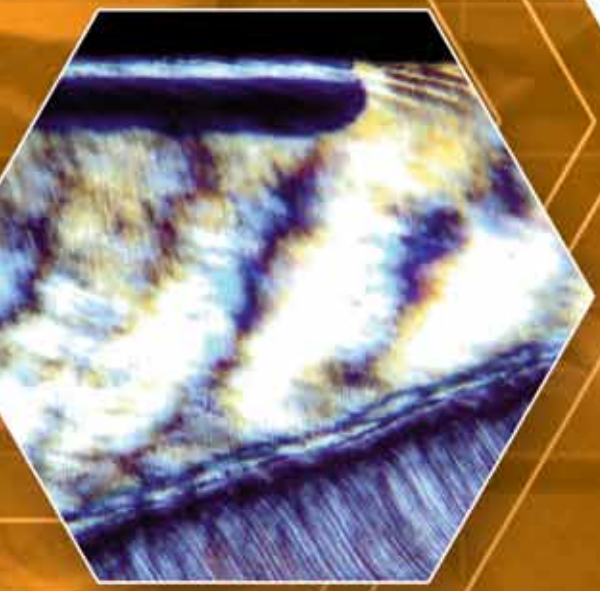
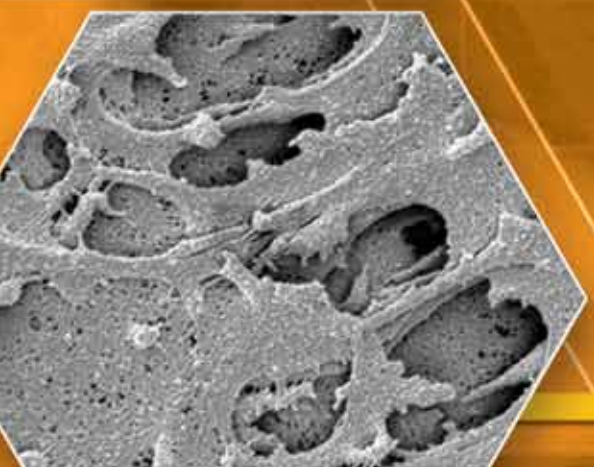
The University of Iowa
College of Dentistry & Dental Clinics

Iowa Section of the American Association for Dental Research (AADR)

61st Annual Meeting





2014

Keynote Address:

Oral and Periodontal Regenerative Medicine: Prospects for the Future

Repairing periodontal soft and hard tissue defects caused by periodontal disease or trauma is a major goal of reconstructive therapy. Regenerative medicine combines advances in materials science and the life sciences to repair tissues and organs. This presentation will review emerging therapies in materials science, growth factor biology, and cell/gene therapy for clinical application. He will also highlight the use of polymeric delivery systems and image-based scaffolding platform technologies to reconstruct periodontal and peri-implant defects and using regenerative molecule delivery and host modulation therapies to treat periodontal osseous defects.

Our Keynote Speaker

Dr. William Giannobile is the Najjar Endowed Professor of Dentistry & Biomedical Engineering at the University of Michigan School of Dentistry and College of Engineering and department chair of periodontics & oral medicine. He received his DDS and an MS in oral biology from the University of Missouri, a certificate in periodontology and DMSc in oral biology from Harvard University, and completed postdoctoral training in molecular biology at the Dana-Farber Cancer Institute and Harvard Medical School. Dr. Giannobile was a faculty member at Harvard and the Forsyth Institute in Boston, a visiting professor in 2006 at the Biotechnology Institute of Regenerative Medicine (University of Genova Medical School, Italy), and also a visiting professor at the UCL Eastman Dental Institute, (London, England) in 2013.

Dr. Giannobile has published and lectured about periodontal regenerative medicine and tissue engineering and authored several textbooks in clinical research and periodontal research methodologies. He is editor-in-chief of the *Journal of Dental Research* and a consultant to the Food and Drug Administration, the National Institutes of Health, and several biotechnology companies focused on regenerative medicine. Dr. Giannobile is a diplomate of the American Board of Periodontology and maintains a private practice limited to periodontics and implantology in Ann Arbor.

William Giannobile
D.D.S., D.Med.Sc.

Dental research images for the cover were provided by Matthew Black, Austin Foster, Zachary Goettsche, Courtney Mann, Eddie Pantzlaff, Denise Seabold, and Gustavo Avila-Ortiz.

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Dear Colleagues:

Thank you for your participation in the 61st Anniversary of the University of Iowa College of Dentistry's Local Research Day on February 11, 2014. Research is central to our mission and is important in itself and for the culture of inquiry that it supports. This day is one of the highlights of our life as an academic community. The event's planning committee and research presenters are to be heartily commended for their hard work.

We are honored to host Dr. William Giannobile as our keynote speaker. Dr. Giannobile is the Najjar Endowed Professor of Dentistry and Biomedical Engineering at the University of Michigan School of Dentistry and College of Engineering. He is also the chair of the Department of Periodontics & Oral Medicine.

Our College has been very successful in recruiting very bright and talented faculty in the past few years. This includes faculty with significant interests in tissue engineering, ceramics, genetics, malocclusion, health policy, and translational and clinical research. This infusion of new ideas has brought new avenues of research and mentoring opportunities across the pre-doctoral, clinical post-doctoral, and graduate programs. It is an exciting time for the College's future!

Local Research Day shows the people and the spirit of discovery that have always made possible outstanding education, service, research, and patient care within our College.

Local Research Day and this research abstract book offer many opportunities to learn about fascinating research within our College. Thank you for being a part of this important event.

Best wishes,

David C. Johnsen, D.D.S., M.S.
Dean

Dental Research participants and Iowa Section of the AADR

We would like to join in welcoming everyone to the Iowa section of the AADR annual research day on February 11, 2014. This research day is an important time of the year where we stop and listen to what each of our colleagues think and do in regards to their scholarship. This year we have the honor to welcome a special guest, Dr. Will Giannobile DDS, PhD, from the University of Michigan and the current editor-in-chief of the *Journal of Dental Research*.

The AADR annual research day celebrates the range of research interests across the College and shows the multiple links that we have with the entire campus at the University of Iowa. Here, undergraduates, dental students, residents, graduate students, and faculty all present their research results. The work spans the areas of basic, translational, clinical, and health services research all within one forum. This is an unusual event.

Of value during this day is the opportunity to discuss, critique, and learn from each other. This is a critical event in the life of the College and we hope you enjoy the day!

Warmest Regards,

Clark M. Stanford DDS, Ph.D.
Associate Dean for Research
Centennial Fund Professor
College of Dentistry and Dental Clinics

Kim Brogden Ph.D.
Director, Dows Institute for Dental Research
Professor
College of Dentistry and Dental Clinics

THE UNIVERSITY OF IOWA
COLLEGE OF DENTISTRY
& DENTAL CLINICS

Dear Colleagues,

On behalf of the Iowa Section of the American Association for Dental Research (AADR), we are very pleased to welcome you to the University of Iowa, College of Dentistry Research Day.

This is the 61st edition of this academic juncture that is arguably more than a mere annual event. Research Day is an open forum where exciting findings and ideas in basic, translational, clinical, and health services research, conducted by members of the College of Dentistry, can be shared with a broad audience. Today's activities demonstrate the investigative accomplishments of students, faculty, and research staff through posters, table clinics and oral presentations. Research Day is an extraordinary opportunity to both celebrate and reinforce the quality of research conducted at our College.

This year, it is our honor to have Dr. William Giannobile as the keynote speaker. He is the Najjar Endowed Professor of Dentistry & Biomedical Engineering at the University of Michigan School of Dentistry and College of Engineering. He is also the chair of the Department of Periodontics & Oral Medicine and current editor-in-chief of the *Journal of Dental Research.* His innovative research has focused on advanced diagnostic methods and novel tissue engineering strategies in the context of regenerative medicine and periodontology.

We would like to thank the presenters, volunteering judges, and supporting staff for their cooperation and support in making this event successful. And finally, we would like to extend a special thank you to all of the sponsors who have generously contributed to make it possible.

Sincerely,

Gustavo Avila-Ortiz, DDS, MS, PhD
Assistant Professor
Department of Periodontics
Department of Prosthodontics
President, Iowa Section of AADR

Chris Barwacz, DDS, FAGD
Assistant Professor
Craniofacial Clinical Research Center &
Vice-President, Iowa Section of AADR

Sharon Seydel
Department Administrative Manager
Dows Institute of Research
Secretary/Treasurer Iowa Section of AADR

Program

Iowa Section of the American Association for Dental Research (AADR)
61st Annual Meeting, Tuesday February 11th, 2014

7:30 a.m.	**Reception with Coffee and Rolls** (1st floor link)
8:00 a.m.	**Welcome Address** (Galagan Auditoria) Dr. David Johnsen and Dr. Clark Stanford **Keynote Speaker Introduction** Dr. Georgia Johnson
8:20 a.m.	**Keynote Address** (Galagan Auditoria) Dr. William Giannobile
9:20 a.m.	**Break**
9:30 a.m. - 11:30 a.m.	**Oral Presentations** Pre-Doctoral (Gal. A) Graduate & Post-Doctoral (Gal. B & C) Faculty & Staff (Gal. A, C, & Oral B Classroom N212)
11:30 a.m. – 12:40 p.m.	**Poster & Table Clinic Presentations** (Dows Institute & W220 A/B)
5:00 p.m.	**Awards Banquet Reception with Cash Bar** (Coralville Holiday Inn)
6:00 p.m.	**Awards Banquet Dinner & Awards** (Coralville Holiday Inn)

Presentation Assignments

Presenters are **underlined**.
Mentors are *italicized.*

Oral Session 1: Pre-Doctoral & Faculty

9:30 a.m. - 11:30 a.m., Galagan A

(a) Max Smith Pre-Doctoral Competition
(b) Iowa Society of Periodontology Pre-Doctoral Award

1a. **C.M. Stanford**, S. Raes, D. Cecchinato, J. Brandt, N. Bittner

Prospective, Randomized, Controlled, Multicenter Study Comparing Two Versions of an Implant System

1b. **S.R. Armstrong**, C. Bergeron, D.S. Cobb, G.E. Denehy, S. Guzman-Armstrong, M.M. Hernandez, J.L. Kolker, F. Qian

36 Month Clinical Evaluation of One-Step Self-Etching Adhesive in NCCLs

2. [a] **B. Darling**, *M.J. Kanellis*, S.C. McKernan, P. Damiano

Iowa Dentists' Willingness to Utilize Auxiliaries to Perform Restorative Procedures

3. [a,b] **E.N. Recker**, G. Avila-Ortiz, C.L. Fischer, K. Pagan-Rivera, *K.A. Brogden*, D.V. Dawson, S. Elangovan

Biomarkers of Inflammation around Implants Versus Natural Teeth

4. **D.V. Dawson**, D.R. Blanchette, K.W. Kramer, J.J. Warren, K.R. Phipps, D.E. Starr, T.A. Marshall, D.R. Drake

Deciduous Tooth Eruption Patterns in American Indian Children

5. [a,b] **J.R. Van Hemert**, A. Progulske-Fox, *K.A. Brogden*

***Porphyromonas gingivalis* HagB Binds to Dendritic Cell Membrane Proteins**

6. [a] **C.D. Hatch**, N. Nidey, *L.M. Moreno Uribe, G.L. Wehby*

Relationship between Perceived Facial Attractiveness and 3-Dimensional Facial Shape Components

7. **L. Hong**, N. Wei, T. Sharp, S. D'mello, A. Salem, B.A. Amendt

MicroRNA-Based Approaches for Restoring Oral and Craniofacial Disorders

8. **J.A. Banas**, M. Zhu, D.R. Blanchette, S.M. Levy

Isolation and Identification of Streptococci from Dental Plaque Samples

Oral Session 2: Graduate & Post-Doctoral

9:30 a.m. - 11:30 a.m., Galagan B

(c) Max Smith Graduate and Post-Doctoral Competition
(d) Dental Specialty Award Competition: Pediatric
(h) Dental Specialty Award Competition: Orthodontics
(i) Endodontic Michel Fuller Post-Doctoral Award
(m) Dental Specialty Award Competition: Prosthodontics

9. [c,i] **A. Brasser**, *M. Gomez*, D.J. Caplan, D.V. Dawson

Invasive Cervical Root Resorption: A Review of Clinical Cases

10. [c,m] **J. Garaicoa**, G. Avila Ortiz, C.M. Stanford, J. Holloway, P.W. Wertz, *K.A. Brogden*

Minimal Inhibitory Concentration of Antimicrobial and Antifungal Agents in Denture Adhesive Material against Candida Albicans

11. [c] **C.L. Fischer**, T. Abbasi, S. Vali, P.R. Nair, R. Vidva, *K.A. Brogden*

A Predictive Model of an Oral Inflammatory Response

12. [c,h] **C.M. Hoppens**, S.F. Miller, M.L. Marazita, G.L. Wehby, *L.M. Moreno Uribe*

Microesthetic Dental Analysis in Parents of Children with Oral Clefts

13. [c,d] **S.M. Leifker**, *K. Weber-Gasparoni*, M.J. Kanellis, F. Qian

Iowa Dentists and the Age One Dental Visit: 20-Year Follow-Up

14. [c,h] **C.A. Weaver**, S.F. Miller, *L.M. Moreno Uribe*

Candidate Gene Analyses of 3D Dental Phenotypes in Patients with Malocclusion

15. [c] **C.S.G. Da Fontoura**, S.F. Miller, N.E. Holton, T.E. Southard, V. Allareddy, B.A. Amendt, *L.M. Moreno Uribe*

Craniofacial Genes Associated with Dento-Facial Phenotypes in Patients with Malocclusion

16. [c,m] **C.L. Nicholas**, A.M. Bates, L. Hughes, C.A. Barwacz, D. Gratton, *C.M. Stanford*

Geometric Morphometric Assessment of Stability of Three Implant Abutment Designs

Oral Session 3: Graduate & Faculty

9:30 a.m. - 11:30 a.m., Galagan C

(c) Max Smith Graduate and Post-Doctoral Competition
(i) Endodontic Michel Fuller Post-Doctoral Award
(k) Dental Specialty Award Competition: Preventive & Community Dentistry
(l) Dental Specialty Award Competition: Operative Dentistry
(n) Iowa Society of Periodontology (Postdoctoral)

17. **D.J. Caplan**, D. Oliveira, C. Anil Kumar, T.S. Ghazal

Association Between Dental Status and Time-to-Death Among Nursing Home Residents in Eastern Iowa

18. **R.L. Ettinger**

Some Ethical Issues in Geriatric Dentistry

19.[c,i] **D.G. Meier**, *A.E. Williamson*, P.W. Wertz, F. Qian

Effect of Application Time on Chlorhexidine Substantivity in Root Canals: An *in vitro* Investigation

20.[c,k] **A. Singhal**, *P. Damiano*, C. Buresh, D.J. Caplan, M. Jones, R.A. Kuthy, E. Momany

Eliminating Medicaid Adult Dental Coverage Increases Use of Emergency Departments in California

21.[c,l] **P. Ortega-Verdugo**, *S. Guzman-Amstrong*, *D.S. Cobb*, J.L. Kolker, M.M. Hernandez, J.J. Warren

Eight-Year Report of Stepwise Excavation Outcomes in a US Academic Setting: Preliminary Research Study

22.[c,n] **C.T. Poulsen**, C.L. Fischer, A.M. Bates, J.M. Guthmiller, G.K. Johnson, P.W. Wertz, *K.A. Brogden*

Differential Cytotoxicity of Long Chain Bases for Human Oral Keratinocytes, Fibroblasts, and Oral Squamous Cell Carcinoma Cell Lines

23. **A. Butali**, P.A. Mossey, W.L. Adeyemo, E.A. Mekonen, L.A. Gaines, J.C. Murray

Resequencing of NSCLP GWAS Candidate Genes in Two African Populations

24. **I. Denry**, J. Holloway

Effect of Strontium Additions on Crystallization Bahavior of Fluorapatite Glass-Ceramics

Oral Session 4: Faculty & Post-Doctoral

9:30 a.m. - 11:30 a.m., Oral B Classroom N212

25. **R.A. Kuthy**, S.C. McKernan

Monitoring Dentist Workforce: Iowa's Trends Since 1997

26. **N.E. Holton**, M.J. Ravosa, R.G. Franciscus, T.E. Southard

Dietary Behavior and Mandibular Form in "Robust" and "Gracile" Mice

27. **D.R. Drake**, A.L. Villhauer, D.J. Lynch, J.J. Warren, D.V. Dawson, T.A. Marshall

Colonization of mutans Streptococci in American Indian Children

28. **C.A. Squier**, N.A. Slach

Tobacco — New Products, New Marketing and New Risks?

