immune-inflammatory response in the adjacent host tissues and can initiate periodontitis. This long lasting low –grade inflammation is a key feature in many chronic infectious diseases, such as periodontal disease and cardiovascular diseases. A recently published review concluded that periodontitis may indeed contribute to the systemic inflammatory burden and pathogenic processes, leading to systemic diseases in otherwise healthy individuals. **Purpose:** The aim was to study the influence of oral hygiene on MMP-9 and TIMP-1 in blood from subjects who in a longitudinal study had developed chronic periodontitis. **Methods:** A group of 50 subjects were randomly selected in 2003 from 1,390 periodontally healthy individuals initially examined in 1985. Clinical parameters were determined at the start and end of the study. At the time of the final oral examination, blood was collected after 12 hours of overnight fasting for the analysis of MMP-9 and TIMP-1. The relation between dental plaque, MMP-9 and TIMP-1 as dependent variables and several independent variables were evaluated in a multiple regression model. **Results:** Clinical examination 16 years after baseline revealed that 16 subjects had developed chronic periodontitis 31 were still periodontally healthy. Multiple logistic regression analyses identified PLI as a principal independent predictor in blood for MMP-9 as well as for TIMP-1 with OR, 6.54; $p=0.013$, CI 1.48 – 29.0 and OR 6.30, $p=0.029$, CI 1.20 – 33.0, respectively. **Conclusions:** Our results implicate that dental plaque associate with increased levels of MMP-9 and TIMP-1 in blood hence supporting the oral infection – systemic inflammation paradigm.

The study was sponsored by Philips Oral Healcare (Snoqualmie, WA, USA), and Karolinska Institutet, Stockholm, Sweden.

Adjunctive Clinical Effect of a Water-Cooled ND:YAG Laser in Supportive Periodontal Maintenance Patients

*Dagmar E. Slot, RDH, MSc; Mark F. Timmerman, DDS, PhD; Paula A. Versteeg, RDH; Ubele van der Velden, DDS, PhD; Fridus A. van der Weijden, DDS, PhD

Problem Statement: Debridement of the diseased root surface is usually performed by mechanical scaling and root planing using manual or power-driven instruments. The Nd:YAG laser has shown a bactericidal effect, although at 3 months following supra and subgingival debridement, no additional advantage was achieved with the adjunctive use of a Nd:YAG laser on clinical and microbiological parameters of periodontitis in subjects with moderate to severe generalized periodontitis. The adjunctive effect of a water-cooled Nd:YAG laser during periodontal maintenance care is unknown. **Purpose:** To test whether use of a water-cooled Nd:YAG laser as an adjunct to periodontal maintenance care with a thorough professional prophylaxis by hand and ul-

trasonic instruments improves clinical outcomes as compared to periodontal maintenance care alone during a recall program. **Methods:** This study was an examiner-blind, randomized, controlled clinical trial using a split-mouth design. Thirty subjects diagnosed with moderate to severe generalized periodontitis at baseline and following active periodontal treatment enrolled in a maintenance program were selected based on ≥2 sites with a residual probing pocket depth (PPD) of ≥5 mm in each quadrant. Immediately following a full-mouth supra- and subgingival prophylaxis the pockets ≥5 mm in 2 randomly assigned contra-lateral quadrants were additionally treated with the Nd:YAG laser (1,064 nm, 4W, pulse 250 µsec) by a dental hygienist. Clinical assessments PPD and bleeding upon pocket probing (BOPP) were performed pre-treatment and at 6 months post- treatment. In addition, the periodontal inflamed surface area (PISA) value was estimated. **Results:** At 6 months, clinical parameters had significantly improved for both regimens. No statistically significant differences ($p<0.05$) between treatment modalities were observed for PPD and BOPP scores at any time. Changes in PISA values support these findings ($p=0.178$). **Conclusions:** The additional use of the Nd:YAG laser to a professional maintenance program does not provide a clinically significant advantage. The study protocol was approved by the Medical Ethics Committee of the Academic Medical Center in Amsterdam (MEC # 02/270).

This study was self-funded by the Clinic for Periodontology Utrecht, The Netherlands.