29. **K.A. Brogden**

Use of Models to Provide New Directions for Research and Hypotheses in Molecular Interactions and Cell Signaling

30. **S.F. Miller**, S.M. Levy, J.J. Warren, T.E. Southard, *L.M. Moreno Uribe*

Dental Arch Shape and Integration in a Cross-Sectional Sample

31. **L.M. Moreno Uribe**, S.F. Miller, S.M. Weinberg

Exploratory Genotype-Phenotype Correlations of Facial Form and Asymmetry in Unaffected Relatives of Children with Non-Syndromic Cleft Lip and/or Palate

Pre-Doctoral Posters

11:30 a.m. - 12:40 p.m., Dows Institute, W220 A/B

(e) Procter and Gamble Pre-Doctoral Award
(b) Iowa Society of Periodontology Pre-Doctoral Award
(f) ADA Pre-Doctoral Competition

32.[e,f] **H.R. Anderson**, *J.J. Warren*, M.M. Jarrett, C.W. McBrearty

Practitioner Compliance in Providing Appropriate Treatment Following Caries Risk Assessment

33.[e,f] **J.D. Anderson**, *M.J. Kanellis*, F. Qian

Pulpotomy Ratio in Primary Teeth Treated with Stainless Steel Crowns

34.[e,f] **M.D. Baudino**, D.J. Lynch, A.L. Villhauer, *D.R. Drake*

Comparison of Identification Methods for *Streptococcus sobrinus* and *Streptococcus mutans*

35.[e,f] **J. Gradoville**, *T.A. Marshall*[1], D. Blanchette, *J.J. Warren*, D.V. Dawson, K.R. Phipps, D. Starr, D.R. Drake

Nutrient Intakes and Caries Experience in Native American Children

36.[e,f] **C.E. Bohn**, *M.R. McQuistan*, S.C. McKernan, J.A. Kirch, N.M. Askelson

Exploring Dental Patients' Preferences Towards Incorporating iPad Technology During Patient Education: A Focus Group Study

37.[e,f] **T.J. Crary**, *S.R. Armstrong*, F. Qian, R. Maia, S. Geraldeli

A New Fixation Method for Microtensile Testing of the Resin-Dentin Bond

38.[e,f] **A. Foster**, *N.E. Holton*, C.L. Nicholas, T.E. Southard

Ontogenetic Patterns of Lower Facial Integration

39.[e,f] **Z.S. Goettsche**, *R.L. Ettinger*, M.M. Hogan, J.D. Harless, F. Qian

In Vitro Assessment of NaF Rinse Concentration on Reduction of Demineralization

40.[e,f] **M.M. Jarrett**, *J.J. Warren*, H.R. Anderson, C.W. McBrearty

Assessment of Factors that Classify Patients as High Caries Risk

41.[e,f] **N. Major**, *M.R. McQuistan*, F. Qian

Changes in Dental Students' Attitudes Towards Treating Underserved Populations

42.[e,f] **D.M. Meirick**, *C.A. Squier*, *N.A. Slach*, F. Qian

Acceptability and Efficacy of Preventive Health Screening Measures in the Dental Office

43.[e,f] **K. Thomas**, *T.A. Marshall*, B. Broffitt, S.M. Levy

Early Diet and Oral Hygiene Behaviors and Adolescent Caries Experience

44.[b,e,f] **M.K. Black**, *S. Elangovan*, K.A. Brogden, D.V. Dawson, *G. Avila-Ortiz*

The Effect of Peri-Implant Keratinized Mucosa Width on Pro-I nflammatory Cytokine Expression

45.[b,e,f] **U.A. Diehl**, *C.A. Barwacz*, C.M. Stanford, L.T. Hughes, F. Qian, L.F. Cooper, J.S. Feine, M.K. McGuire

Electronic Assessment of Peri-Implant Mucosal Esthetics Around Three Implant-Abutment-Configurations

46.[b,e,f] **K. Hoogeveen**, *G. Avila-Ortiz*, V. Allareddy, M. Tamegnon, *C.A. Barwacz*

Assessment of Current Trends in CODA-accredited North American Pre-Doctoral Dental Implant Education

47.[b,e,f] **E. Pantzlaff**, D.V. Dawson, K.A. Brogden, J.C. Murray, G. Avila Ortiz, S. Elangovan, *C.M. Stanford*

Systemic Inflammation and the Impact of Obesity on Gingival Inflammation: A Pilot Clinical Study

48.[b,e,f] **K. Zimmerman**, *S. Elangovan*, K.A. Brogden, K. Pagan-Rivera, D.V. Dawson, G. Avila-Ortiz

Correlation Between Peri-Implant Radiographic Marginal Bone Loss and Inflammatory Biomarkers

49.[e,f] **J.J. Grabouski** , *R.N. Staley*, K. Pagan-Rivera, D.V. Dawson

Normal Versus Crowded Occlusions in Mixed and Permanent Dentitions

50.[e,f] **M. Hash**, *M. Geneser*, T.A. Marshall, F. Qian

Adolescent Knowledge and Perceptions of Sugared Beverages: Consumption Patterns and Caries Risk

51.[e,f] **R.S. Lubinsky**, M. Vickerman, F. Qian, *J.A. Banas*

Endodontic File Sterilization: a Survey of General Practitioners and Endodontists

52.[e,f] **A. Whitesell,** *J.J. Warren*, D.R. Drake, F. Qian, K.R. Phipps, D. Starr, D.V. Dawson, T.A. Marshall

Effects of Antibiotics on Oral Bacteria in American Indian Children

53. **E.C. Babor**, B. Broffitt, J.J. Warren, *S.M. Levy*

Patterns of Fluoride Intake From 6-17 Years of Age

54. [e,f] **N.A. Van Ess**, *J.A. Banas*, H. Zhang,

Extract Screening for *S. mutans* Growth Inhibition and Biofilm Breakdown

55. **R. Bowers**, *H. Ding*, *C.M. Stanford*, N. Shen, P. Nemmers

Development of Laser Micro-Surface Topographies for Dental Implant Cellular Attachment

56. **J. Garcia**, *J.J. Warren*, T.A. Marshall, B. Broffitt, S.M. Levy

Oral Health Behaviors, BMI and Beverage Consumption in Adolescents

57. **M. Johnson**, *R.N. Staley*, F. Qian, E. Spurgeon

Tooth Size-Arch Perimeter Discrepancy in Normal and Crowded Occlusions

58. **T.G. Layer**, A.L. Villhauer, D.J. Lynch, *D.R. Drake*

Comparison of *Streptococcus mutans* Genotypes in Two Minority Populations

59. **K.J. Lee**, *D.J. Caplan*, H. Cowen, R.L. Ettinger

Health Trends in the University of Iowa Special Care Patient Population

60. **C.A. Mann**, *C.A. Barwacz*, F. Qian, G. Avila-Ortiz

Effect of Introductory Dental Education on Perceptions of Peri-implant Esthetics

61. [e,f] **M.R. McCormick**, *J.A. Banas*, F. Qian

Effects of Chlorhexidine and Xylitol Floss on Interproximal Bacteria Concentrations

62. **E. Moellers**, F. Qian, *R.A. Kuthy*

Individual School Lunch Eligibility and Dental Treatment Needs

63. **B.M. Nashleanas**, *S.C. McKernan*, R.A. Kuthy, F. Qian

Accuracy of Fourth-Year Dental Students' Prediction of First Employment

64. **B. Roemmich**, E. Kopec, *R.N. Staley*, F. Qian

Molar A/P Transitions in Normal and Class II Occlusions

65. **N. Saur**, A.L. Villhauer, D.J. Lynch, F. Qian, D.V. Dawson, J.J. Warren, T.A. Marshall, K.R. Phipps, *D.R. Drake*

***Streptococcus mutans* and Lactobacilli in Young American Indian Mothers**

66. **C. Shao**, *M.R. McQuistan*, T. Chen, C.F. Espanto

Can Hypothetical Scenarios Be Used To Predict Real-Life Dental Treatment Decisions?

67. **S. Swanke**, *D.R. Drake*, S.M. Levy, F. Qian, A.L. Villhauer, D.J. Lynch

Cariogens in 16-19 Year Olds in the Iowa Fluoride Study

68. **T.M. Zmoos**, *J.A. Banas*, F. Qian

Clinical Effects of Listerine Compared to Listerine Zero

Graduate, Faculty & Staff Posters & Table Clinics

11:30 a.m. - 12:40 p.m., , Dows Institute, W220 A/B

(d) Dental Specialty Award Competition: Pediatric
(g) ADA Graduate and Post-Doctoral Competition
(i) Endodontic Michel Fuller Post-Doctoral Award
(l) Dental Specialty Award Competition: Operative Dentistry
(m) Dental Specialty Award Competition: Prosthodontics

69.[g,l] **R. Alammari**, *M. Vargas*, D.S. Cobb, J.L. Kolker, F. Qian, M.M. Hernandez

Assessing Differences between the Dentin Color and the Tooth Color

70.[g,l] **L. Alghaith**, *S.R. Armstrong*, E. Glenn, J. Jessop, F. Qian, D. Aunan, R. Maia, G.E. Denehy

Ceramic Thickness and Translucency Effect on Polymerization of Resin Cement

71.[g,l] **M. Alrefeai**, *J.L. Kolker*, F. Qian

Treatment Subsequent to Placement of Anterior Composites over 15+ Years

72.[d,g] **S.R. Fox**, J.J. Warren, K. Weber-Gasparoni, T.A. Marshall, A. Schumacher, *D.V. Dawson*, D.R. Drake, M.J. Kanellis

Factors Associated with Early Childhood Caries in a Midwestern Hispanic Community

73.[g,i] **C. Garcia**, *S. Guzman-Armstrong*

Restoring Canine Guidance with Lingual Nanofilled and Facial Microfilled Resin Based Composite

74.[g,i] **B.C. Jorgensen**, *A.E. Williamson*, R. Chu, F. Qian

The Efficacy of the WaveOne Reciprocating File System Versus the ProTaper Retreatment System in Endodontic Retreatment of Two Different Obturating Techniques

75.[g,m] **A. Mahrous**, K. Wongkamhaeng, D.V. Dawson, D. Gratton, *G.N. Thalji*

Reliability of E4D Compare Software: An Inter-Rater Evaluation

76.[d,g] **K. Risma**, *K. Weber-Gasparoni*, S. Swenson, R.L. Ettinger, F. Qian

Caregivers' Comfort Levels Regarding Physical Resistance during Oral Care Delivery

77.[d,g] **G. Weinberg**, *K. Weber-Gasparoni, M. Geneser, F. Qian*

Perceptions of Pediatric and General Dentists on Placement of Stainless Steel Crowns on the Teeth of Ethnically Diverse Patients

78.[g,i] **A. Young**, *A.E. Williamson*, B. Hajdik, F. Qian

Reduction in Bone Density Necessary for the Detection of Periapical Pathosis

79. **T.S. Ghazal**, *S.M. Levy*, N.K. Childers, G. Cutter, H. Wiener, M. Kempf, J.J. Warren, J. Cavanaugh

Factors Associated with Early Childhood Caries Incidence among African-American Children in Alabama

80. **A.C. Lidral**, S.A. Bullard, G. Bonde, L.M. Moreno Uribe, J. Machida, A. Visel, X. Li, B.A. Amendt, M.L. Marazita, K. Christensen, R.A. Cornell

Identification of Human Craniofacial, Thyroid and Heart Enhancers at the FOXE1 Locus

81. **J.J. Warren**, D.R. Blanchette, D.V. Dawson, K.R. Phipps, D. Starr, T.A. Marshall, D.R. Drake

Caries Prevalence in American Indian Children at Age 36 Months

82. **J.A. Kirch**, *S.C. McKernan, M.R. McQuistan, C. Straub-Morarend*

Developing an Assessment Tool to Review Electronic Patient Education Materials

83. **D.R. Blanchette**, D.V. Dawson, J.J. Warren, K.R. Phipps, D.R. Starr, T.A. Marshall, D.R. Drake

Longitudinal Course of Caries in Young Native American Children

84. **J. Reynolds**, *P. Damiano*, J. Glanville, J. Oleson, M.R. McQuistan

Neighborhood and Family Social Capital and the Oral Health of Children in Iowa

85. **D. Seabold**, K. Walters, C. Allamargot, *C.M. Stanford*

Evaluation of Keratinocyte and Fibroblast Cellular Dynamics on Innovative Coated Surfaces

86. **A.L. Villhauer**, D.J. Lynch, D.V. Dawson, J.J. Warren, T.A. Marshall, K.R. Phipps, *D.R. Drake*

Genotypic Diversity and Transmission of *Streptococcus mutans* in American Indians

87. **K. Anfinsen**, *M. Geneser* , K. Weber-Gasparoni , G. Gilbaugh, F. Qian

Oral Health Training for Caregivers in Residential Care Settings

Abstracts

1a. Prospective, Randomized, Controlled, Multicenter Study Comparing Two Versions of an Implant System

C.M. Stanford[1], S. Raes[25], D. Cecchinato[26], J. Brandt[27], N. Bittner[28]

[1]University of Iowa, Iowa City, IA;[25]Department of Periodontology and Oral Implantology, Faculty of Medicine and Health Sciences, Dental School, University of Ghent, Belgium; [26]Institute Franci, Padova, Italy; [27]Department of Prosthodontics, Goethe University, Frankfurt am Main, Germany; [28]College of Dental Medicine, Columbia University, New York, USA

Introduction: Aim of this 5-year, prospective, randomized multicenter study is to evaluate surgical and prosthetic aspects of two implant systems. Implant design changes included modifications in implant body shape, drilling protocol and abutment connections. Material and

Methods: 5 clinics participated in this study; all had IRB approval. Two versions of the implant system were used; EV (test) and TX (control). 120 subjects were randomized with either test or control implants. 59 subjects received 79 test implants and 61 received 87 controls. Partially edentulous subjects with healed sites allowing implant placement were recruited. Jawbone classification was related to thickness of the cortical bone trabecular bone structure in the test group. In the control group, implant installation followed the recommendations by the manufacturer dictated by bone quantity and quality judgment (Lekholm & Zarb). Bone classification, insertion torque values (ITV), surgeon's perception of primary stability were recorded. Marginal bone levels were evaluated on radiographs at restoration (baseline), 6 and 12 months post loading.

Results: Bone classification in the test group demonstrated soft trabecular bone and thin cortex in the maxilla, the mandible had an equal distribution of thick/thin cortex. Corresponding bone quantity and quality recordings in the control group revealed B/3 in the maxilla and B/2 in the mandible. Most subjects received one implant placed in the premolar or molar area (95% of sites). Fifty-three percent of the implants were placed in the maxilla. Mean ITV at placement was 30±13 Ncm and 22±9 Ncm for test and control groups, respectively. The surgeons reported a perception of elevated primary stability for the implants placed in the test group compared to the control group. Mean marginal bone level changes 6 months after functional loading showed a slight gain in both groups with no significant difference between the implant versions. Marginal bone levels up to 1 year of functional loading were stable. In total, 6 implants have been lost (4 test, 2 control) from implant placement.

Conclusions: Treatment with EV implant system utilizing its bone classification for guidance of drilling protocol, resulted in enhanced perception of implant stability. Marginal bone levels were stable 12 months after functional loading and did not differ between the implant versions.

Supported by: Dentsply Implants

1b. 36 Month Clinical Evaluation of One-Step Self-Etching Adhesive in NCCLs

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Objectives: IRB-approved thirty-six month matched-pair RCT to evaluate the effectiveness of a single component one-step self-etching adhesive in non-carious class V lesions (NCCLs) as compared to gold standard etch-and-rinse 3-step system.

Methods: Two premolars with NCCLs mostly in dentin were randomly assigned, pumice cleaned only, and restored by two clinicians in 30 adult subjects using either a self-etch 1-step or etch-and-rinse 3-step adhesive and nanofilled composite (Bond Force/Estilite Sigma Quick-BF/ESQ, Tokuyama; Optibond FL/Premise-OPFL/P). Cotton and cord was used for isolation in all but four restorations. Esthetic (surface luster and stain, marginal stain, color match, anatomic form), functional (retention, marginal adaptation, patient's view) and biologic properties (sensitivity, caries, tooth integrity, periodontal response, adjacent mucosa) were collected by two blinded and calibrated clinical evaluators at baseline, 6, 12, 24 and 36 months using Hickel et al., 2007 and 2010 criteria. The McNemar's test and Bowker's test of symmetry were used to compare restorations and Kaplan-Meier survival analysis was conducted to evaluate the survival distributions of length of overall clinical success between the two restorations (statistically significant if $p<0.05$, marginally significant if $0.05 < p < 0.10$).

Results: Retention over 36 months: OPFL/P one partially lost and BF/ESQ four lost restorations with all failed restorations from one clinician. Twenty-three patients were available for recall at 36 months. Within groups as compared to baseline: BF/ESQ had a significantly worse marginal stain (p=0.0186), retention (p=0.0455), marginal adaptation (p=0.0018); OPFL/P had improved periodontal response (p=0.0455). Between groups BF/ESQ had significantly better color match at baseline (p=0.0107) and significantly worse marginal adaptation (p=0.0252) at 36 months. A marginally significant difference between restoration survival (p=0.0568 log-rank test and p=0.0751 Wilcoxon test) was found with estimated 36-month probabilities of survival for BF/ESQ and OPFL/P of 0.75 and 0.92, respectively.

Conclusion: OPFL/P had significantly better clinical performance in NCCLs through 36 months as compared to BF/ESQ.

Supported by: Supported by Tokuyama Dental Corp, Japan

2. Iowa Dentists' Willingness to Utilize Auxiliaries to Perform Restorative Procedures

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Objectives: Utilization of expanded function auxiliaries (EFDAs) has been found to increase the capacity and efficiency of dental practice while maintaining acceptable quality of care. In looking to maximize the efficiency of dental practices in Iowa, stakeholders have discussed the possibility of expanding functions that can be provided by EFDAs. This survey of Iowa dentists explored their willingness to utilize EFDAs with restorative capacities.

Methods: Questions related to dentists' willingness to utilize EFDAs with restorative capacities were included in the "2013 Survey of Iowa Dentists." Survey data was integrated with the Iowa Dentists Tracking System to link responses to dentist characteristics. Only responses from primary care dentists in private practice were included. Independent variables included dentist's age, gender, specialty (pediatric vs. general dentistry), Medicaid participation, hours worked, and perceived workload. The study's dependent variable was dentists' willingness to consider utilizing EFDAs for placement and shaping of amalgam restorations; placement and shaping of composite restorations; and fitting and cementing stainless steel crowns (SSCs) on primary teeth. Bivariate analysis examined relationships between dentist characteristics and acceptability of delegating restorative functions.

Results: Response rate was 59.1% (n=677), with 97.0% of respondents being general dentists, 76.5% male, and 55.6% age 50 or older. Of all respondents, 22.3% would consider using EFDAs to perform amalgam restoration, 18.6% for composites, 31.9% for SSCs, and 37.0% would consider utilizing EFDAs to perform at least one of these restorative procedures. Bivariate analysis revealed that pediatric dentists were more likely to consider utilizing EFDAs to perform restorative procedures (p=0.004). No other variables were significant.

Conclusion: Over one-third of Iowa dentists indicated they were willing to consider utilizing EFDAs to perform restorative procedures, including placing and shaping amalgams or composites, and cementing SSCs on primary teeth. Pediatric dentists were more likely to consider utilizing EFDAs than general dentists.

Supported by: University of Iowa Dental Research Grant

3. Biomarkers of Inflammation around Implants Versus Natural Teeth

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The production of chemokines, cytokines, and biological mediators in peri-implant crevicular fluid (PICF) may differ from that in gingival crevicular fluid (GCF). Any differences among these anatomical locations may be used as biomarkers of periodontal and peri-implant health or early detection of periodontitis and peri-implantitis.

Objectives: The objective was to determine the production and concentration of 13 biomarkers of inflammation in the PICF and GCF in an adult population enrolled in a regular maintenance program.

Methods: PICF and GCF were collected from 45 females and 28 males (mean age, 59.95 with a standard deviation of 14.23; minimum age, 20; maximum age 86; and median age, 60). Concentrations of 13 biomarkers were determined with magnetic bead immunoassays (Millipore, Billerica, MA USA) in the Luminex 100 IS (Austin, TX) using Milliplex Analyst V5.1 (Millipore). Descriptive statistics, including sample size, mean, standard deviation, minimum, 25th percentile, median, 75th percentile and maximum, were computed for all biomarker outcomes (expressed as the median of the replicates). Differences of each outcome for the two sites within subject (i.e., the measurement at the implant site — the measurement at the control/tooth site) were calculated. Sign tests were performed to see if there was a difference in biomarker levels around dental implants vs. those around the natural tooth.

Results: Levels of IL-1α, IL-1β, IL-4, IL-6, IL-8, IL-10, IL-12, CRP, RANKL, osteoprotegerin, and adiponectin were all detected and concentrations did not differ significantly between the implant and control tooth sites. The data provided evidence at the 0.05 level for higher levels at the implant site than the control/tooth site for IL-17 (p=0.0225) and TNF-α (p=0.0319).

Conclusion: Levels of IL-17 and TNF-α were higher at the implant site than at the control/tooth site, and may be contributing factors in the pathogenesis of peri-implantitis.

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4. Deciduous Tooth Eruption Patterns in American Indian Children

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Objectives: The aims of this study were to describe deciduous tooth eruption in an American Indian population, to compare patterns of eruption by gender, and to contrast them with other populations.

Methods: A group of 239 mother-child dyads participated in a longitudinal oral health project conducted on the reservation of a Northern Plains tribe. Dental examinations were performed at baseline (approximately one month of age (±30 days)) and target ages of 4, 8, 12, 16, 22, 28, and 36 months. Descriptive statistics, 95% confidence intervals and graphics were used to describe tooth eruption patterns, which addressed the number of erupted teeth, time to eruption, and the number of erupted surfaces. Findings were compared for males and females, and with published data from other populations.

Results: There was no evidence of gender differences in the numbers of erupted teeth present over the longitudinal course ($p>0.05$). The mean number of erupted teeth at approximately 4, 8, 12, 16, 22, 28, and 36 months of age was 0.30, 3.68, 7.80, 12.49, 16.20, 18.93, and 19.95, respectively. Overall, there was an impression of early tooth eruption: natal teeth occurred in 4 of 239 children (1.67%); 16% had teeth present by age four months; 88% had teeth present by age 8 months. Observed patterns suggested that, on average, these children had more teeth present at age 12 months, and shorter times to eruption, than several other non-American Indian populations.

Conclusions: Tooth eruption patterns in this Native American sample suggest a possible contributing factor to high levels of decay in deciduous teeth of Native American children: earlier eruption implies that teeth have longer exposure to risk of caries and thus greater potential for decay. These findings could have practical implications for childhood oral health care and parental oral health education in this American Indian community.

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5. *Porphyromonas gingivalis* HagB Binds to Dendritic Cell Membrane Proteins

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Porphyromonas gingivalis hemagglutinin B (HagB) attaches to the surface of human myeloid dendritic cells. However, the identity of HagB binding proteins on dendritic cell membranes is not known.

Objectives: The objective of this study was to isolate and identify HagB-binding proteins from human myeloid dendritic cell membrane extracts.

Methods: 3.0 X 10^6 human myeloid dendritic cells were washed and permeabilized to remove cytoplasmic proteins (DUALXtract, DualSystems Biotech. Inc., San Pedro, CA). The remaining membrane fragments were solubilized with cell lysis buffer (Cell Signaling, Danvers, MA). Solubilized membrane proteins were mixed with magnetic beads containing immobilized HagB (Dynabeads, Life Technologies, Corp., Carlsbad, CA). After the beads were washed, affinity purified HagB binding proteins were removed, separated by Two-Dimensional Fluorescence Difference Gel Electrophoresis (2-D DIGE), picked, and sequenced.

Results: Multiple proteins were isolated and identified from magnetic beads containing immobilized HagB. Many of these proteins are involved in membrane structure and function. Among these was a receptor that was previously isolated using a HagB affinity column. This protein, identified as ACVR2 (activin A receptor type II), may be a potential HagB receptor on the dendritic cell surface.

Conclusions: ACVR2 is a cell surface protein spanning the cytoplasmic membrane that appears to bind HagB. As a ligand, HagB binding to ACVR2 may affect signal transduction contributing to robust chemokine and cytokine responses seen in HagB-treated dendritic cells.

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6. Relationship between Perceived Facial Attractiveness and 3-Dimensional Facial Shape Components

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Objectives: Patients often desire treatments that enhance facial esthetics. Thus, providers need standardized methods for measuring esthetics. We evaluated relationships between subjective perceptions of facial attractiveness and objective facial shape and asymmetry measurements from three-dimensional facial images. The long-term goal is to establish a valid, standardized method for dental providers to evaluate facial esthetics based on objective measurements.

Methods: The study included 3dMD images of 325 adult males and females without history of facial surgery or craniofacial anomalies. To capture subjective perceptions of facial attractiveness, frontal and profile (right and left) images were obtained from the 3dMD images, and rated for facial attractiveness by ten volunteers (Female=5; Male=5) on a 5-point Likert-scale and a Visual Analogue Scale (VAS); 33 images were duplicated to measure test-retest reliability. To capture objective facial shape and asymmetry, the images were digitized with 32 landmarks. The 3-dimensional coordinate data were submitted to geomorphometric analyses including Procrustes fit and principal component analyses to generate components of shape variation, including fluctuating asymmetry. Multivariate regression was utilized to test the association between attractiveness ratings and facial shape and asymmetry measurements controlling for subjects' gender and age and raters' gender.

Results: Test-retest reliability for overall facial attractiveness ratings was 0.69 on the Likert-scale and 0.75 on the VAS (no difference by raters' gender). The Likert-scale and VAS ratings were strongly correlated (r=0.87). Facial shape components related to facial height, width and upper and lower facial protrusion or retrusion as well as fluctuating asymmetry were significant predictors of overall attractiveness ratings on the Likert-scale and VAS ($p<0.001$). Increased facial width, lower facial protrusion, upper facial retrusion, low-set ears, and decreased facial height were associated with reduced attractiveness ratings.

Conclusion: Facial attractiveness can be partially explained by facial shape components related to height and width, overall facial size, and fluctuating asymmetry.

Supported by: Iowa Dental Research Grant

7. MicroRNA-Based Approaches for Restoring Oral and Craniofacial Disorders

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MicroRNA (miR) is a small non-coding RNA molecule, which functions in transcriptional and post-transcriptional regulation of gene expression via base-pairing with complementary sequences within mRNAs. The miRs actively participate in multiple signaling pathways of osteogenesis and osteoclastogenesis and regulate systemic and oral inflammatory reaction. Two research projects have been developing novel approaches using miRs to restore periodontitis-induced bone loss and craniosynostosis (premature suture fusion). Specifically, we are testing the effects mediated by overexpression of miR-200a and 200c, the members of miR-200 family, on regulation of osteogenic differentiation and proinflammatory factor expression. We preliminarily observed that miR-200a overexpression effectively inhibited *in vitro* osteogenic differentiation of human preosteoblasts by down-regulating expression of Runx-2, ALP, osteocalcin, and calcium content. We also found that overexpression of miR-200c reduced IL-8 expression, an inflammatory chemokine in human preosteoblasts after they were exposed to bacterial endotoxin *in vitro*. These data suggested that miR-200a may potentially be used to prevent osseous fusion of cranial sutures for craniosynostosis treatment and miR-200c may be used to prevent or arrest periodontal bone loss induced by acute and chronic periodontitis. In addition, our preliminary studies have shown that miR-200a can be intracellularly delivered into human preosteoblasts using biodegradable nanoparticles and transfect the cells, which indicates that this non-viral delivery system may potentially be used for delivering miRs for clinical application.

Supported by: NIH/NIDCR and the UI start-up grant

8. Isolation and Identification of Streptococci from Dental Plaque Samples

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Objective: Although *Streptococcus mutans* is recognized as a prominent cariogenic species, it is known that caries can occur in the absence of detectable quantities of *S. mutans*. An alternative etiology proposes a role for low pH oral streptococci of various species, including *Streptococcus oralis* and *Streptococcus mitis*. These low pH strep are atypical, possessing acid properties that are more similar to *S. mutans* than to the type strains of their particular species. As part of a project to examine a potential role for low pH strep, we have sought to isolate strains of *S. oralis* and *S. mitis* from site-specific plaque samples.

Methods: A series of biochemical tests were used to select presumptive *S. oralis* and *S. mitis* strains. PCR-based tests were selected for genetic confirmation.

Results: The isolation of *S. mitis* and *S. oralis* was less frequent than predicted. A potential explanation is that both the biochemical screening and genetic confirmations have limitations. However, the biochemical screening was particularly useful in identifying strains of *S. oralis* as it out-performed the genetic tests intended for species confirmation.

Conclusions: The categorization of oral isolates by biochemical patterns, in conjunction with testing of acid-related phenotypes, will enable a broad-based analysis capable of linking a larger pool of low pH oral strep to dental caries or health. Data analysis can proceed in the absence of species identification and may be used to direct speciation efforts to the strains of greatest interest.

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9. Invasive Cervical Root Resorption: A Review of Clinical Cases

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A retrospective analysis of records from patients with cervical resorption at the University of Iowa was performed. Numerous variables were analyzed, from patient descriptive factors to history of various dental treatments. Data were analyzed to better understand the etiology of invasive cervical root resorption and classify this current case series.

Fifty cases were investigated from patients aged 14 to 86. Only data readily available in the records was used, therefore missing information was encountered. Forty-six percent of the patients with cervical resorption had undergone orthodontic treatment, while 16% reported no orthodontic treatment; the remainder of the data was missing. 18% reported history of trauma to the associated teeth, while 10% reported no trauma history. Thirty-two percent reported periodontal therapy to the associated tooth, while 14% reported none. Thirty-two percent reported no known associated risk factors, while 30% reported multiple associated risk factors. Twenty-six percent of cases were treated by extraction, 18% were repaired without root canal treatment (RCT), 22% were repaired following RCT, and 28% were monitored. 6% of patients elected no treatment. Only 2 cases were diagnosed as class I, while 17 were class IV.

Attempting to look at risk factors for cervical resorption is difficult in a retrospective manner, due to missing information in patient records. The issue is quite complex, as some cases have no known risk factors and some appear to be multifactorial. A prospective examination may prove beneficial to further understand risk factors associated with this process.

Supported by: The University of Iowa College of Dentistry Department of Endodontics

10. Minimal Inhibitory Concentration of Antimicrobial and Antifungal Agents in Denture Adhesive Material against *Candida Albicans*

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Approximately 26% of the US population between the ages of 65 and 74 years is edentulous. Of the different proposed predictors and risk factors, low income and education levels have the highest correlation with tooth loss. While the incidence of complete edentulism in the United States has progressively declined over the past decade, the continued growth of the population strongly suggests that edentulism prevalence will likely remain constant or increase over the next few decades. However, complications can arise that include denture-associated *Candida* species infections and stomatitis. The infection and inflammation are sore, painful, and can impede oral function. In this study we assessed the activity of 11 agents in dental adhesive material as a delivery system against 2 strains of *C. albicans*. In conventional MIC assays, *C. albicans* were resistant to histatin 5 and lactoferrin yet very susceptible to SMAP28; long chain bases sphingosine, dihydrosphingosine, and phytosphingosine; and anti-fungal agents amphotericin B, chlorhexidine dihydrochloride, chlorhexidine gluconate, fluconazole, and nystatin. However, in 1% gel (final concentration) *C. albicans* were resistant to histatin 5, lactoferrin, SMAP28, sphingosine, dihydrosphingosine, and phytosphingosine suggesting that the components in denture adhesive may inactivate local innate immune factors in the oral cavity possibly predisposing users to fungal infections in or near their prostheses. In MIC assays in 1% gel (final concentration) *C. albicans* were very susceptible to amphotericin B, chlorhexidine dihydrochloride, chlorhexidine gluconate, fluconazole, and nystatin strongly suggesting that these anti-fungal agents could be candidates for inclusion in denture adhesive materials and used as a prescribed treatment in individuals with oral fungal infections in or near their prostheses.

11. A Predictive Model of an Oral Inflammatory Response

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Recently, we developed an *in silico* simulation model to predict chemokine and cytokine responses of dendritic cells to pro-inflammatory stimulation. In this study, we are working toward the development of an *in silico* keratinocyte/dendritic cell/CD4+ Tcell co-culture simulation model to predict chemokine and cytokine responses of oral mucosa to pro-inflammatory stimulation.

Objectives: The objective of this study was to compare the predicted responses of *in silico* stimulated keratinocytes, dendritic cells, and CD4+ Tcells to chemokine and cytokine agonists with the observed responses of cultured cells treated with the actual agonists.

Methods: Functional simulation models for keratinocytes, dendritic cells, and CD4+ Tcells were developed from manual information aggregation of published data on signaling pathways and intermediates, transcription factors, enzyme kinetics, and gene regulations. Cultures containing $2.0x10^4$ cells of keratinocytes, dendritic cells, or CD4+ Tcells were treated with 0.01M PBS, pH7.2; 10.0 and 1.0µg/ml *Escherichia coli* LPS, 50.0 and 5.0ng/ml IL4; 10.0 and 1.0µg/ml Pam3CSK4; 5.0 and 0.5µg/ml TGFβ; 200 and 100ng/ml IL10; or 200 and 100ng/ml IFN_{γ} for 16 hours. Concentrations of GM-CSF, MIP-1a, CCL4 (MIP-1β), CCL5 (RANTES), IL-1α, IL6, IL8, TNFα, IL12(p40), and VEGF were determined in culture supernatants with magnetic bead immunoassays (Millipore, Billerica, MA) in the Luminex100 IS (Austin, TX).

Results: A strong correlation was detected among predicted responses of *in silico* stimulated keratinocytes, dendritic cells, and CD4+ Tcells to 6 agonists with the observed responses of these cells exposed in culture to 2 different concentrations of the same 6 agonists.

Conclusion: These results are the first step to create a co-culture simulation model for studying oral inflammatory diseases that can be used to predict the effect of agonist concentration, the primary and secondary signaling pathways involved, the concentration and composition of the resulting chemokine and cytokine responses, and eventually provide the basis for novel therapeutic design.

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12. Microesthetic Dental Analysis in Parents of Children with Oral Clefts

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Background: Nonsyndromic cleft lip and palate (NSCL/P) is a complex trait caused by genetic and environmental factors that interact producing a wide spectrum of orofacial malformations, including dental anomalies. The underlying genetic etiology that accounts for phenotypic variation in affected families is poorly understood.

Purpose: The purpose of this study is to utilize shape and microesthetic analysis to characterize the maxillary anterior dentition in unaffected parents of children with NSCL/P (cases) compared to control adults with no CL/P history to identify dental morphology features that are part of the NSCL/P phenotypic spectrum and can therefore be used in refining NSCL/P phenotypes and identifying genetic risk factors.

Methods: Individuals were recruited from 5 sites including Iowa, Texas, Hungary, the Philippines, and Pittsburgh, PA. From a total of 3,202 individuals, 482 qualified after strict selective criteria. Digital photographs from 322 females (158 cases, 164 controls) and 160 males (95 cases, 65 controls) were analyzed using linear metrics and 2D-coordinate landmark-based geometric morphometrics (GM) to compare dental esthetics and deviations from "golden proportions." Differences in central incisor and connector height proportions were evaluated using paired T-tests. Anterior tooth shapes, angulations, and gingival margin heights were examined using GM techniques.

Results: Female cases had significantly ($p<0.05$) wider central incisors, more square anterior tooth shapes, increased inward dental angulations, and more unaesthetic gingival margin height configurations compared to female controls. Male cases also displayed increased inward dental angulations and a tendency for unaesthetic gingival margin heights.

Conclusions: Significant differences in anterior dental morphology were found between cases and controls, with controls displaying a more ideal dental morphology than cases for most evaluated measures. The identification of these distinct dental features in carriers of NSCL/P genetic risk factors further characterizes the phenotypic spectrum of NSCL/P which can enhance the power of genetic studies.

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13. Iowa Dentists and the Age One Dental Visit: 20-Year Follow-Up

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Purpose: Assess current attitudes, knowledge and behaviors of Iowa general dentists regarding the age one dental visit. An additional purpose was to compare results with previous surveys conducted in 1994 and 2004 and evaluate trends over the last two decades.

Methods: A 13-item survey was mailed to 1,167 Iowa dentists. Bivariate analyses and logistic regression models were used to analyze data (alpha=0.05).

Results: Overall response rate was 72%. Currently, more Iowa dentists (57%) believe children should be seen for their first dental visit before age 2 compared to only 11% in 1994 and 36% in 2004. The same trend was observed regarding willingness to accept 0- to 23-month-old patients into their practices (26% in 1994, 53% in 2004, and 80% currently). Bivariate and multiple logistic regression analyses indicated that dentists who believed children should have their first visit before age 2 and those willing to see children before age 2 were younger, more recent graduates, more likely to be female, aware of the AAPD age 1 dental visit recommendation, and already seeing children 0 to 23 months ($P<.05$ in all instances). Furthermore, Iowa graduates who rotated at the University of Iowa Infant Oral Health Program (IOHP) located at a local WIC clinic were significantly more likely ($P<.0001$) to believe children should be seen for their first dental visit before age 2 compared to those who did not rotate at the IOHP.

Conclusions: Significant improvements have been made over the last 20 years regarding the age 1 dental visit in Iowa.

Supported by: Research supported by the Delta Dental of Iowa Foundation

14. Candidate Gene Analyses of 3D Dental Phenotypes in Patients with Malocclusion

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Objectives: About 2% of the US population suffers from severe malocclusion discrepancies that are beyond the limits of orthodontics alone. This study explores correlations between 3D malocclusion phenotypes and craniofacial development genes.

Methods: CBCTs (124) or digital casts (161) of 285 subjects with skeletal Class I (n=60), II (n=143) and III (n=82) malocclusion were digitized with 48 dental landmarks. Three-dimensional coordinates were superimposed prior to Principal Component (PC) analyses to identify symmetric (sym) and asymmetric (asym) aspects of shape variation related to malocclusion. PCs explaining 51%-67% of total shape variation were regressed on 200 variants genotyped within 75 genes adjusting for race, gender, age and data source.

Results: Significant correlations (p<0.01) were found for sym variation and BMP3, PITX2, *SNAI3*, *ARHGAP29* and FGF8 and asym variation with *PAX7*, *TBX1*, *LEFTY1*, *SATB2*, *SOX2* and *TP63*.

Conclusion:

Results: The results suggest that genetic pathways are associated with malocclusion.

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15. Craniofacial Genes Associated with Dento-Facial Phenotypes in Patients with Malocclusion

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Objectives: Dento-facial phenotypic variations resulting in moderate to severe dental and skeletal malocclusion are thought to be the result of susceptibility genes, environmental factors and/or their interactions. This study evaluates genetic associations between craniofacial genes and dento-facial phenotypes in patients with malocclusion.

Methods: Lateral cephalometric radiographs of 258 Euro-American untreated adults presenting with Class I (straight facial profiles), Class II (convex facial profiles mostly due to mandibular deficiencies) and Class III (concave profiles with maxillary deficiency, mandibular prognathism or both) malocclusion were digitized with 29 landmarks. 2D coordinates were submitted to a Procrustes fit prior to a principal component analysis (PCA). Individuals were genotyped with 198 single nucleotide polymorphisms (SNPs) located within 75 craniofacial genes and loci. Phenotype-genotype correlations for the first 4 components explaining 60% of the total variation were tested via multivariate regression.

Results: PC1 explains 25% and is related to vertical discrepancies ranging from skeletal deep to skeletal open bites and is correlated (p<0.01) with a SNP in the PAX5 gene. PC2 explains 21.5% of the variation and depicts horizontal maxillary discrepancies ranging from maxillary retrusion to protrusion and it is correlated with SNPs in MYO1H and SNAI3. PC3 explains 7.7% of the variation and shows variation ranging from bimaxillary retrusion and a steep cranial base to bimaxillary protrusion and a flat cranial base. PC3 is correlated with SNPs in RUNX2, PAX5, NRIP2 and loci 12q13.13. Finally, PC4 explains 6% of the variance and shows variation ranging from a large to a small mandibular body and is correlated with SNPs in IRX1 and TWIST1.