The Effect of Tongue Cleaning in Reducing Oral Bacterial Load in Hematopoietic Cell Transplant Recipients

*Nobuo Motegi, DDS, PhD; Yumiko Ikegami, DH, MS; Kazuteru Ohashi, MD, PhD; Atsushi Takayanagi, DDS, PhD

Problem Statement: Hematopoietic cell transplant (HCT) recipients frequently develop severe stomatitis following chemotherapy and radiotherapy. Preventive oral care has been instituted, resulting in a decreased incidence of the complication. However, there are few studies on changes in oral microflora with oral care in HCT recipients. **Purpose:** This study was designed to examine the effectiveness of tongue cleaning in reducing oral bacterial load. **Methods:** The study included 15 subjects randomly selected from HCT recipients at Komagome Hospital. Mucosal swab samples were obtained from the tongue dorsum before and after tongue cleaning. The tongue was cleaned 3 times a day after meals from 4 weeks pre-transplant to 3 weeks post-transplant. The subjects were instructed to scrape residue off the tongue by using a sponge brush and stroking in 1 direction. Swab samples were subjected to microscopy and bacterial culture. Gram-positive cocci (G+C), Gram-positive rods (G+R), Gram-negative cocci (G-C) and Gram-negative rods (G-R) were observed under microscope. Bacterial counts of ≥50, <50≥20 and <20 were given the scores of +3, +2 and +1, respectively. Alpha-streptococci (α-S) and Neisseria (N) were cultured on agar. Over 2/3, <2/3≥1/3 and <1/3 of the agar surface area occupied by the bacterial colonies were scored by visual inspection as +3, +2 and +1, respectively. Pre- and post-cleaning scores were compared using the Wilcoxon signed-rank test. **Results:** Microscopic examination revealed pre-cleaning scores of 1.9±1.2, 1.9±0.7, 0.7±0.7 and 1.3±1.1, and post-cleaning scores of 1.3±1.0, 1.1±1.0, 0.1±0.3 and 0.4±0.6, for G+C, G+R, G-C and G-R, respectively. Significant reductions were observed for G+R, G-C and G-R ($p<0.05$). Culture tests also demonstrated significant reductions in the score from 2.7±0.5 and 1.6±0.9 before cleaning to 1.1±1.4 and 0.5±0.8 after cleaning for α-S and N, respectively ($p<0.05$). **Conclusions:** These results suggest that tongue cleaning is effective in reducing bacterial load on the tongue dorsum.

Effects of a Paste-Free Prophylaxis Polishing Cup and Various Polishing Prophylaxis Pastes on Enamel and Esthetic Restorative Materials: An In Vitro Investigation

*Caren M. Barnes, RDH, MS; David A. Covey, DDS, MS; Hidehiko Watanabe, DDS, MS

Problem Statement: Polishing of teeth and existing dental restorations is an integral part of an oral prophylaxis as defined by ADHA and other dental professional organizations. It is vital that dental hygienists and other dental health care providers are knowledgeable of effects that various prophylaxis polishing agents and devices have on surface characterization of hard dental tissues and esthetic restorative materials. **Purpose:** The purpose of this study was to measure surface roughness and surface gloss of tooth enamel, composite resin and dental porcelain when polished with a paste-free prophylaxis polishing cup and conventional prophylaxis polishing pastes. **Methods:** Samples of human enamel, a composite resin restorative material and dental porcelain were prepared by a series of polishing papers to produce a flat smooth surface. Baseline average surface roughness (Ra) was measured using a contact stylus profilometer and

surface gloss was measured with a glossmeter. Test samples were subjected to a standardized polishing routine using a paste-free prophylaxis polishing cup, a fine particle and a coarse particle prophylaxis polishing paste. Post-treatment surface roughness and gloss measurements were compared using a paired t statistical test. The paired t-test with statistical significance set at a p value of 0.05 was used to compare roughness and gloss of the baseline and treated composite resin, dental porcelain and tooth enamel surfaces. **Results:** The conventional prophylaxis pastes increased the surface roughness and decreased the gloss of the composite resin and tooth enamel test groups. The paste-free cups did not significantly affect the surface roughness of the enamel or esthetic restorative materials. Dental porcelain surface roughness was not affected by the application of paste-free cups or the fine or coarse prophylaxis pastes. **Conclusions:** Unlike conventional prophylaxis pastes, paste-free prophylaxis polishing cups can be used on enamel and esthetic restorative materials without significant disruption of the surface characterization.

Funding for this project was provided by Sunstar Americas, Inc.