Conclusion: Our findings indicate top priority candidate genes for future analyses related to vertical and horizontal facial variation. Also, our results replicated those of previous studies since both SNPs in 12q13.13 and MYOH1 were previously associated with maxillary retrusion and mandibular prognathism.

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16. Geometric Morphometric Assessment of Stability of Three Implant Abutment Designs

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Objectives: Current dental implant abutment design aims to create maximum long-term stability of the implanted tooth. Instability of the implant can lead to infection and, ultimately, implant failure, making this a key metric for predicting implant success. Monitoring patterns of morphological change around the implant site through time may provide a means of assessing implant stability.

Methods: Three implant abutment designs were randomly assigned to patients enrolled in the study. Subjects (n=144) had PVS dental impressions made prior to implant placement and at standard time intervals post-implantation through 1 year. Casts were poured and scanned using an optical scanner (3M Lava Scan ST), producing 3D surface renderings. 2D and 3D analyses of surface morphology around the tooth of interest were undertaken employing standard geometric morphometric (GM) analyses. Where possible, the contralateral tooth to the tooth of interest was used as a control. Coordinate landmarks and sliding semi-landmarks (digitized using Landmark Editor and tpsDIG2) were used to capture shape, and relative warps analysis (RWA; a type of factor analysis used for analyzing shape data) was run on the data using the program R.

Results: Shape variation was better detected by the 2D methodology than the 3D methodology. In the 2D dataset, relative warp (RW) 1 correlated with tooth type (incisor, canine, premolar), indicating that this captures an aspect of pre-existing shape variation. RWs 2 and 3, however, depict changes in the angulation of the inferior border of the alveolus (RW2) and concavity/convexity of the anterior alveolus (RW3). Time variables (i.e., visits) correlated strongly with RW2 (p=0.00273) while grafting correlated with RW3 (p=0.00114).

Conclusion: Variation in alveolar shape due to surgical intervention can be detected using a GM approach. This demonstrates that using a GM methodology to monitor patterns of change through time is an additional way to measure implant study outcomes.

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17. Association Between Dental Status and Time-to-Death Among Nursing Home Residents in Eastern Iowa

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Introduction: Students and faculty from the UI College of Dentistry provide comprehensive dental care to nursing home residents as part of the Special Care extramural rotation. Data collected during these rotations were analyzed to evaluate the association between residents' dental status and their time-to-death.

Methods: From 2006-08, dental screening forms were completed for all residents of ten nursing homes. Information about oral and general health was obtained, including number of natural teeth and use of dental prostheses. Information from the screening forms was linked with death certificate data from the Iowa Department of Public Health. Time-to-death was defined as the number of years between the screening date and the death date. Descriptive statistics about residents' general and oral health were compiled, and retrospective comparisons of their dental status and other variables were made between subgroups based on their time-to-death.

Results: 586 residents were screened. About 69% were female, and by September 2013, 502 residents (85.7%) had died. Overall, the mean (SD) age at screening was 83.8 (10.8) years; those who subsequently died were on average 9.1 years older at screening than those who had not. For this analysis, the cohort was stratified into three groups: Those who died from 0-1.5 years after screening (n=273); those who died from 1.5-6.5 years after screening (n=229); and those who had no death record (n=84). In a multivariable multicategory logit model, baseline variables significantly associated with greater time-to-death included younger age ($p<0.001$), female sex ($p=0.012$), and greater number of natural teeth ($p=0.042$).

Conclusions: These preliminary results are consistent with the notion that residents with more teeth lived longer after screening than did residents with fewer teeth, controlling for age and sex. Additional analyses are planned to further elucidate this relationship.

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18. Some Ethical Issues in Geriatric Dentistry

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The US population is aging — the life expectancy at age 65 in 1900 was 11.0 years while in 2000, it was 17.9 years. The fastest growing population is the cohort aged 85+. The emergence of the new dentate elderly consumer has resulted in many persons having oral health problems, which are known to influence general health. As people are living longer, dementia is going to be an increasing problem and more persons will end up being institutionalized. Longitudinal data from the geriatric mobile unit suggests there may be a bias in the way decisions are made regarding dental care services. This review highlights a series of ethical questions dealing with abandonment by health professionals or abuse by institutions or those holding power of attorney for health care of older adults.

19. Effect of Application Time on Chlorhexidine Substantivity in Root Canals: An *in vitro* Investigation

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Objectives: To determine of the effect of application time on substantivity of chlorhexidine used as a final rinse in root canal treatment of maxillary anterior teeth *in vitro*.

Materials and Methods: Forty-five extracted single canal maxillary anterior teeth with fully developed apices were decoronated and instrumented to within 1 mm of the apex, coronally flared with Gates Glidden burs, and prepared to a size 45/.04. Three percent NaOCl was used an irrigant during instrumentation. Seventeen percent EDTA was applied for 1 minute after cleaning and shaping had been completed for smear layer removal. A 2% CHX rinse was applied to three groups of 45 specimens for 1, 2, and 5 minutes in the canal. Paper points were used to dry the canals.

The samples were stored at 37˚C under 100% relative humidity. Each group was randomly divided into 3 subgroups and substantivity was evaluated after 24 hours, 7 days, and 28 days of incubation. The amount of CHX (in micrograms) was measured through UV absorption at 255 nm. Statistical analysis was performed by 2 way ANOVA.

Results: Preliminary data shows application time may have an effect on chlorhexidine substantivity during root canal treatment.

Conclusions: The use of chlorhexidine as a final rinse in root canal treatment may be beneficial due to its substantive nature even with limited application time.

Supported by: AAE Foundation

20. Eliminating Medicaid Adult Dental Coverage Increases Use of Emergency Departments in California

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Objective: To examine the impact of eliminating Medicaid adult dental coverage on emergency department (ED) use for dental problems by Medicaid adult enrollees.

Methods: Interrupted time series, a quasi-experimental study, was conducted using natural experiment of policy change in California, where Medicaid adult dental coverage was eliminated on July 1, 2009. State Emergency Department Databases (SEDD) for the state of California were acquired from the Agency for Healthcare Research and Quality (AHRQ) for 2006 to 2011 and a data use agreement was signed. The database contains information on all ED visits that occurred in California which did not lead to an admission. A non-equivalent dependent variable was used as a control to minimize treats to internal validity. Primary diagnosis ICD-9 codes were used to select ED visits due to dental problems. The study was approved by the University of Iowa IRB. Segmented linear regression analyses were conducted using SAS version 9.3.

Results: Before Medicaid adult dental benefits were eliminated, an average of 40.3 enrollees visited an ED per 100,000 enrollees over three and a half years (pre-intervention period). Over the next two and a half years (post-intervention period), an average of 53.4 enrollees visited an ED per 100,000 enrollees. Elimination of adult dental benefits under Medicaid had a statistically significant immediate increase in the proportion of Medicaid adult enrollees who visited ED for dental problem (beta=0.046, p-value=0.0011). There was a significant time trend and a constant increase in proportion of Medicaid adult enrollees who visited ED for dental problems throughout the study period (beta=0.0025, p-value<0.0001). However, the policy change did not change this time trend significantly.

Conclusion: The quasi-experimental study provides strong evidence that eliminating Medicaid adult dental benefits leads to an immediate and significant increase in the proportion of Medicaid adult enrollees who visit an ED for dental problems.

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21. Eight-Year Report of Stepwise Excavation Outcomes in a US Academic Setting: Preliminary Research Study

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Objectives: The purpose of this study was to demonstrate the effectiveness of a stepwise excavation procedure (SWP) for the treatment of deep carious lesions performed at The University of Iowa College of Dentistry (UICD) between 2004-2012 in patients from 18 to 65 years of age.

Methods: A retrospective analysis was done using recorded data of patients who had SWP in any of their teeth between 2004-2012 using the Electronic Health Record- Axium at the UICD.

The primary outcome denoting successful treatment was tooth survival, defined as a SWP-treated tooth which was re-evaluated/re-entered, did not result in an outcome of root canal treatment or extraction, and for which a final direct/indirect restorative material was placed. Restorative outcomes were assessed after the re-evaluation/re-entry of vital teeth treated by SWP. Descriptive statistics were generated, both on a restoration and subject level. The association between treatment outcomes and factors such as age, gender, provider, number of miles traveled, size of restoration, tooth arch position, and tooth type were also evaluated.

Results: Our preliminary data showed that the number of SWP performed at the UICD between 2004-2012 was 2,037 (1,370 subjects). The number of teeth re-evaluated/re-entered after SWP was 975 (47.86%), and 1,062 (52.14%) were not re-entered/re-evaluated. Of the 975 re-evaluated procedures, 686 had a final direct/indirect restorative material placed (~70%). Additional analyses assessed the association between clinical outcomes and survival rates of stepwise excavation completed treatments and their relationship with demographic characteristics and tooth characteristics.

Conclusions: These preliminary results provide significant information on the outcomes of stepwise caries excavation procedures completed at the UICD from 2004 to 2012. Additional investigation is needed to determine the reasons for the high percentage of procedures with no re-evaluation/re-entry follow-up.

22. Differential Cytotoxicity of Long Chain Bases for Human Oral Keratinocytes, Fibroblasts, and Oral Squamous Cell Carcinoma Cell Lines

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Background: Long chain bases (sphingosine, dihydrosphingosine, and phytosphingosine) are present in the oral cavity and have potent antimicrobial activity against oral pathogens, including gram-negative bacteria such as *Porphyromonas gingivalis*, which is involved in the development and progression of periodontal disease. However, little is known about the cytotoxicity of these long chain bases in relation to host cells of the oral cavity, an important step in considering their potential as future antimicrobial agents for oral infections.

Objectives: The objective of this study was to determine the lethal dose 50 (LD_{50}) of long chain bases for primary human oral keratinocytes, primary oral fibroblasts, dendritic cells, and oral squamous cell carcinoma cells.

Methods: Cells were exposed to long chain bases and glycerol monolaurate (10.0-640.0 μM) in cell culture medium containing Alamar blue. Cell metabolism was assessed at 48 hours by the conversion of resazurin to resorufin and the LD_{50} values were determined as the 50 percent intercept of the percent cytotoxicity values and the long chain base concentration.

Results: Primary oral keratinocytes and oral fibroblasts were found to be more resistant to the cytotoxic effects of the long chain bases with mean LD_{50} values of 362.88 and 260.35 μM respectively. Human dendritic cells and oral squamous cell carcinoma cells, however, both showed significantly lower LD_{50} levels of 86 μM indicating more susceptibility to long chain bases. Primary oral keratinocytes demonstrated the highest resistance to long chain bases. Sphingosine, dihydrosphingosine, and phytosphingosine all had similar cytotoxic effects on each cell type.

Conclusions: Overall, long chain bases have lower cytotoxicity for human oral keratinocytes and fibroblasts in comparison to human dendritic and oral squamous cell carcinoma cell lines, a finding important to their future potential as therapeutics for prevention or treatment of periodontal disease infections.

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23. Resequencing of NSCLP GWAS Candidate Genes in Two African Populations

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Objective: Genome-wide association studies for nonsyndromic cleft lip and palate (NSCL(P)) reported significant association for common variants near genes involved in craniofacial development, i.e. *MAFB*, *VAX1*, *PAX7* and *IRF6*. Furthermore, resequencing studies on the NSCL(P) GWAS candidate genes or adjacent genes suggest a role for rare functional variants. Previous association studies using samples in the African population did not find any significant association with the GWAS candidate genes. However, the contribution of rare functional variants in GWAS candidate genes has not been examined in the African population.

Methods: We obtained saliva samples from 220 case triads in Nigeria and Ethiopia (140 Nigerians and 80 Ethiopians) for Sanger sequencing of the GWAS candidate genes.

Results: We found a rare missense variant that changes amino acid histidine to asparagine at position 165 (p.His165Asn) in *MAFB*; a novel splice-site variant that creates a new donor splice-site in *PAX7*; a novel missense variant that changes aspartic acid to asparagine at position 428 (p.Asp428Asn) in *PAX7*; previously reported missense variant that changes glycine to serine at position 466 (p.Gly466Ser) in *PAX7* and two previously reported missense variants were found in *ARHGAP29*.

Conclusions: There is a need for genome-wide association and sequencing studies using samples from Africa in order to identify genetic factors that are specific to this population.

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24. Effect of Strontium Additions on Crystallization Behavior of Fluorapatite Glass-Ceramics

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Strontium-containing bioactive glasses have been shown to promote bone formation and osseointegration.

Objective: to investigate the effect of partial substitution of strontium for calcium on the microstructure and phase composition of fluorapatite glass-ceramics as scaffold materials for bone grafts.

Methods: Four glass compositions with increasing amounts of strontium oxide from 0 to 24 mol.% were prepared by melting at 1525˚C for 3h. Glasses were cast into cylindrical ingots. Disc-shaped specimens were cut from the ingots and heat treated at various temperatures from 775 to 900˚C for one hour. The crystalline phases were analyzed by x-ray diffraction. The crystallization behavior was investigated by DTA/TGA. The microstructure of the glass-ceramics was characterized by high resolution SEM.

Results: XRD analyses revealed that strontium additions led to the crystallization of partially substituted strontium fluorapatite ($(Ca,Sr)_{10}(PO_4)_6F_2$) and strontium akermanite ($(Ca,Sr)_2MgSi_2O_7$). The lattice parameters and consequently, the unit cell volume increased linearly with the amount of strontium added for both strontium fluorapatite (R^2=0.96) and strontium akermanite (R^2=0.97). Thermograms of Sr-glasses were characterized by two exotherms attributed to Sr-fluorapatite and Sr-akermanite. The temperature difference between the two exotherms increased linearly with increasing amount of strontium in the composition (R2=0.98). Strontium also affected the microstructure by increasing the number of crystallization sites and significantly decreasing fluorapatite crystal diameter from 1.66±0.55 microns to 0.36±0.01 microns after heat treatment at 800˚C for 1h (p<0.05). A coast-to-island microstructure of mixed Sr-akermanite and Sr-fluorapatite crystals developed after heat treatment at 900˚C for 1h, accompanied by a decrease in mean crystal size as the amount of strontium increased.

Conclusion: Strontium was successfully incorporated into both fluorapatite and akermanite phases, proportionally to the amount added to the glass composition. Strontium additions delayed the crystallization of akermanite and led to a significant decrease in fluorapatite crystal diameter.

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25. Monitoring Dentist Workforce: Iowa's Trends Since 1997

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Objective: To monitor the statewide number of dentists, both full- and part-time, using a unique, non-regulatory system.

Methods: Biographical, educational, and professional information about every active Iowa dentist is gathered and updated at least semi-annually through the Iowa Dentist Tracking System (IDTS), which is one of five health professional systems in the state. The first full year of data collection for dentistry was 1997. This period approximates the time when women were dramatically increasing their presence in the profession and the preponderance of male dentists was beyond 50 years of age. For these analyses, part-time is defined as working fewer than 32 hours per week, on average.

Results: The number of active dentists in Iowa remained relatively stable (range 1,417-1,461) for a decade, then it increased by 6.2% from 2008 through 2012. The percentage of women has more than doubled (11.4% to 24.6%) during the past 16 years. Conversely, the percentage of private practitioners 60 years and older, which is overwhelmingly male, increased from 13.8% to 23.8%. Part-time dentists decreased from 13.8% to 11.3% from 1997 to 2007, then rose gradually to 16.1% by 2012. However, the percentage of female dentists who worked part time was approximately double that of their male colleagues for each year. In 2012, dentists had the largest percentage of its profession who were 60 years or older among the statewide tracking systems. Forty-three of Iowa's 99 counties had a population-to-dentist ratio of greater than 3000:1, with 15 of those counties having a ratio of greater than 5000:1.

Conclusions: There has been a dramatic increase in the percentage of female dentists since the beginning of this tracking system. It is anticipated that more rural counties will be adversely affected as a large bolus of dentists reach retirement age.

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26. Dietary Behavior and Mandibular Form in "Robust" and "Gracile" Mice

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Patterns of mandibular variation in past and present human populations are thought to reflect differences in jaw loading associated with dietary consistency (e.g., hard vs. soft). Comparative studies in recent humans have documented a predictable relationship between diet and measures of overall mandibular size and robusticity. Nevertheless, recent work has highlighted variability in form-function relationships in recent humans suggesting that the influence of function on mandibular form is not homogeneous across populations. To better understand variation in the morphological response to masticatory function, we examined two mouse models that exhibit baseline differences in mandibular cortical bone thickness. Our "robust" (C3H/HeJ) and our "gracile" (C57BL/6) strains were both separated into hard-diet and soft-diet trial groups. The hard-diet trial groups were fed normal pelleted mouse chow, while the soft-diet trial groups were fed mouse chow ground to a fine powder and mixed with water. The experimental protocol began at 5 weeks of age and continued for 60 days. Using microCT images we assessed mandibular cortical bone area in the molar region and assessed mandibular shape variation using geometric morphometric methods. Our results indicate a heterogeneous response to variation in functional loading. In our robust mouse model, there was a significant difference in mandibular cortical bone area between the hard- and soft-diet trial groups. Moreover, there were considerable differences in mandibular shape with the soft-diet trial group appearing more similar to the gracile mouse model. In contrast, the gracile mouse model trial groups did not exhibit any differences in mandibular cortical bone area or in mandibular shape. These results indicate that while functional loading influences the mandibular phenotype, the morphological response is variable. With respect to human comparisons, this suggests that there may be important population differences in form-function relationships and that mandibular form may reflect loading history only in some comparisons.

27. Colonization of mutans Streptococci in American Indian Children

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American Indian children suffer from a devastating form of caries called Severe Early Childhood Caries (S-ECC). We have conducted a five-year study looking at multiple variables that play a role in the development of this rapid and severe disease in very young children. We report here on aspects on transmission and acquisition of mutans streptococci from mother/primary caregiver to child in a subset of our study population. A description of the study design and colonization data will be discussed. Key findings within this focus are that a large proportion of these children are colonized very early (12 months) and that there is a high proportion of *Streptococcus sobrinus* (SS) along with *Streptococcus mutans* (SM) in this population. A synopsis of the profiles of multiple genotypes of SM shared vertically from mother/primary caregiver to child as well as shared genotypes across families will be provided today by other members of the research team. We are finding a cadre of variables that all seem to interplay and create the perfect storm that is S-ECC in these children.

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28. Tobacco — New Products, New Marketing and New Risks?

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While cigarette sales have declined over the past decade, the tobacco industry has promoted a range of attractive new products that can be chewed or sucked as well as smoked. These include small, favored cigars that circumvent the FDA restrictions on flavored cigarettes and hookah smoking, which is popular in college towns. A form of smokeless tobacco known as snus resembles the Swedish product but is not subject to the same controls on carcinogen levels as in Sweden. 'Dissolvables' consisting of soluble tobacco that resembles candy or is produced in the form of toothpicks or strips avoid the restrictions of smokefree laws. Electronic cigarettes are effective nicotine delivery devices, the use of which has doubled among youth in the past year and can be purchased by children in many jurisdictions; however, there are many questions as to the health effects on users and those inhaling the vapor from e-cigarettes.

This presentation will review the data on the health effects of these products, including the claims to harm reduction and discuss the challenges for tobacco control in particular and public health in general.

29. Use of Models to Provide New Directions for Research and Hypotheses in Molecular Interactions and Cell Signaling

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In our work, we are using a variety of methods to better understand the ability of peptides in saliva (e.g., defensins, histatins, etc.) to serve as downstream suppressors of cytokine signaling to recombinant hemagglutinin B (HagB) from the periodontal pathogen *Porphyromonas gingivalis*. Outside the cell, innate immune peptides likely interact with HagB. Surface plasmon resonance spectroscopy kinetic and equilibrium analyses, protein microarray studies, and I-TASSER structural models all have demonstrated the putative structure of HagB as well as the presence of two histatin 5 binding sites on HagB; one HBD1 binding site on HagB; and one HBD3 binding site on HagB. One histatin 5 binding site on HagB has a stronger affinity with a KD1 of 1.9 μM and another has a weaker affinity for histatin 5 with a KD2 of 60.0 μM. On the cell surface, HagB likely interacts with CD14 and activin receptors. However, the binding pattern seems to be influenced by pre-incubation of HagB with HBD3. Within the cell, histatin 5, HBD1, and HBD3 seem to alter the HagB-induced chemokine and cytokine responses. *In silico* dendritic cell functional simulation models and dendritic cell tissue cultures both demonstrated that 20.0 μM histatin 5 attenuated ($p < 0.05$) 0.02 μM HagB-induced CCL3/MIP-1α, CCL4/MIP-1β, and TNFα responses and 2.0 μM HBD3 enhanced ($p < 0.05$) 0.02 μM HagB-induced 6 chemokine and cytokines responses, attenuated 7 chemokine and cytokine responses, and both enhanced/attenuated the CXCL1 and TNFα responses. Such models have provided valuable new insights on the effects of innate immune peptides on agonist (e.g., HagB)-induced chemokine and cytokine responses.

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30. Dental Arch Shape and Integration in a Cross-Sectional Sample

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Objectives: Occlusal discrepancies of the maxillary and mandibular arches can have serious impacts on dental health and quality of life by reducing masticatory, respiratory, and speech functionality in growing individuals. This study evaluates shape variation and patterns of integration or modularity in the dental arches of four cross-sectional snapshots of the Iowa Fluoride Study cohort to identify maxillary and mandibular arch discrepancies.

Methods: Dental casts at ages 5 (n=305), 9 (n=272), 13 (n=151) and 17 (n=129) were scanned and digitized with 42—58 3D landmarks. After procrustes superimposition, the data were subjected to a Relative Warps Analysis to identify key components of dental arch variation. Two-Block Partial Least Squares analysis was employed to quantify levels of integration between the upper and lower arches using Escoufier's RV coefficient.

Results: The primary axis of arch shape variation across all time points (explaining 23.5%—28.5% of the variance) relates to the antero-posterior (AP) plane, with individuals ranging from an Angle Class II to a Class III malocclusion. Additional components of arch variation address vertical and transverse arch discrepancies. Maxillary and mandibular arch integration was high across all stages of dental development, with RV coefficients ranging from 0.74—0.79. However, testing for sets of landmarks with the least amount of integration resulted in the lowest levels of covariation (RV=0.45 at age 9) for the anterior vs. posterior regions of both dental arches.

Conclusion: The results highlight that the greatest amount of occlusal discrepancy was in the AP dimension and such patterns were present as early as age 5. Also, the least amount of covariation was not between the maxillary and mandibular arches (as one might expect), but rather within the anterior vs. posterior portions of both arches. This modularity was found to be greatest at age 9, which is consistent with the mixed dentition stage.

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31. Exploratory Genotype-Phenotype Correlations of Facial Form and Asymmetry in Unaffected Relatives of Children with Non-Syndromic Cleft Lip and/or Palate

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Objectives: Family relatives of children with nonsyndromic cleft lip with or without cleft palate (NSCL/P) who presumably carry genetic risk yet do not manifest overt oral clefts, often present with distinct facial morphology including facial asymmetries of unknown genetic etiology. This study examines whether candidate genes previously associated with NSCL/P overt clefts and left-right body patterning are correlated with facial features most commonly seen in carriers of NSCL/P risk.

Methods: Relatives of individuals with NSCL/P ("Cases"n= 188) and controls (N=194) without family history of NSCL/P were genotyped for 20 SNPs across 13 candidate genes for NSCL/P (*PAX7*, ABCA4-ARHGAP29, IRF6, MSX1, PITX2, 8q24, FOXE1, TGFB3, *MAFB*) and left-right body patterning (LEFTY1, LEFTY2, ISL1, and SNAI1). Facial shape and asymmetry phenotypes were obtained via principal component analyses (PCA), from 32 coordinate landmarks, digitized on 3D facial images. Phenotypes that differed between cases and controls ($p<0.05$) were regressed on the genotypes adjusting for age and gender.

Results: Case-control testing of facial shape differences showed that cases have significantly ($p<0.05$) more profile concavity with upper face retrusion, upturned noses with obtuse nasolabial angles, more protrusive chins, increased lower facial heights, thinner and more retrusive lips and more protrusive foreheads compare to controls. Furthermore, cases showed significantly different levels of facial asymmetry compared to controls. Genotype-phenotype correlations suggest that facial height and width were associated with SNAI1. The AP position of the midface is associated with LEFTY1. Also, the AP position of the chin is correlated with SNAI1, IRF6, MSX1 and *MAFB*. The AP position of the forehead and the width of the mouth were correlated with ABCA4—ARHGAP29 and *MAFB*. Lastly, facial asymmetry was correlated with MSX1 and LEFTY1.

Conclusion: In conclusion, genes underlying lip and palate formation and left-right patterning also contribute to facial features characteristic of the NSCL/P spectrum.

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32. Practitioner Compliance in Providing Appropriate Treatment Following Caries Risk Assessment

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Objective: Caries risk assessment (CRA) is used to measure the patient's probability of developing new carious lesions or progression of existing ones. Subsequent preventive and restorative treatment should be appropriate to the patient's risk level. The objective for this study was to determine whether patients attending the University of Iowa Dental Clinics received appropriate care according to their caries risk status.

Methods: Electronic dental records (Axium) were used to identify patients categorized as high- or low-risk according to the CRA during visits which occurred between July 2009 to July 2012. Selected treatment codes provided within 6 months of a completed CRA were collected. The proportions of patients receiving each treatment were recorded for both the high- and low-risk groups. A secondary analysis investigated other non-coded treatments provided by means of a manual audit of randomly-selected patient records.

Results: A total of 3,158 high-risk and 1,950 low-risk patient records were queried. The most common treatment for high-risk patients was prescription of high-fluoride dentifrice with 46% of patients receiving at least one prescription. In contrast, only 12% of low-risk patients received prescriptions. In-office topical fluoride was provided for 40% of high-risk and 39% of low-risk patients. Prescriptions for anti-microbial rinses were provided for 21% of high-risk and 15% of low-risk patients. Other treatments (e.g., sealants) were rarely (<5%) provided for either group. The patient record audit showed approximately 8% of high-risk patients received salivary aids and approximately 11% of high-risk patients received treatments that were not coded in the electronic record.

Conclusions: The majority of patients classified as high caries risk according to the CRA received at least some appropriate treatment. It appears that high-fluoride dentifrices were most appropriately used, but in-office topical fluoride treatments and prescriptions for anti-microbial rinses may have been under used for high-risk patients and over used for low-risk patients.

Supported by: Iowa Dental Research Grant

33. Pulpotomy Ratio in Primary Teeth Treated with Stainless Steel Crowns

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Purpose: Stainless steel crowns (SSCs) are often used to restore heavily decayed primary teeth. When caries extends into the pulp, and teeth remain vital, they are also candidates for a pulpotomy. The ratio of SSCs to pulpotomies in primary teeth is of interest, however little published data documenting typical ratios exists. This study documents the SSC to pulpotomy ratio in primary teeth at the University of Iowa College of Dentistry.

Methods: Electronic patient data were collected for all primary teeth restored with SSCs from FY 2008 to 2013. Variables studied included pulpotomy status, patient age, gender, tooth type, provider level, and payer mix. Bivariate analyses, followed by logistic regression models, were used to analyze the data ($alpha$=0.05).

Results: 7,707 primary teeth received SSCs. Of these, 27% (n=2,069) also received a pulpotomy. Patient age was significant. Every 1-year increase in age resulted in a 4% increase in the odds of having a pulpotomy (P=.0115; OR=1.04). First primary molars were most likely to receive pulpotomies (30%) followed by second primary molars (26%) and incisors (9%) (P<.0001). Dental students were more likely to perform pulpotomies on teeth receiving SSCs than residents or faculty (P=.0006; OR=1.42). Bivariate analysis indicated payer mix significantly affected pulpotomy rates, however logistic regression analysis revealed this was not a significant predictor.

Conclusions: Increased patient age, molars, and decreased provider experience are all associated with higher pulpotomy rates in primary teeth receiving SSCs. Payer mix and Medicaid status were not influencing factors.

Supported by: Iowa Dental Research Grant

34. Comparison of Identification Methods for *Streptococcus sobrinus* and *Streptococcus mutans*

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Background: Severe early childhood caries is common in minority populations, particularly American Indian children. While *Streptococcus mutans* (SM) is still considered a primary etiological agent for this aggressive disease, *Streptococcus sobrinus* (SS) can also be present. Data from our current cohort study indicate a high percentage of SS present in these children. Accurate identification of these organisms in epidemiological studies is therefore important.

Objectives: To assess and compare identification of SS and SM using repetitive extragenic palindromic-polymerase chain reaction (rep-PCR) with enterobacterial repetitive intergenic consensus (ERIC) primers, PCR targeting the species-specific glucosyltransferase B (*gtfB*) gene for SS and SM, and metabolic profiles.

Methods: Fifty total SS and SM isolates previously identified by sugar fermentation profiles were used to test two PCR identification methods. DNA was extracted and rep-PCR using ERIC primers and PCR using *gtfB* primers were performed on each isolate. Gels were analyzed and dendograms were generated using GelCompar II v6.5 software.

Results: All rep-PCR isolate identification agreed with metabolic identification. PCR using *gtfB* primers correctly identified all SM isolates but was not a reliable method for identifying SS.

Conclusion: rep-PCR using ERIC primers identified SS and SM isolates. However, the data were inconsistent in that multiple repeat reactions were necessary to validate identification. Experiments to optimize rep-PCR and *gtfB* protocols for SS are currently underway.

Supported by: Iowa Dental Research Grant

35. Nutrient Intakes and Caries Experience in Native American Children

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Malnutrition interferes with enamel mineralization, salivary function, and immune response and is hypothesized to increase susceptibility to dental caries.

Objective: To identify associations between nutrient intakes and early caries experience in American Indian (AI) children.

Methods: This is part of an ongoing longitudinal study of risk factors for caries in young AI children (n=233; 103 male, 130 female) from a Northern Plains tribal community. Dietary data at 8 and 12 months and caries data at 16 months were used in these analyses. Twenty-four hour dietary recalls administered by trained staff members to the child's caregiver were analyzed using Nutritionist ProÆ to obtain nutrient intakes. Standardized dental examinations were completed by trained dental hygienists. The exams were surface-specific for frank decay and caries as dmfs. Associations between nutrient intakes and dmfs were assessed by Spearman rank correlations and regression analyses (SAS version 9.3).

Results: Mean age at dental exams was 15.4±0.4 months. Mean dmfs and erupted surfaces were 1.45±3.68 and 52.87±15.06, respectively. Vitamin D (rs=-0.133; p=0.0444) was negatively and vitamin E (rs=0.197; p=0.0028) positively associated with dmfs at 8 months; these associations were not significant following adjustment for erupted surfaces. At 8 months median (minimum/maximum) vitamin D intake was 8.3 (0.2/32.3) ug: 36% of children consumed the Adequate Intake (AI) of 10 ug/day. Vitamin E intake was 0.0 (0.0/28.7) mg: 19% consumed the AI of 5 mg/day. Nutrient intakes were not associated with dmfs at 12 months. At 12 months, median vitamin D intake was 6.9 (0.0/34.2) ug: 23% of children consumed the AI, while vitamin E intake was 0.8 (0.0/11.9) mg: 11% consumed the AI.

Conclusion: In this population, vitamin D and E intakes were deficient and associated with caries development. The relationship between malnutrition and caries deserves additional investigation.

36. Exploring Dental Patients' Preferences Towards Incorporating iPad Technology During Patient Education: A Focus Group Study

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Objective: The aims of this study were to 1) assess preferences towards various aspects of dental electronic patient education apps and 2) determine perceptions regarding the use of apps in a dental setting.

Method: Six focus group sessions of 3-6 people each were conducted at the University of Iowa College of Dentistry (COD). Escorts of COD patients were recruited from the waiting rooms. Participants were asked to pretend they were patients receiving a dental bridge. They were shown four dental patient education apps that were projected from an iPad onto a screen at the front of the room: DDS GP, Dental Aid, Solution21, and 3D4Medical. Participants were asked questions about the apps using a semi-structured interview format. These questions ascertained general preferences about the apps' content, images and features. The sessions were digitally recorded and analyzed via note-based methods for thematic coding.

Results: Participants' ages ranged from 20-89 years (n=25). Several general themes arose regarding participants' preferences pertaining to each app. Many participants indicated they would like an app that could be tailored to the individual and modified according to scope of content. Some participants wanted to learn about additional details beyond the procedure, such as cost, hygiene, anesthesia and maintenance. Participants favored pleasant and clean images of teeth without showing the anatomy of bone, nerves and roots. They liked interactive and visual features such as animation, drawing capabilities, navigation, and computer-enhanced graphics. Participants unanimously agreed that if apps are used, they should be used in conjunction with dentists' explanations about procedures.

Conclusion: Participants believed electronic patient education apps should be used to enhance understanding, but not as a replacement for interaction with the dentist. Participants had difficulty selecting "the best app" and expressed the need for a hybrid app that allowed for personalization.

Supported by: Dental Research Grant, University of Iowa, College of Dentistry

37. A New Fixation Method for Microtensile Testing of the Resin-Dentin Bond

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Objectives: The development and subsequent validation of a user-friendly resin-dentin μTBS testing system with improved precision and accuracy. This is necessary due to lack of standardization and wide variability reported in the literature when using glue fixation during μTBS testing.

Methods: Upon completion of repeated testing methods development studies, a custom specimen-mounting device was fabricated for the Geraldeli V2 (Brazilian patent pending #Pl1107314-4) testing device. Non-carious human molars were prepared to expose occlusal dentin allowing composite bonding (Z100, 3M-ESPE). Each dentin-composite build-up was sectioned into 16 specimens (n=64) then tensile tested (Zwick Z2.5; Zwick GmbH) to failure at 1 mm/min using cyanoacrylate (Zapit) for fixation to the Geraldeli V2 device. Failure mode was verified with stereomicroscopy at 40X (Stemi2000, Carl-Zeis, Oberkochen, Germany).

Results: Overall: mean μTBS = 79.62±38.71 MPa including 8 specimens that pulled out of the fixation device before failure. The vast majority of failures were cohesive or could not be determined. Tooth effect on μTBS was not significant as tested by one-way MANOVA (Wilk's Lambda=0.53, p=0.6716). A two-sample t-test revealed a significant tooth region effect on μTBS (p<0.0001) with a mean stress of 90.25 and 51.06 MPa for peripheral and central region, respectively, and no difference for fractures involving cyanoacrylate was found (p=0.3484).

Conclusion: The Geraldeli V2 device requires further development before adoption due to the relatively high coefficient of variance, frequent specimen pullouts and infrequent debonds at the adhesive joint. Evaluation of Geraldeli V2 against comparable systems will be necessary. Under the limitations of the research design and the current design of the μTBS testing device, neither debonds involving the glue nor the tooth had a significant effect, whereas tooth region did effect μTBS.

38. Ontogenetic Patterns of Lower Facial Integration

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Objectives: The craniomandibular phenotype is influenced by distinct patterns of morphological integration. Variation in the interaction among skeletal components likely contributes to abnormal patterns of facial growth e.g., those resulting in skeletal malocclusions. Determining patterns of morphological covariation in the skull, therefore, is essential to understanding both normal and abnormal craniofacial development. While craniomandibular integration has largely been studied in adults, it is unclear whether patterns of morphological covariation are established early in ontogeny or are modified during development. In the present study we examine whether there is variation in both the patterns and strength of lower facial integration using a mixed longitudinal sample.

Methods: Using geometric morphometric techniques, we assessed morphological integration in three different age groups: 4-5 (n=189), 11-12 (n=129) and 18+ (n=73) years. We used two-block partial least squares analysis of Procrustes scaled coordinate landmarks to examine covariation between (a) the maxilla and the mandible and (b) the anterior and posterior facial columns. The strength of inter-block covariation patterns was measured using the RV coefficient.

Results: There was a common pattern of morphological covariation in both sets of inter-block comparisons across all three age groups. The first singular vector described morphological patterns of covariation associated with dolicho- and brachyfacial morphologies. While the pattern of morphological covariation was similar across our samples, RV coefficients increased with age in both maxillary-mandibular and anterior-posterior facial column comparisons. Maxillary-mandibular RV coefficients were always appreciably higher.

Conclusions: Our results suggest that patterns of lower facial integration are established early in ontogeny. Moreover, the strength of integration increased during ontogeny suggesting that the latest age group is more integrated than the earlier age groups. This tendency is potentially due to differential patterns of growth cessation indicating that lower facial form is influenced to a greater degree by the development of surrounding morphological structures.

Supported by: Iowa Dental Research Grant

39. *In Vitro* Assessment of NaF Rinse Concentration on Reduction of Demineralization

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Objectives: This study investigated whether 0.022% rinse used twice per day resulted in the same reduction of demineralization as using 0.05% rinse once per day.

Methods: Nine extracted teeth collected from the College of Dentistry were painted with acid resistant varnish, leaving a 1mm x 4mm window of exposed enamel on the buccal surface. All teeth were then subjected to a demineralizing solution for 96 hours to create artificial carious lesions. The teeth were then sectioned through the created lesions using a hard tissue microtome to produce as many sections from each tooth as possible. The lesion depths were measured using both distilled water and Thoulet's 1.47 imbibing medium under polarized light microscopy. Ninety-five sections were equally distributed among 6 experimental groups. The groups consisted of: (1) a control with no treatment, (2) 0.05% rinse q.d., (3) 0.022% rinse b.d., (4) 1000 ppm paste b.d., (5) 1000 ppm paste b.d. in addition to 0.05% rinse q.d., (6) 1000 ppm paste b.d. in addition to 0.022% q.d. After 10 days of treatment, all lesion depths were measured again using both imbibing mediums under polarized light microscopy. A statistical analysis was performed to determine differences between experimental groups.

Results: When distilled water was used as the imbibing medium, a statistically significant decrease in demineralization was observed in the dentifrice and dentifrice combined with 0.05% rinse groups vs. the control group. When Thoulet's 1.47 was used as the imbibing medium, a statistically significant decrease in demineralization was observed between the dentifrice and dentifrice combined with 0.05% groups vs. the 0.05% and 0.022% rinse groups.