Collaboration Between Two Health Disciplines to Train Dental Hygiene Students to Identify Risk Factors for Obstructive Sleep Apnea

*Diane P. Kandray, RDH, MEd; Mary L. Yacovone, RRT, MEd

Purpose/Goals: The purpose of this program was two-fold. First, to institute collaborative measures between dental hygiene and respiratory faculty to develop a program to instruct dental hygiene students about Obstructive Sleep Apnea (OSA). Secondly, to implement a program to train dental hygiene students how to effectively incorporate screening methods for OSA into the dental hygiene examination. **Significance:** Many dental patients have undiagnosed chronic diseases. The impact of these undetected diseases on an individual's general and oral health may have implications on their social life and workplace environment. The dental professional has a unique opportunity to recognize signs and symptoms of OSA and refer patients for further evaluation. **Approach/Key Features:** The respiratory therapy and dental hygiene faculty trained students on 2 separate measurement tools used to assess patients for OSA. First was the Epworth Sleepiness Scale, a daytime sleepiness questionnaire composed of 8 questions completed during the health history assessment. Secondly, the students were trained to evaluate the patients' oropharynx using the Modified Mallampati classification. To measure the accuracy of the students' ability to perform the Modified Mallampati, the clinic dentist also performed the Modified Mallampati classification. The results of the student and dentist assessments were compared to determine the students' performance of the Modified Mallampati classification in the clinic setting. **Evaluation:** After 3 semesters of students utilizing these 2 screening tools they have successfully performed these simple assessments during the dental hygiene visit to screen patients for risk factors associated with OSA.

Funding for this project was through the Department of Health Professions, Dr. Dominic A. and Helen M. Bitonte College of Health and Human Services, Youngstown State University

A Survey of United States Dental Hygienists' Knowledge, Attitudes and Practices (KAP) Regarding Current Dental Infection Control Guidelines

*Kandis V. Garland, RDH, MS

Problem Statement: The Centers for Disease Control (CDC) indicated a need to understand KAP of dental workers because evidence indicates low compliance with infection control practices among health care providers. Identifying KAP of U.S. dental hygienists (USDH) regarding infection control guidelines (ICG) will provide data for future interventions. **Purpose:** To assess 4 questions: 1) What do USDH know about ICG? 2) What are USDH attitudes regarding ICG? 3) What infection control behaviors are used by USDH? 4) Are there relationships among demographics and KAP data? **Methods:** After IRB approval, a proportional stratified random sample of USDH (n=2500) was recruited for participation in a descriptive survey. The instrument, "KAP of USDH Regarding Current ICG," was adapted from a validated instrument that included a scoring rubric categorizing compliance barriers into domains (lack of familiarity, awareness, agreement, self-efficacy, outcome expectancy; previous practice; external factors). Descriptive data analyses reported demographics. Cronbach's alpha determined internal reliability of the domains. Spearman's rho determined relationships among demographics and KAP responses. The level of significance was set at <0.05. **Results:** A 31% response rate (n=765 of 2,500) was attained. Internal reliability of the domains was not validated by Cronbach's alpha at the 0.70 level; however, 2 domains approached significance: familiarity=0.671 and environmental factors=0.666. Respondents somewhat agreed to familiarity with guidelines (mean=4.23/6.0) and relevance to pa-

tients (mean=4.26/6.0). Responses indicated ICG recommendations were rarely followed for alcohol-based hand rubs (mean=2.66/5.0), pre-procedural rinses (mean=2.86/5.0), and utility glove use (mean=2.34/5.0). Significant positive relationships ($p<0.05$) were found between years of practice and 2 items: utility glove use and inconvenience of guidelines. Comments indicated time is a barrier, and respondents' perceived a need for involvement of the entire dental team. **Conclusions:** Interventions for improving compliance with dental infection control guidelines are needed.

Funding provided by the Division of Health Sciences, Idaho State University.

Student and Faculty Perceptions of Distance Education in Dental Hygiene Bachelor Degree Completion Programs

*Maureen Tsokris, RDH, EdD

Problem Statement: Dental Hygiene Bachelor of Science degree completion programs across the country are utilizing distance education to deliver their curriculums, yet little research has been conducted to explore the perceptions, of faculty and students who have had experience with this method of learning. **Purpose:** The purpose of study was to investigate student and faculty perceptions of online learning in Dental Hygiene BS degree completion programs. **Methods:** Part I of the study was conducted as a qualitative multiple case design. Subjects were selected by purposeful sampling. Semi-structured interviews were conducted with 6 students. NVIVO qualitative software was used for data analysis. Part II of the study was conducted as a quantitative analysis. An email invitation with a link to the 36 question, faculty survey was sent to faculty teaching online in degree completion programs in the U.S. The faculty survey was created using Vovici online web survey service. Data analysis was conducted utilizing SPSS 17. **Results:** Students reported the amount of effort they put into the classes directly impacted the quality of the learning experience. Findings indicated students would like more opportunity to interact with their classmates online. Students reported the convenience and flexibility of online is what most influenced their satisfaction. Faculty was well-informed regarding the factors that influence the quality of the learning experience. Moreover, they were aware of the significant role they play in developing discourse, and in providing well-organized courses that incorporated various instructional techniques. There were no differences found in the faculty's perceptions on the dimensions explored based on the format they taught in or faculty position. **Conclusions:** By examining faculty and student perceptions of online learning environments, program administrators and faculty members in BS degree completion programs will be better able to meet the needs of advanced degree seeking dental hygienists.