Conclusions: The results of the study indicate that a difference may exist between using the 0.022% twice per day compared to using the 0.05% once per day, especially when using the rinses along with dentifrice.

Supported by: University of Iowa Dental Research Grant

40. Assessment of Factors that Classify Patients as High Caries Risk

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Objective: The objective of this study was to determine which factors are most often associated with high caries risk patients using data from the University of Iowa College of Dentistry's caries risk assessment (CRA) tool.

Method: Electronic health record information was accessed for this project. Queries were run on patients who were classified as high and low caries risk according to the CRA during visits, which occurred between July 2009 to July 2012. The four categories of risk factors were contributing factors, dietary factors, clinical conditions, and general health conditions. In addition, a random subsample of 100 high risk patient records were assessed to gather additional information on caries risk factors.

Result: Among the 3,185 high-risk patients queried, the factor most frequently associated with high caries risk patients was the presence of cavitated or non-cavitated active carious lesions, with 76.5% of high-risk patients affected compared to 3.5% of the 1,950 low risk patients. Among dietary factors, drinking sugared beverages daily was cited for 53.7% of high risk patients compared to 19.4% of low-risk patients. Moreover, 37.0% of high-risk patients reported drinking at least 20 ounces of soft drinks per day compared to only 5.3% of low-risk patients. Lastly, among general health conditions, medications that reduced salivary flow was most frequently identified for high-risk patients at 29.5% compared to 13.7% of low-risk patients. The assessment of individual patient records did not identify additional risk factors not recorded on the CRA tool.

Conclusion: Active caries and sugared beverage consumption were most frequently associated with high-risk patients. Both the CRA and assessment of patients' records identified similar factors, with no additional factors identified by patient record review.

Supported by: Iowa Dental Research Grant

41. Changes in Dental Students' Attitudes Towards Treating Underserved Populations

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Objective: To assess changes in dental students' feelings, willingness, and perceived responsibility towards treating underserved populations as they progress through their pre-doctoral education.

Methods: An original survey instrument was developed to assess first-fourth year (D1-D4) pre-doctoral dental students' predicted attitudes towards treating and willingness to treat thirteen underserved populations post-graduation. The same surveys were distributed from 2008-13, resulting in four years of longitudinal data from two graduating classes (N=160). IRB approval was obtained prior to conducting the study. Descriptive statistics were calculated, and bivariate analyses, using the Wilcoxon signed-rank test, were conducted to assess changes in students' responses from the D1-D4 year ($p<0.2$).

Results: 87 students (Class of 2012=41; 2013=46; overall response rate = 54%) completed all four annual surveys (D1-D4). In comparison to the D1 year, students anticipated feeling more negative towards treating homebound, non-English speaking, homeless, low income, other ethnic, and frail elderly populations after graduation. Students' feelings were more positive towards treating HIV+/AIDS populations, known drug users, mentally compromised populations, and children <3 years. Students' anticipated willingness to treat homebound, non-English speaking, frail elderly, Medicaid, and low-income populations five years after graduation became more negative, while willingness to treat medically complex populations, known drug users, HIV+/AIDS populations, children <3 years, and jail inmates became more positive. Students were less likely to strongly agree that it is their responsibility to treat underserved populations as they progressed through school. Clinical interactions with patients were more likely to influence students' desire to treat underserved populations than faculty or peer interactions.

Conclusion: Students' feelings towards treating and willingness to treat underserved populations changed for ten of the thirteen populations as they progressed through their education. Clinical interactions with patients had a great influence. It is important to know that students might need guidance to achieve positive clinical experiences with patients.

Supported by: Iowa Dental Research Grant

42. Acceptability and Efficacy of Preventive Health Screening Measures in the Dental Office

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Background: Patients often visit their dentist on a more regular basis than their physician. This provides the opportunity for preventive health care screening in the dental office. The Iowa Department of Public Health (IDPH) has initiated a training program to encourage dental offices to implement regular blood pressure and tobacco monitoring. The objectives for this study were first, to determine the acceptance of preventive health screening among offices who have received IDPH training, and second, to evaluate the need for continuing education regarding oral cancer risk assessment.

Materials & Methods: Questionnaires were distributed by mail. Twelve offices consisting of 13 dentists, 13 hygienists, and 12 assistants participated. Attitudes toward blood pressure, tobacco, and oral cancer preventive screening were compared for these three groups.

Results: 100% of dentists, 73% of hygienists, and 75% of dental assistants believed tobacco screening to be an effective use of time in their own office . This difference was significant. Overall, 73% believed it to be worthwhile for all dental practices. In contrast, a total of 54% believed blood pressure monitoring to be worthwhile in their office. No significant difference was seen between or among groups. Eighty-one percent would advise others to implement this screening. Finally, no significant difference was observed between dentists and hygienists when asked about their overall confidence in oral cancer screening, and a majority felt they needed more training in this area. Personnel who screened scored an average of 13 out of 20 when asked to identify potential oral cancer risk factors.

Conclusions: Although dental professionals showed strong support for tobacco monitoring within their offices, this did not extend to blood pressure screening. Dentists and hygienists acknowledge the need for more training in oral cancer screening and this is supported by their imperfect knowledge of risk factors.

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43. Early Diet and Oral Hygiene Behaviors and Adolescent Caries Experience

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Caries experience in primary teeth is associated with increased caries risk in the permanent dentition. Relationships between early dietary and oral hygiene behaviors and later caries experience are not well understood.

Objective: To examine relationships between early childhood risk factors for primary teeth caries and adolescent caries in Iowa Fluoride Study (IFS) subjects.

Methods: Secondary analyses were conducted on IFS data, a longitudinal investigation of fluoride intake from birth-17 years. Dietary exposure frequencies and oral hygiene (i.e., fluoride, brushing) behaviors were assessed using food diaries and questionnaires completed at ages 5 and 17. Caries data are from exams completed at age 17; caries experience is defined as the presence of 1+ cavitated or filled surfaces. Spearman correlation and chi-square analyses were used to identify bivariate relationships (SAS version 9.3).

Results: Subjects (n=272) were 46.3% male and 53.7% female. The mean DFS at age 17 was 3.4±5.2. Age 5 meal/snack event, sugared beverage, sugared food, starch exposures and oral hygiene behaviors were not statistically associated with age 17 caries (p>0.05). Beverage water exposure at age 5 was negatively associated with age 17 caries (p=0.019). Subjects in the top quartiles of milk exposure at both ages 5 and 17 had lower caries (p=0.003), while those in the top quartiles of soda-pop exposure trended toward higher caries (p=0.101). Among subjects brushing their teeth<twice/day, subjects in the top quartiles of milk (p=0.039) or 100% juice (p=0.042) exposures at both ages had lower caries, and those in the top quartiles of water exposure trended toward lower caries (p=0.086). Brushing twice/day at age 17 did not reduce caries in subjects drinking 8+oz total sugared beverages/day (p=0.525).

Conclusions: Early dietary exposures and oral hygiene behaviors have marginal impact on age 17 caries. Age 5 beverage habits continued to age 17 might impact adolescent caries risk.

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44. The Effect of Peri-Implant Keratinized Mucosa Width on Pro-Inflammatory Cytokine Expression

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Objectives: Current evidence regarding whether a minimum band of keratinized mucosal width (KMW) is essential in maintaining peri-implant health is controversial. The purpose of this cross-sectional study was to evaluate the effect of KMW surrounding dental implants on the expression of pro-inflammatory cytokines in peri-implant sulcular fluid (PISF). Determination of the role KMW has in maintaining peri-implant health may assist clinicians in providing appropriate treatment to patients with dental implants surrounded by a narrow band of keratinized mucosa.

Methods: Subjects (n=74) in a regular maintenance program who have at least one dental implant and who have met specific criteria for inclusion in the study were recruited. During the study visit at the University of Iowa College of Dentistry and Dental Clinics, a single calibrated examiner measured and recorded the facial KMW around each study implant. PISF was also collected using paper strips that were placed for 30 seconds in the gingival sulcus at four sites surrounding the dental implant. The multiplex assay system (Luminex 100 IS Instrument) was used to determine the concentration (pg/30 seconds) of key pro-inflammatory cytokines including IL-1a, IL-1fl, IL-4, IL-6, IL-8, IL-10, IL-12, CRP, RANKL, osteoprotegerin and adiponectin in the PISF.

Results and Conclusions: Preliminary analyses of data from 53 subjects suggest that peri-implant KMW does not have an effect on the levels of molecular markers of inflammation in this population. Further analyses are underway with additional data from 21 more subjects to see if these results persist with a larger sample size. These findings suggest that augmentation of KMW surrounding dental implants to improve the conditions of health may not be indicated in patients with dental implants who are enrolled in a regular periodontal maintenance program.

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45. Electronic Assessment of Peri-Implant Mucosal Esthetics Around Three Implant-Abutment-Configurations

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Objectives: As single-tooth implant success rates are high, attention has turned to the esthetics of implant restorations. Implant-abutment-configurations may play a role in the stability and maintenance of peri-implant mucosa, yet their effect on the adjacent soft-tissue complex is unclear. The objectives of this study were to evaluate the mucosal esthetics around 141 maxillary anterior single-tooth implants up to 1 year post-implant placement (IP) with 3 different implant-abutment-configurations using the Pink Esthetic Score (PES), as part of a multicenter, prospective, randomized controlled clinical trial [(PROOF)-NCT00820235].

Methods: 649 clinical photographs were evaluated and scored according to the PES through a novel web-based application on iPads by 5 clinicians. Mean and median PES totals were calculated to compare gingival esthetic differences. Intra-observer reliability was assessed by randomly duplicating 10% of the photographs. Observer correlation was quantified by the intraclass correlation coefficient (ICC).

Results: No significant difference was found between the 3 implant-abutment-configurations with either methodology. Statistical analyses were based on mean PES data. There was strong agreement among all 5 observers (inter-observer agreement) with an ICC of 0.84 (0.79-0.85) and no significant difference (p=0.8309) between the repeated measurements (intra-observer agreement). At 1 year, there were no significant differences among the 3 implant-abutment-configurations (a two-sided p-value <0.05 was considered statistically significant). Mean total PES values improved over time for all 3 implant-abutment-configurations, from 7.2 ± 2.3 at visit 4 (provisionalization) to 10.0 ± 1.9 at visit 8 (1 year post-IP).

Conclusions: A novel electronic methodology was developed and verified as an appropriate vehicle to evaluate PES clinical photographs. At 1 year post-IP, there were no statistically significant differences in the perception of mucosal esthetics adjacent to 3 implant-abutment-configurations. Total PES scores improved with time from provisional to 1 year post-IP. Further analyses will be completed for annual follow-up time points, 3 years post-IP.

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46. Assessment of Current Trends in CODA-accredited North American Pre-Doctoral Dental Implant Education

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Objective: To assess current educational trends of CODA-accredited North American pre-doctoral implant programs by gathering information on pre-doctoral dental implant director demographics, curricular preferences, and perception of clinical preparedness for provision of implant therapy upon graduation.

Materials and Methods: An electronic-survey was distributed to pre-doctoral implant program directors. Associations and trends between Canada and United States were stratified using descriptive statistical methods. Pre-doctoral implant program director demographics were analyzed including gender, age range, specialty training and representation, implant training, and tenure of program director. Pre-doctoral implant program curricular preferences were analyzed including surgical guide preparation requirements, training methodology preferences, impression methods primarily taught, abutment types and biomaterials employed, and coronal fixation/retention modalities primarily employed.

Results: All seventy-four North American CODA-accredited pre-doctoral dental programs were contacted. Fifty-nine program directors responded. The average program director has a tenure of fewer than two years and is a fifty-one-year old or older male prosthodontist with implant specialty training. Training is predominately posterior implant-supported single crowns and mandibular implant-supported overdentures in both countries. Direct patient-care implementation was the most homogenous non-didactic method of teaching. Surgical guide preparation was unanimously required in United States programs and nearly unanimously in Canada. Fixture level impressions were consistently preferred. The most prevalent abutment biomaterial was titanium. Discrepancy between custom and stock abutments revealed virtually equal distribution in United States programs. A small majority of Canadian programs primarily use custom abutments. United States programs predominately teach cement-retained restorations. However, Canada primarily teaches screw-retained restorations. The majority of North American implant program directors reported a perception of adequate pre-doctoral student preparedness for provision of restorative implant therapy upon graduation.

Conclusions: The educational trends of pre-doctoral implant dental programs are diverse and vary between North American institutions. These findings may be valuable to institutions interested in establishing or modifying pre-doctoral implant curriculum.

Supported by: Dows Student Research Award

47. Systemic Inflammation and the Impact of Obesity on Gingival Inflammation: A Pilot Clinical Study

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C-Reactive Protein (CRP) is an acute-phase response marker used to measure inflammatory status. Elevated levels of serum CRP have been associated with a variety of acute and chronic diseases including myocardial infarction, ischemic stroke, peripheral arterial disease, diabetes, impaired insulin secretion, dyslipidemia, and accelerated atherosclerosis. Elevated CRP is a good predictor for type 2 diabetes-associated cardiovascular diseases. Elevated levels of CRP can be detected in the saliva and gingival crevicular fluid (GCF) originating from acute and chronic inflammation in the oral cavity. For example, in patients with a history of chronic periodontitis, severity is correlated with elevated CRP. Elevated levels of CRP can also be detected in the saliva and GCF originating from systemic production as a result of the aforementioned chronic inflammatory diseases. The primary purpose of this study is to assess CRP concentrations with markers for obesity: For this, serum and GCF samples from 30 subjects (split evenly between groups, age and gender balanced) will be collected for CRP determination. Anthropometric measurements (height, weight, body fat analysis, waist circumference, vitals, blood glucose) will be gathered, an oral exam will gather GCF, gingival index, plaque index, and periodontal probing depths, as well as a blood draw for CRP and genetic analysis. Obesity will be defined as BMI > 30. Subjects with BMI 18.5-25 will comprise the Non-Obese group. We hypothesize that serum levels of CRP will correlate with GCF levels of CRP. Elevated markers of proinflammatory cytokines and systemic inflammatory markers (e.g., CRP, IL-1, IL-6, etc.) in GCF will positively correlate with measures of obesity. CRP gene variation will reflect variations in patient CRP levels.

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48. Correlation Between Peri-Implant Radiographic Marginal Bone Loss and Inflammatory Biomarkers

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Objectives: To investigate the association between radiographic marginal bone loss (MBL) and pro-inflammatory cytokines and bone remodeling markers in peri-implant sulcular fluid (PISF) collected from patients with implants who are in maintenance care at the University of Iowa College of Dentistry.

Methods: Participants were selected if they had at least one functionally-loaded dental implant and were enrolled in a periodontal maintenance program. PISF was collected using paper strips at four sites around the implant of interest. Expression of key cytokines and bone turnover markers in PISF were analyzed using the multiplex assay system. MBL was measured in periapical radiographs, which were obtained within one year from the time of PISF collection, by a calibrated, masked examiner. Linear measurements from the implant platform to the most coronal aspect of the bone to implant contact point on the mesial and distal aspect of the implants were made. Extent of MBL was correlated with the expression of pro-inflammatory and bone turnover cytokines collected from the PISF at the implant sites using Spearman rank correlation test.

Results: Of the13 biomarkers assessed, a modest but statistically significant positive correlation was noted between bone level measurements on the distal aspect of implant and levels of IL-4 in PISF (rho=-0.304, p=0.0499) and between IL-8 and mesial bone measurements (rho=0.355, p=0.021).

Conclusion: In general, MBL patterns do not appear to respond to the expression of pro-inflammatory cytokines and bone markers in PISF. This study is the first to investigate the correlation between MBL and PISF biomarkers in a homogenous maintenance patient population.

Supported by: Dows Student Research Award

49. Normal Versus Crowded Occlusions in Mixed and Permanent Dentitions

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Objective: Using longitudinal casts of subjects who had Class I normal occlusion (CIN) and Class I crowded malocclusion (CIC): the goals were (1) Test gender differences in sum of tooth widths mesial to permanent first molars (TW) and arch perimeter mesial to permanent first molars (AP) in both arches, (2) Test hypotheses that no change occurs in TW and AP between MD and PD., and (3) Test the hypothesis that no differences in TW or AP exist between CIC and CIN.

Method: Casts of 19 males (M) and 16 females (F) (CIN) and 14 M and 10 F (CIC) in the Iowa Growth Study [IRB] were measured in MD and PD. AL and TW were measured with digital calipers. Intra-class correlations were used to assess intra-rater reliability; Wilcoxon rank sum tests were used to compare genders and groups.

Results: Intraclass correlations exceeded 0.90 ($p<0.0001$) indicating excellent reliability. CIN vs. CD: Maxillary TW were larger in CD than CIN in MD ($p<0.05$). No gender differences were found for tooth width. Males had larger maxillary AP ($p<0.05$) in both groups and dentitions; CIN males had larger mandibular AP ($p<0.003$) than females. Mean decrease in male TW from 8 to 12 years was -3.1 mm. Mandibular AP differences were significant ($p<0.0004$) for both genders; the mean AP decrease from 8 years to 12 years was -2.8 mm in males and -3.2 mm in females.

Conclusion: In CIN, TW was stable from MD to PD, except in males. From MD to PD both genders experienced a decrease in mandibular AP. In CIN, the maxilla was stable in TW and AP from MD to PD. In MD, CIC maxillary TW were > CIN.

Supported by: Director's Research Award

50. Adolescent Knowledge and Perceptions of Sugared Beverages: Consumption Patterns and Caries Risk

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Purpose: Unhealthy dietary habits among adolescent populations remain high despite many public health efforts designed to increase education on healthy choices. At the forefront of poor dietary habits is the frequent consumption of sugared beverages. What is unknown is the association between adolescent perceptions of a healthy diet and their dietary practices, especially in relation to sugared beverages. This study was designed to describe the relationship between adolescents' perceptions of sugared beverages and their caries experience.

Methods: Adolescent subjects were identified in the Department of Pediatric Dentistry at the University of Iowa College of Dentistry. A self-reported survey was used to gather information including age, gender, sugared beverage intake, and knowledge of oral and systemic health effects. Caries data were obtained by accessing dental records.

Results: Ninety adolescent subjects aged 12-17 years (mean 14.0±0.9), with 51% female, were included in this analysis. Sixty-four percent of respondents reported they drank juice, 55% reported they drank regular soda and 55% drank "other sugared beverages." Over half of those surveyed, 58%, had access to regular soda from a vending machine at school. Sixty-four percent of respondents had caries experience. Most subjects agreed that regular pop (70%), diet pop (42%), energy drinks (74%) and sports drinks (44%) are harmful to teeth. Sixty-seven percent of subjects reported that their dentist had discussed the health effects of sugared beverages with them; 73% of these subjects valued their dentist's opinions and 51% had changed their behaviors.

Conclusions: Over half of this adolescent population drinks sugared beverages on a regular basis despite most indicating that they were aware of the dangers of this behavior. Statistical analysis is in progress to determine how behaviors and perceptions relate to caries experience. Dentists have the potential to impact adolescent behavior regarding sugared beverage intake.

Supported by: Iowa Dental Research Grant

51. Endodontic File Sterilization: A Survey of General Practitioners and Endodontists

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Objectives: According to the CDC guidelines for infection control in dental healthcare settings, critical patient-care items, such as endodontic files, are to be heat sterilized before use because they have the greatest risk of transmitting infection. As such, the protocol for implementing an unused, newly opened endodontic (endo) file from the manufacture packaging involves sterilization prior to use. Research has shown that particulate and bacterial contamination can be present on new, unused endo files. The purpose of this study is to determine the sterilization practices of clinicians primarily working in private practice.

Methods: An electronic survey was sent to 1,284 clinician and private practice email addresses obtained from a randomly sampled, nationwide list of ADA-member street addresses. An additional 200 paper surveys were mailed to addresses that were not contacted electronically. The survey questioned recipients over new, unused endo file sterilization practices, the sterilization of other instruments, and concern over the effects of autoclaving on file integrity. As an adjunct, seventeen different packages of unused files were tested for bacterial contamination.

Results: Analysis of the 102 returned surveys showed 52.4% of respondents sterilize new unused files, 7.6% sometimes sterilize, and 40.0% don't sterilize. There was no statistical correlation between whether or not unused files were sterilized and concern over weakening the files via autoclaving. Of the seventeen packages of new, unused endo files tested, 6 packages contained ≥ 1 file with bacterial contamination, with 8 of 94 total files showing contamination. A Gram-stain of each revealed 7 files contaminated with Gram-variable rods and one file contaminated with large, Gram-positive rods.

Conclusion: This survey demonstrates that over one-third of practitioners do not sterilize new, unused endo files. These files remain a source of potential infection as our tests revealed 8.5% of new, unused files were contaminated.

Supported by: Dows Research Award

52. Effects of Antibiotics on Oral Bacteria in American Indian Children

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Objective: Previous studies have shown that American Indian and Alaskan Native (AI/AN) children have a high incidence of decay at a young age. Few studies have assessed causative factors. The purpose of this paper is to assess the relationship between antibiotic exposure and oral flora of very young children from a Northern Plains tribal community.

Method: The parent study was conducted to study ECC in a Northern Plains tribal community, and focused on the transmission of cariogenic bacteria from mother to child. Mothers with newborns were recruited into the study between June 2009 and June 2010, resulting in 239 mother-child pairs enrolled. Follow-up visits were completed when the child was 4, 8, 12, 16, 22, 30, and 36 months (+30 days). At each visit, plaque samples were collected from the mother and child and *S. mutans* counts were obtained via selective media. All antibiotic records were obtained from Indian Health Service medical records and entered into a Microsoft Excel spreadsheet and combined with existing oral flora data for each child. This paper reports on oral flora at 16 months of age and previous antibiotic exposure.

Result: Bacterial count and antibiotic data were available for 81 subjects at a 16 month time point and were included in the analysis. The subjects had an average of 3.7 antibiotic episodes; 80% of the children had antibiotic exposure. Of these subjects, 25 of them had no *S. mutans*. No significant correlation between the number of antibiotic episodes from birth to 16 months and *S. mutans* levels was found (p=0.2806). Also, there was no significant correlation between the total number of days of antibiotic usage and *S. mutans* levels (p=0.9422).

Conclusion: Our early findings suggest that antibiotics do not have a significant effect on *S. mutans* bacterial levels in these very high-risk children.

Supported by: Iowa Dental Research Grant

53. Patterns of Fluoride Intake From 6-17 Years of Age

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Objective: To report daily fluoride intake from water, other beverages and selected foods, dentifrice, and dietary fluoride supplements, both individually and combined, among children participating in the Iowa Fluoride Study from 6 to 17 years of age.

Methods: This study involved 787 children whose parent(s) were recruited from 1992-95 and returned mailed questionnaires sent every 3-6 months between ages 6 and 17 to gather information on fluoride exposures and intake from various sources. Daily fluoride intake (mg F) from water, other beverages and selected foods, dentifrice and supplements was estimated based on responses to a detailed series of questions. Dietary assessments included frequencies and amounts of beverage intake for the previous week from water, milk, ready-to-drink beverages made by adding water to concentrate, and selected foods with substantial water content. Documented water fluoride levels, individual water assays and assays of bottled water and other beverages were used, in conjunction with amounts consumed, to estimate total fluoride ingestion. Fluoride ingested from dentifrice was estimated by combining toothbrushing frequency, fluoride concentration in the reported brand of toothpaste, amount used, and estimated percentage of dentifrice swallowed. Fluoride ingested from supplements was estimated from frequency of use and dosage level of each supplement.

Results: Mean dietary fluoride ingestion from both water and other beverages and selected foods increased slightly with age. Reported fluoride ingestion from dentifrice and supplements decreased with age. Fluoridated water was the major source of ingested fluoride, contributing over 50% of total daily intake at all ages. Dietary fluoride supplements were a minor source of ingested fluoride, as supplement use from 6 to 17 years of age was minimal.

Conclusion: Daily mean fluoride intakes from single and combined sources are relatively stable, and fluoridated water is the most important source of fluoride from 6 to 17 years of age among these children.

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54. Extract Screening for *S. mutans* Growth Inhibition and Biofilm Breakdown

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Objectives: *Streptococcus mutans* is a primary pathogen in the development of dental caries. Compounds specifically targeting *S. mutans* could help restore a non-cariogenic plaque ecology. In this study, extract fractions from plants native to Asia were examined for their growth inhibitory effects against *S. mutans* and common plaque streptococci, and for their ability to breakdown pre-formed *S. mutans* biofilm.

Methods: Fractions dissolved in DMSO (4mg/ml) were tested for growth inhibition of *S. mutans* UA159 in 96-well microtiter plates (5ul extract per 100ul culture). Optical density (OD) following overnight incubation was measured spectrophotometrically. Fractions displaying greater than 20% OD reduction compared to controls were also tested for activity against *S. mutans* ATCC25175, *S. mitis* ATCC49456, *S. oralis* ATCC35037, *S. sanguinis* ATCC10556, and *S. salivarius* ATCC 25975. For biofilm breakdown activity, *S. mutans* UA159 sucrose-based biofilms were grown overnight in 96-well microtitre plates, washed and measured spectrophotometrically. Fractions were added (5 uL/well) and incubated at 37° C for 1 hour, and again washed and measured for OD. Fractions exhibiting greater than 15% OD reduction compared to initial measurements were tested in combinations.

Results: 74 of 136 fractions demonstrated at least 20% inhibition of *S. mutans* growth. Three unique fractions from extracts of the genus Michelia (in the Magnolia family) were found to be inhibitory to a second strain of *S. mutans* but only borderline inhibitory to *S. sanguinis*, and non-inhibitory towards *S. salivarius* and *S. oralis*. No combinations of fractions reproducibly broke down pre-formed *S. mutans* biofilms more than the modest 15% observed with a subset of the individual fractions.

Conclusions: Three fractions from the genus Michelia were identified that hold promise for selective toxicity against *S. mutans*. Future investigation will focus on the breadth of selective activity in biofilm models, and on the identification of active components within the fractions.

Supported by: Iowa Dental Research Grant

55. Development of Laser Micro-Surface Topographies for Dental Implant Cellular Attachment

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Objectives: The objective of this research was to generate titanium modified surfaces for research concerning cell attachment to the various surface topographies on dental implants. Creation of topography will allow research concerning bone and connective tissue attachment to titanium.

Methods: Titanium foil 30 µm thick was imprinted using stainless steel TEM meshes (15µm thick) with grid widths varying from 26 µm to 37 µm. The experimental setup was a 1" by 1" piece of glass placed on the top and bottom of a sample consisting of a piece of titanium foil sandwiching each side of a TEM mesh in the center. Several mirrors and a final focusing lens were used to concentrate the beam size from 7 mm to 1.5 mm in diameter. Laser pulses of 380 mJ in energy were used in a 3 by 3 overlapping pattern covering the TEM mesh to effectively cover the entire mesh area. An optical surface profiler and SEM imaging were used to view and measure the depth of the impressions on the titanium foil.

Results: Grid imprints on the titanium foil were achieved ranging from 2.5 µm to 6.0µm in depth. The 200 grid meshes (37 µm bar width) were imprinted 4.5-6.0 µm deep and the 400 grid meshes (26 µm width) were imprinted 2.5-4.0 µm deep. Seven samples produced of each grid type showed slight variability (1.5 µm) seen in the depth values primarily due to the glass clarity over repeated shots on the samples. The surface patterns achieved were well-defined based on the optical surface profiler and SEM imaging completed.

Conclusion: Well-defined surface patterns can be generated in short periods of time using laser imprinting methods with TEM meshes onto titanium foils. Using this method can provide large numbers of samples for biological attachment analysis with various topography dimensions and shapes from different TEM mesh types available.

Supported by: Dows Institute for Dental Research

56. Oral Health Behaviors, BMI and Beverage Consumption in Adolescents

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Objectives: Sugared beverage consumption has been linked to obesity as well as poor oral health, but the linkage relationship between obesity and oral health behaviors are unclear. The purpose of this study was to explore the association of body mass index (BMI),with sugared beverage consumption, tooth brushing frequency, and measures of oral hygiene among a cohort of 17 year olds.

Methods: The Iowa Fluoride Study, a birth cohort originally recruited during 1992-95, is an ongoing study where parents of children (n=436) were asked to complete detailed questionnaires about fluoride exposures, oral hygiene, and diet at regular intervals. Dental examinations, including assessments of oral hygiene, along with height and weight measurements, were conducted periodically, including age 17. Adolescents in the BMI groups of underweight, normal, overweight and obese were compared cross-sectionaly on beverage consumption, tooth brushing frequency and gingival and plaque index scores.

Results: Overweight or obese adults consumed significantly (p=0.031) higher mean daily amounts of diet soda pop (2.2 ounces) than did normal/underweight (1.1 ounces), and significantly (p=0.14) lower mean daily amounts of 100% juice (1.9 vs. 1.1 ounces). There were no other significant differences in beverage consumption among BMI groups. Adolescents who were overweight/obese had significantly (p<0.01) lower mean daily tooth brushing frequency (1.54) than did underweight/normal subjects (1.74). Those in the higher BMI groups also had significantly higher mean gingival index (0.62 vs. 0.47) and higher mean plaque index scores (0.89 vs. 0.81) than did their underweight/normal counterparts.

Conclusion: Obesity/overweight was related to decreased oral hygiene levels but not to higher greater sugared beverage consumption. Diet pop consumption was higher in the higher BMI group, likely in response to being overweight or obese in these cross-sectional analyses. Future analyses will consider earlier, longitudinal patterns of sugared beverage consumption and how these relate to body mass index and oral hygiene.

Supported by: Dows Dental Student Award

57. Tooth Size-Arch Perimeter Discrepancy in Normal and Crowded Occlusions

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Objective: The aims of this study were to (1) explore explanations for crowding by comparing tooth size, arch perimeter, and arch widths in the permanent dentitions between two groups — Class 1 normal occlusion (C1N) and Class 1 crowded malocclusion (C1C), and (2) develop norms.

Method: 37 subjects with ClN (17 females/20 males, 15-27 years old) were obtained from the Iowa Facial Growth Study, while 43 subjects with C1C (19 females/24 males, 15-27 years old) were obtained from the Department of Orthodontics. Digital calipers were used to take measurements on casts: (1) widths of teeth mesial to the first molars in both arches, sum, TW; (2) a series of 6 arch length measurements between mesial of the right first molar to mesial of the left first molar, the sum, arch perimeter(AP); and (3) arch widths at first molars and canines. Descriptive statistics were conducted and a two-sample t-test was used to determine whether a significant difference existed between the two groups based on tooth width sum, arch perimeter, and gender (alpha=0.05).

Results: Significant differences were found between the ClN and ClC groups in variable AP minus TW in both arches ($p<0.0001$). CIN had positive means and CIC had negative means. Only one significant difference was found between groups for arch widths: maxillary inter-molar widths of the CIC group were significantly smaller than the widths of the CIN group ($p=0.0180$). Moreover, males had a significantly higher TW in both arches than females ($p<0.05$). Descriptive statistics showed potentially significant differences between groups in upper and lower tooth width sums, and arch perimeters.

Conclusion: The CIC group had significantly greater crowding and narrower upper inter-molar widths than the CIN group, and males had significantly higher molar arch widths in both arches than females.

Supported by: Study Support: University of Iowa Dows Research Award; Iowa Dental Research Grant

58. Comparison of *Streptococcus mutans* Genotypes in Two Minority Populations

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Background: Dental caries is one of the most common chronic diseases to affect children in the United States today. However, it is not evenly distributed among populations around the world. *Streptococcus mutans* (SM) is still widely regarded as the primary etiological agent of dental caries.

Objective: To compare *streptococcus mutans* genotypes in an initial subset of two low socio-economic communities with high caries rates to see if they share some common genotypes. We analyzed SM isolates from a Northern Plains tribe and a group of children from Muscatine, Iowa.

Methods: Isolates from seven Northern Plains tribe children (3 years old) and seven children from Muscatine Iowa (3-5 years old) were obtained from plaque samples. DNA was extracted using a rapid extraction technique, amplified using AP-PCR using OPA-2 primers. All gels were visualized using a FOTO/Convertible™ Dual Light Transilluminator and a FOTO/Analyst Luminary imaging system from Fotodyne®. The genotypes analyzed using GelCompar® II v6.5 software by Applied Maths.

Results: Seven genotypes were found in these 14 children. Five of these SM genotypes were found in both study populations. One genotype was unique to the Northern Plains children and one genotype was unique to the Muscatine children.

Conclusions: There are multiple SM genotypes shared across the American Indian and Muscatine, Iowa populations with two identified to date that are unique to a population. Our analysis of SM genotype profiles in these two populations continues.

Supported by: Iowa Dental Research Grant

59. Health Trends in the University of Iowa Special Care Patient Population

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Background: The US population is aging, so the proportion of dental patients with multiple health conditions and/or taking multiple medications could reasonably be expected to be increasing. To quantify recent changes in the health of our patient populations at the University of Iowa (UI) College of Dentistry, particularly with respect to medication use and mental illness, we evaluated health histories from patients presenting for initial comprehensive dental examinations during two recent five-year periods.

Methods: This retrospective chart review compared 388 randomly generated patient records from the UI's Special Care (SPEC) and Family Dentistry (FAMD) clinics during the periods 1996-2000 and 2006-2010; there were 97 records from each of SPEC and FAMD cohorts 1 and 2. Data from health questionnaires were abstracted and recorded. Univariate frequency distributions were generated and reviewed, and bivariate analyses were conducted using extended Cochran-Mantel-Haenszel Chi-squared tests, Student's T-test, and one-way ANOVA.

Results: Mean ages (SD) for SPEC cohorts 1 and 2 were 57 (20.1) and 59 (19.5), respectively, compared to FAMD cohorts 1 and 2, which were 46 (19.9) and 52 (18.9), respectively. Comparing the earlier SPEC cohort 1 versus the recent SPEC cohort 2, the mean (SD) number of medications taken was 4.0 (3.1) vs. 6.6 (4.0), respectively ($p<0.0001$). Variations in health questionnaire wording over the years precluded comparison of the two SPEC cohorts with respect to prevalence of mental illness, but a history of mental illness was significantly more prevalent among SPEC cohort 2 (49%) than FAMD cohort 2 (10%) ($p<0.0001$).

Conclusions: Compared to 1996-2000, patients presenting to the UI Special Care or Family Dentistry clinics from 2006-2010 tended to take more medications, consistent with recent US demographic changes.

Supported by: Director's Research Award

60. Effect of Introductory Dental Education on Perceptions of Peri-implant Esthetics

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Objectives: The primary aim of this study was to evaluate the effect that introductory periodontics education has on first-year dental students' perception of peri-implant soft tissue esthetics, within the framework of the PES (Pink Esthetic Score) proposed by Fürhauser et al. in 2005. Secondary aims included the assessment of the influence of gender and whether educationally-dependent changes in perception (if present) is toward a "gold-standard" set by periodontal faculty.

Methods: Clinical photographs depicting five single-tooth implant supported restorations were presented to first-year dental students before beginning and at the completion of their introductory-level periodontal methods course. The subjects evaluated each implant case seven times, corresponding with each PES parameter, in a randomized fashion. A total of 29 first-year pre-doctoral students (18 males and 11 females) and 5 full-time faculty members participated in the study.

Results:

- No significant differences were found between pre- and post-total PES scores for all cases ($p>0.05$ in each instance) and no gender differences between males or females were observed.
- No significant differences between the first-year pre-doctoral students and faculty were found regarding pre- and post-total scores in 3 out of 5 cases ($p>0.05$ in each instance).
- There was a significant difference between pre-doctoral students and faculty members for the post-total PES scores under case 2 ($p=0.0172$) and for the pre- and post-total PES scores under case 5 ($p=0.0048$ and 0.0454, respectively) using a two-sample t-test.

Conclusions: The results indicated that there is no significant difference between pre- and post- introductory-level periodontal education in the selected first-year dental students' ability to evaluate peri-implant soft tissue esthetics. Additionally, gender did not seem to influence this observation. A planned future direction for this research is to evaluate how the same dental class cohort may alter their responses upon completion of their clinical periodontal education.

Supported by: Iowa Dental Research Grant

61. Effects of Chlorhexidine and Xylitol Floss on Interproximal Bacteria Concentrations

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Effects of Chlorhexidine and Xylitol Floss on Interproximal Bacteria Concentrations

Objectives: Determine the efficacy of antibacterial-coated floss, one impregnated with chlorhexidine and another with xylitol, in comparison to the mechanical removal of plaque using wax floss.

Methods: Twenty human subjects were recruited for this double-blind, randomized, clinical trial. Each subject was randomly assigned to one of two groups: chlorhexidine (CHX) or xylitol (XYL). All subjects required three separate data collection sessions, 8-10 days apart. Each session consisted of the sampling of four sites, one site in each quadrant, including between maxillary right molars (Q1), maxillary left premolars(Q2), mandibular left molars (Q3), and mandibular right premolars (Q4). The efficacy of each floss was determined through the calculation of CFU/ml total bacteria (total) and *S. mutans* (MS) concentrations at each site. The first session determined initial interproximal bacterial concentrations (baseline), the second session included measurements after use of wax floss (follow-up 1), and the final data collection was conducted after use of a chlorhexidine or xylitol impregnated floss (follow-up 2).

Results: Within the CHX group, a statistically significant reduction (paired-sample t test) in total interproximal bacterial concentrations occurred between baseline and follow-up 2 for Q1 and Q3. There was also a reduction in MS between follow-up 1 and follow-up 2 for Q3 for the CHX group. There were no significant differences in total counts and MS counts between any two time points within the XYL Group.

Conclusions: Within the limits of this study, the use of chlorhexidine-coated floss significantly reduced bacterial counts at some interproximal sites beyond what could be achieved with wax floss. Xylitol-coated floss, however, did not result in any greater reduction in total bacteria or mutans streptococci beyond that achieved with wax floss.

Supported by: Dows Student Research Award

62. Individual School Lunch Eligibility and Dental Treatment Needs

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Objectives: Determine whether a kindergartner participating in the free and reduced cost lunch (FRL) program will have unmet dental treatment needs.