Cultural Competence and Dental Hygiene Program Evaluation

*Cheryl M. Westphal Theile, RDH, EdD

Problem statement: There was a void in the literature to demonstrate the effectiveness of the curricular interventions for cultural competence. This study involved the fourth phase of an action research project which was designed to answer the question: How effective is the dental hygiene program curriculum in educating students to become more sensitive to different cultures? **Significance:** Oral health disparities within the United States are documented by the Oral Health in America: A report of the Surgeon General (USDHHS, 2000). The Institute of Medicine report on health disparities, Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care (IOM, 2002) called upon all health professionals to be trained in cultural competence as an action towards removing this disparity. **Methods:** The dental hygiene cultural competence curriculum had been implemented since 2006 and encompassed lectures, clinical experiences and discussions. A mixed methods approach was designed to evaluate the curriculum by collecting data from 3 sources: students in a focus group, patient satisfaction surveys and student exit surveys upon graduation. The IRB application and approval assured student and patient confidentiality of information. The data from the focus group yielded subjective information on strengths, challenges and suggestions for improvement. The patient and student exit surveys yielded data analyzed for themes and opinions. **Evaluation:** Statistical results indicated that the dental hygiene program was 98% effective in educating students to be sensitive to different cultures. Students found difficulty conversing with the patient if English was not the native language. Improved communication could improve the provider-patient relationship. Investigating those students delivering care and those patients receiving dental hygiene care is suggested as methodology to evaluate program effectiveness.

Funding for this project was through the Dental Hygiene Program at New York University.

Increasing Antiplaque/Antigingivitis Efficacy of an Essential Oil Mouthrinse Over Time (6-Months)

*Christine Charles, RDH; Pejmon Amini, DDS; J. Anthony McGuire, MS; Krista Simmons; James Qaqish

Problem Statement: The Third National Health and Nutrition Examination Survey in the U.S. revealed that 62% of individuals had gingivitis at the time of examination. This number may be an underestimate as other surveys suggest over 90% of the population have some gingival inflammation. This study was conducted to evaluate the effect of a fixed combination of essential oils in a mouthrinse in reducing existing plaque and gingivitis over time. **Purpose:** This randomized, observer-blind, parallel, controlled clinical study evaluated essential oil-containing (EO) antiseptic mouthrinse (LISTERINE® Antiseptic) efficacy in reducing and/or controlling existing plaque and gingivitis over 6 months compared to a control (C) (toothbrushing and placebo rinse). **Methods:** One hundred thirty-eight healthy adults with mild to moderate plaque and gingivitis, following ethics board approval, were randomized into EO or C groups. All subjects received oral examinations, oral/written instructions on mouthrinse usage, monthly supplies replenishment and compliance assessment and assigned rinses to use unsupervised twice daily. Efficacy variables were whole mouth mean Modified Gingival Index (MGI), Turesky Modification of Quigley Hein Plaque Index (PI) and Bleeding Index (BI). Data were analyzed at 6 weeks, 3 and 6 months via ANCOVA. **Results:** EO group provided significant ($p<0.01$) MGI, BI, and PI reductions vs. C group, with increasing efficacy over each examination period. Control group MGI, BI and PI means remained relatively stable throughout the 6 month period with minimal increases across time. Compared to control, at 6 weeks, 3 and 6 months, MGI reductions were 4.7%, 9.1%, 20.4% and PI reductions were 7.6%, 12.6%, 26.3%, respectively. BI scores decreased over time and were significant vs. control. Additionally, MGI % sites improved for EO, 14.1%, 26.4%, and 43.3%, respectively. **Conclusion:** This study demonstrated that an EO containing mouthrinse provides an increasing benefit over a period of 6 months when used twice daily. The results confirm that daily use of an antiseptic EO rinse provides a clinically significant benefit in reducing existing plaque and gingivitis.

Funding for this project through Johnson & Johnson Consumer & Personal Products Worldwide, Division of Johnson & Johnson Consumer Companies Inc., Morris Plains, NJ, USA.

Factors Influencing Oral Hygiene Behaviour 12 Months After Dental Hygiene Treatment

*Birgitta Jönsson, RDH, PhD; Kerstin Öhrn, RDH, PhD

Problem statement: A patient's engagement in his own oral hygiene self-care is fundamental for a successful outcome in periodontal treatment. Little is known of which factors contribute to a predication of future interproximal cleaning behavior. **Purpose:** The purpose of the study was to provide an empirical test of the extended Theory of Reasoned Action (TRA) and the prospective direct and indirect role of attitudes, normative beliefs, subjective norms, self-efficacy and decisional balance in adult oral hygiene behavior and gingival outcomes. A second aim was to explore if a cognitive behavioral intervention in oral hygiene behavioral change had an impact on oral hygiene behavior and gingival outcomes 3 and 12 months after treatment. **Method:** The experimental intervention was based on cognitive behavioral strategies and Motivational Interviewing and the control was routine oral health education (information and instruction only). Structural equation model and maximum likelihood estimation with bootstrapping was used to test direct and indirect effects of the extended TRA model on oral hygiene behavior and gingivitis after treatment. The model was tested in a population (n=113) who had undergone initial periodontal treatment performed by dental hygienists. A blinded periodontist performed the clinical examinations. Before baseline examination, participants completed a questionnaire assessing oral hygiene behavior, TRA, attitude towards dental hygienists, self-efficacy and pros and cons towards interproximal cleaning. **Results:** The extended TRA, a cognitive behavioral intervention and gingival health at 3 months explained 73% of gingival outcomes at 12 months. A higher level of self-efficacy to perform interproximal cleaning at baseline was associated with higher frequencies of interproximal cleaning at 3 months (β-0.248, $p<0.05$). Greater beliefs in the hygienist and being female was linked to more normative beliefs which, in turn, related to greater self-efficacy in interproximal cleaning. Cognitive behavioral intervention was the strongest predictor for gingival health outcome at 3 months (β-0.664; $p<0.01$). **Conclusions:** The model demonstrated that psychosocial characteristics, impact from dental health professionals, gender and cognitive behavioral intervention are predicting factors for oral hygiene behavioral change.

Interdisciplinary Approach to Care: The Role of the Dental Hygienist on the Pediatric Feeding Team

*Merri L. Jones, RDH, MSDH; Denise M. Bowen, RDH, MS; Linda D. Boyd, RDH, RD, EdD

Problem Statement: Achieving and maintaining optimal oral health is challenging in children with special health care needs (CSHCN) due to the many challenges this group faces in both medical and dental care. **Purpose:** The purpose of the study was to gain a consensus from Washington State pediatric community feeding team members on the role of the dental hygienist as a team member in relation to elements of care coordination (assessment, dental hygiene diagnosis, planning, implementation, evaluation, advocacy and health education/promotion). **Methods:** The Delphi technique was used in 2 online rounds to survey community feeding team members (n=112). In round one, participants were asked to identify items within the elements of care coordination deemed necessary for inclusion in the roles of the dental hygienist as a member of the team. Items identified were categorized within the elements of care coordination. In round two, participants rated the importance of each item for inclusion. **Results:** Participants identified 33 items for possible inclusion in the role of the dental hygienist in round one and reached consensus in identifying 31 specific roles for the dental hygienist in all seven elements of care coordination in round two. **Conclusions:** Members of the WSCFTs believe the dental hygienist's role in an interdisciplinary approach to care would encompass all elements of care coordination. These findings may provide a framework for future implementation of a model for integrating dental hygienists into this interdisciplinary team.

Practice Research Coordinator Involvement Improves Study Participation

*Ashley C. Grill, RDH, BSDH, MPH; Damon Collie, BS; Ronald G. Craig, DMD, PhD; Van P. Thompson, DDS, PhD; Frederick A. Curro, DMD, PhD

Purpose/Goals: The goal of practice based dental research networks is to answer the questions that dental practitioners encounter in everyday dental practice. **Significance:** Practice based research networks help build the knowledge base in dentistry. **Approach/Key Features:** The network is made up of over 200 dental sites. Each site has a designated practitioner-investigator (P-I) and practice research coordinator (PRC). P-Is are defined as dentists, and PRCs are members of the dental team such as dental hygienists, dental assistants and office personnel. Site P-Is and PRCs are CITI certified and conduct all studies in accordance with Good Clinical Practice (GCP). All studies are IRB approved, and there are 16 studies either ongoing or completed. **Evaluation:** During a recent program evaluation among 84 network respondents, a statistically significant correlation (p=0.004) was found between the level of use of practice research coordinators and the number of studies participated in by each site. Practice research coordinators are key members of the research team, and they are important to conducting clinical studies in everyday practice. In addition, there was a correlation between satisfaction with the training and support and involvement of PRCs in organizing study activities (p=0.008), and there was also a correlation between satisfaction with training & support and the number of PRCs utilized by the office (p=.039).

Funded by NIDCR U01-DE016755.