Methods: Beginning in the 2009 school year, the state of Iowa implemented a law requiring dental screenings for incoming kindergartners, ninth graders and transfer students. The law's goal is to identify and refer children with unmet dental treatment. For this study, data were collected for 1,104 kindergartners in 18 schools in the Iowa City School district, a community in which ~30% of students are FRL eligible. Dental treatment need, gender, birthdate, screening provider type, and date of screening were part of the standardized form. FRL eligibility and race were provided by the school district. Bivariate analyses were performed to explore the association of dental treatment needs and the following covariates: a student's FRL eligibility, gender, race, age, and screening provider type. Statistical significance was set at $p<0.05$.

Results: The mean age of children (47.1% female and 33.7% non-caucasian) was 4.9±0.6 years, with 11.2% of the screened children requiring dental treatment. Either a dentist or a dental hygienist screened more than 90% of the kindergartners. Bivariate analysis indicated that kindergartners who required dental treatment were more likely to be non-white ($p<0.0001$), =5-years old ($p=0.0110$), FRL-eligible ($p<0.0001$), and screened by either a dentist or dental hygienist ($p=0.0023$).

Conclusions: Public health programs generally target schools with a high percentage of FRL-eligible students. In most instances, however, information about the individual's FRL-eligibility is not available. This study revalidates that dental treatment need is related to FRL eligibility at the individual level.

Supported by: Dows Student Research Award

63. Accuracy of Fourth-Year Dental Students' Prediction of First Employment

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Objectives: We compared fourth-year dental students' predicted career plans with their actual activity immediately after graduation. Additionally, we examined other factors affecting their current professional position.

Methods: In May 2013, an alumni survey was sent to 290 University of Iowa graduates (classes of 2007-2010). New dentists were surveyed about their first position after graduation (i.e., private practice, advanced education). These graduates completed a similar survey during the start of their final year of dental school in which they were asked several questions about factors that could influence their career plans immediately after graduation. Forty-six percent of dentists responded to both surveys(n=133) and were included in this analysis. Bivariate statistics were performed to compare factors related to first employment experience between those who choose to enter private practice versus all other employment opportunities, including specialty training or other advanced education. Simple kappa statistics were used to test the reliability of responses pre- and post-graduation.

Results: Approximately 56% of respondents immediately entered private practice after dental school and 29% pursued advanced education. Nearly 70% of respondents graduated with over $150,000 in educational debt. Bivariate analyses revealed no statistical difference ($p>0.05$) in gender, marital status, number of children, educational debt, or graduation year between those who immediately entered private practice versus any other career option. However, there was only moderate agreement (k=0.61) between anticipated career choice and actual first employment or advanced education program. Agreement improved when only considering private practice or specialty, indicated strong agreement between career choice at senior year and first practice employment(k=0.80).

Conclusion: There was moderate to substantial agreement between what fourth-year dental students anticipated as their immediate career plans and their first post-graduation activity. Additional research is necessary to understand what factors affect career decisions among new dentists.

Supported by: Funding: Iowa Dental Research Grant

64. Molar A/P Transitions in Normal and Class II Occlusions

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Objective: The purposes of this study were to (1) compare antero-posterior (A/P) relations of permanent first and primary second molars in the mixed (MD), and (2) compare permanent dentitions (PD) of subjects with Class-I-normal-occlusion (CIN) and Class-II-malocclusions (CII).

Method: 38 subjects with CIN (19-females/19-males) and 28 CII (13-females/15-males) participated in the Iowa Growth Study. Longitudinal data were collected at average ages 7.9 and 17.5 years on MD and PD measurements for CIN, and 7.9 and 18.1 years for CII, respectively. A/P distance from mesio-buccal cusp tip of upper permanent first-molar to the buccal groove of the lower permanent first-molar was measured with digital calipers [mm] in MD and PD. A/P distances between the distal surfaces of the primary second-molars were measured in the mixed dentition. Class-I tendency were negative measures, whereas Class II measures were positive. Zero measures were positive 0.1 mm. The two-sample t-test was used to compare the difference in MD/PD between two groups, while the paired-sample t-test was used to detect a change from MD to PD in first molar measures (alpha=0.05).

Results: MD measures at 3/30 and 14/19 were significantly different between two groups (p<0.0001; 3/30: CIN [0.75±0.83] vs. CII [2.87±0.87]; 14/19: CIN [0.75±0.92] vs. CII [2.92±0.88]). PD measures at 3/30 and 14/19 were significantly different between two groups (p<0.0001; 3/30: CIN [-0.52±1.04] vs. CII [3.54±1.79]; 14/19: CIN [-0.51±1.04] vs. CII [3.56±1.87]). A/T and J/K were significantly different between two groups (p<0.0001; A/T: CIN [-0.79 ±0.75] vs. CII [0.75±0.88]; J/K: CIN [-0.81±0.78] vs. CII [0.80 ±0.89]). In CIN, 1st-molar measures became significantly (p<0.0001) more negative from MD to PD. In CII, no significant change was found in first-molar measures from MD to PD.

Conclusion: CIN measures were significantly more negative than CII measures. In MD to PD transition, CIN measures became less positive, and CII measures did not change significantly.

Supported by: Director's Research Award

65. *Streptococcus mutans* and Lactobacilli in Young American Indian Mothers

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Objectives: Dental caries is the most common chronic disease of childhood. While children of all races and socioeconomic statuses get caries, they are highly prevalent in children from low socioeconomic statuses, specifically American Indian and Alaskan Native (AI/AN) children. We are currently conducting a large scale examination of SM transmission from mother to child in a Northern Plains tribal community. One component of this study is to determine total counts of *Streptococcus mutans*(SM) and Lactobacilli (LB) in plaque samples of mothers in the study cohort at baseline and compare these to total bacterial counts to determine the degree to which SM and LB dominate plaque flora. In addition, we are investigating the correlation between the above variables and caries status for each mother.

Methods: Plaque samples were spiral plated onto MSKB, Rogosa, and blood agar to determine SM, LB, and total oral bacterial counts respectively. Counts were determined using standard spiral plating methodology. Bacterial counts were analyzed using the Wilcoxon rank-sum test to detect the difference between subjects with and without decay. The Shapiro-Wilk test was applied to verify the assumption of normality.

Results: Out of 214 mothers examined, 193 showed decay and 21 had no decay. Based on Spearman's rank correlation, significant (p<0.05), albeit weak, correlations were found between both DMFS and D_{Surf} (total number of untreated decayed surfaces) and the following variables: SM levels, percent SM to total flora, LB levels, percent LB to total flora and the percent of the sum of SM and LB to total flora. Also, the Wilcoxon rank-sum test revealed that mothers with decay had significantly greater LB than those without decay.

Conclusions: According to this baseline data, we have determined that the relative high levels of SM and LB compared to the total flora correlate significantly with caries experiences in this population.

Supported by: This research was funded by the Student Research Program

66. Can Hypothetical Scenarios Be Used To Predict Real-Life Dental Treatment Decisions?

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Objective: To determine if associations exist between making hypothetical dental treatment and general economic decisions with real-life dental treatment decisions.

Methods: Adult patients seeking care at the University of Iowa College of Dentistry were recruited for the study. Participants completed a survey to assess how they would respond to hypothetical dental scenarios pertaining to retaining or extracting teeth and economic questions modeling temporal discounting and risk aversion concepts. Participants' records were then reviewed to determine the actual treatment they selected at their dental appointment (i.e., extraction, "keep tooth"=root canal or restorative, or "other treatment"=reference group). Chi-Square and Fisher's Exact Tests were used to determine associations (p=0.05).

Results: N=66. Record reviews revealed that 44% of participants opted for extraction, 26% opted to keep their teeth, and 30% had other treatment needs. Participants in pain were more likely to select an extraction (64%) than to keep their teeth (20%; other=16%; p=0.04). Participants who chose to keep their teeth in the hypothetical dental situations were also more likely to choose to keep their teeth during their dental appointment compared to the extraction and reference groups (p<0.05). Sex, age, economic decisions, time of travel to the dentist, and past dental treatment were not associated with real-life treatment decisions (p>0.05).

Conclusion: Hypothetical dental scenarios, but not economic decisions, were associated with participants' real-life dental treatment choices suggesting that people may use different thought processes when making dental versus economic decisions. Dentists may be able to predict patients' real-life treatment preferences based on hypothetical dental scenarios.

Supported by: Dows Research Award

67. Cariogens in 16-19 Year Olds in the Iowa Fluoride Study

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Objectives: The oral cavity is home to many microbial species, a number of which play a role in dental caries, one of the most widespread chronic diseases in children. The goal of this study is to determine levels of *Streptococcus mutans* (SM) and Lactobacilli (LB), and the percent of total cultivable flora counts in 45 caries-active (CA) and 45 caries-free (CF) 16 to 19 year-old subjects currently enrolled in the Iowa Fluoride Study (IFS).

Methods: Saliva samples were diluted in TSB-YE broth and spiral plated onto MSKB, Rogosa, and blood agar for SM, LB, and total bacterial counts, respectively. Counts were determined using standard spiral plating methodology. Statistical analysis of bacterial counts was performed using a Wilcoxon rank-sum test. The Shapiro-Wilk test was used to verify the assumption of normality.

Results: There was a significant difference seen in SM counts (p=0.0005) and LB counts (p=0.0321) between CA and CF subjects. No statistically significant difference in total flora counts between the two groups was found (p=0.0726).

Conclusions: SM and LB counts were higher in CA subjects than in the CF subjects in the Iowa Fluoride Study. These data are in agreement with previous reports in the literature. Determination of fluoride exposure as it relates to these cariogenic bacteria is currently underway.

Supported by: Iowa Dental Research Grant

68. Clinical Effects of Listerine Compared to Listerine Zero

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Objective: To clinically compare the effects of using alcohol-free Listerine Zero or traditional Listerine for 21 days by measuring gingival index, bleeding index, and plaque index.

Methods: Prior to morning hygiene or eating/drinking a calibrated clinician measured gingival and papillary bleeding indices on teeth #3, 9, 12, 19, 25, and 28. Afterwards, plaque indices were recorded for teeth numbers 5, 8, 14, 21, 24, and 30. Subjects were given Listerine, Listerine Zero, or a water control and instructed to rinse twice a day, morning and night, for 21 days. Subjects and the clinician were blinded to the mouthwash given. After 21 days, the subjects returned for a follow-up measurement of their clinical indices. A one-way ANOVA with post-hoc Tukey-Kramer test was used to determine significant differences in index changes between pre- and post-21-day regimens of use among the three groups.

Results: There were no statistically significant improvements in any of three oral health indices among Listerine, Listerine Zero and water control groups. Results of one-way ANOVA revealed that there was no significant effect for type of experimental treatment on oral health gingival index changes (p=0.8612), bleeding index changes (p=0.4539), and plaque index changes (p=0.7950) at subject level over pre- and post- 21-day regimen of use. Additionally, no significant differences were found among the three experimental treatment groups for all three oral health measures either at the pre- or post- time period.

Conclusions: The duration of this study was based on the Listerine 21-Day Challenge. Due to the lack of a discernible reduction in plaque or gingival indices following a 21-day course of usage, we conclude that, at least in the short term, one cannot distinguish between Listerine and Listerine Zero use in otherwise healthy individuals. This may be of interest to individuals concerned about repeated exposure to alcohol in mouthrinses.

Supported by: Dows Research Award

69. Assessing Differences between the Dentin Color and the Tooth Color

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Objective: Natural tooth is composed of different structures with different optical properties. The aim of this observational study was to investigate the difference between the dentin color and the tooth color.

Method: Sound, natural extracted maxillary anterior teeth were used. Horizontal and vertical grooves were cut into enamel to be used as a reference for the measurement locations. Teeth were mounted on a dentoform with a bite registration material (Regisil, DENTSPLY). An image of the tooth was captured with an image-based spectrophotometer (Spectroshade Micro, MHT Optic Research). The thickness of enamel for each tooth was determined with a radiograph. Enamel was grinded to expose the facial dentin with a diamond bur. Then an image of the facial dentin was captured. The color of the tooth and the dentin was compared based on the CIELAB color space at nine locations in the incisal, middle and cervical thirds. Color difference between the whole tooth color measurement and the corresponding dentin color measurement was calculated for each tooth.

Result: 89 maxillary extracted anterior teeth were included in the study. Based on the paired-samples t-test, the data provided evidence that there was a significant difference between the color of dentin and the color of tooth ($p<0.05$ in each instance), except for the color parameter L measured at the incisal third ($p=0.9251$). For parameters L and b, the results indicated that the mean color of dentin was greater than the mean color of tooth, while it was lower for parameter a.

Conclusion: The results of this study suggest that the dentin is higher in value than the tooth. In addition, the dentin color was higher in b but lower in a than the tooth color. The difference between the color of the tooth and the dentin was the least in the cervical third.

70. Ceramic Thickness and Translucency Effect on Polymerization of Resin Cement

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Objective: To assess the effects of ceramic opacity and thickness on delivered irradiance and energy density and degree of conversion and microhardness of the light-cured resin cement.

Materials and Methods: IPS e-Max ceramic discs (Ivoclar Vivadent) were fabricated in 3 thicknesses (0.5, 1.0, and 1.5mm) and 4 opacities (HT, LT, MO, HO) (n=3/per group). Light-cured resin cement (Variolink Veneer Luting Cement, shade MVO, Ivoclar Vivadent) 50 µm thick was cured through these ceramics disks using a halogen curing light unit (Optilux 501, Kerr) with its energy density and irradiance measured by MARC from a fixed distance (1.5 mm). Knoop hardness and Raman microscopy were used to evaluate the bottom degree of cure. Descriptive statistics were conducted. One- and two-way ANOVA with post-hoc Tukey's HSD test and Pearson correlation test were used for the statistical analyses (alpha=0.05).

Results: Significant interaction was found between ceramic thickness and opacity on resin cement degree of conversion ($p<0.0001$), irradiance ($p=0.0062$), and energy density ($p=0.0078$). Subsequent analyses demonstrated that there was a significant simple effect for opacity and for thickness on conversion, irradiance and energy density under different conditions of thickness and opacity. Although the curing unit used has relatively good beam homogeneity, no significant correlation was found between hardness and degree of conversion (r=0.03; $p=0.8859$) unless data collection locations of Raman and Knoop hardness were taken in close proximity ($R^2 = 0.9$, $p=0.0006$). The calibration curve representing this correlation will be used in the final data collection.

Conclusion: Ceramic opacity and thickness affect the polymerization of light-cured resin cements and need to be considered and compensated for when bonding indirect restorations. Based upon the findings of this preliminary study, the final study is ongoing.

71. Treatment Subsequent to Placement of Anterior Composites over 15+ Years

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Objective: The present retrospective cohort study assessed the survival rate of anterior composite resin restoration placed at the University of Iowa, College of Dentistry (UICOD) over a period of 15-17 years.

Method: Four-hundred-ninety-one routine patients at UICOD who had anterior composite restorations placed between 1995 and 1997 and had subsequent treatment of the initial composite restoration were included in the study. Patient and restoration information included patient ID, date of birth, gender, tooth number, date of initial restoration placement, surfaces involved in initial restoration, type of provider who placed the initial restoration (faculty, resident, dental student), date of subsequent treatment, and type of subsequent treatment. Data was collected from the date of initial restoration placement (1995-1997) through 2012. Survival rate of a restoration was defined as how long a restoration lasted from the day of placement until the day of subsequent treatment. Subsequent treatment included restorations (composite, amalgam, or glass ionomer), veneer and/or crowns, root canal therapy (RCT), and extraction. One tooth per subject was used for the data analyses.

Result: Of the 491 subjects (mean age at baseline=56.2±13.5 years, and 58.5% female), 214 (43.6%) had restorations on the central incisors, 142 (28.9%) on the lateral incisors, and 135 (27.5%) on the canines. Subsequent treatment included: 8 (1.63%) amalgams, 395 (80.46%) composites, 27(5.49%) glass ionomers, 24(4.88%) crowns, 26 (5.29%) with RCT, 3 (0.62%) crown lengthening gingivectomy, and 8(1.62%) with extraction. Moreover, 264 (53.8%) restorations were done by pre-doctoral dental students, 186 (37.9%) by faculty members, and 41 (8.3%) by residents. The median survival rate for anterior composite restorations was 5.8 years.

Conclusion: A comprehensive review of patient record data can provide valuable information regarding the long term clinical performance of restorations. Based on the findings of preliminary results, further analysis is continuing.

72. Factors Associated with Early Childhood Caries in a Midwestern Hispanic Community

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Purpose: The purpose of this study was to report on factors related to caries experience among pre-school aged children in a Hispanic community.

Methods: Children, ages 2-5 years, were included in the study. Questionnaires about child beverage consumption, fluoride exposure and demographics were given to mothers or caregivers. Saliva samples and clinical assessments were completed. The d1, d2-3 caries criteria were used.

Results: 148 children and their mothers/caregivers were included. The mean age of the children was 50 months. Overall caries prevalence was 50.7%, and those with caries were older (P=.003). The mean number of teeth with visible plaque present was 8.4, and those with caries had higher number of teeth with plaque (P<.001). Those with caries experience had significantly higher mean consumption of regular soda and sugared beverages. Caries prevalence was significantly higher for children who had ever been put to sleep with a bottle. Children who reported drinking milk at meals had significantly lower caries prevalence compared to children who had other beverages with meals. Children with mothers who did not complete high school were significantly associated with early childhood caries. Presence of MS in children was significantly associated with having caries, but having fluoridated water was protective.

Conclusions: This study identified several factors associated with ECC, including lower maternal education, higher levels of visible plaque, and bottle feeding children to sleep. In addition, protective factors including water fluoridation and drinking milk with meals were shown to be effective in reducing caries prevalence in this population.

73. Restoring Canine Guidance with Lingual Nanofilled and Facial Microfilled Resin-Based Composite

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Most clinical cases involving the restoration of maxillary canines include a significant portion in the functional area. In these situations, restorations must accomplish two clinical objectives: 1) Restoring or enhancing esthetic expectations, and 2) Maintaining or re-establishing adequate canine guidance. In choosing the best resin composite to be used for restoring canines, it is important to understand the composition and properties of the restorative materials. The microfilled resin-based composite can achieve esthetic expectations with higher polishability , but shows lower strength and increased wear compared with nano-filled resin-based material. For that reason, a new technique is proposed that maximizes function and esthetics of upper canines by integrating a combination of a lingual shell using nano-filled resin with the facial build-up using microfilled resin. In this technique, a polyvinilsyloxane matrix is made from the patient's waxed-up model to build the lingual shell using nano-filled material, which is extended from the entire lingual area through the incisal edge. This nano-fill shell not only supports functional occlusion and establishes canine guidance, but it also provides the framework to restore the facial portion with a microfilled resin composite. This proposed layering technique will increase the longevity and esthetics of the direct restoration in upper canines with the esthetic facial restoration being supported by a stronger, high wear resistance material on the lingual shell. This predictable restorative technique satisfies the esthetic and functional expectations of the patient and clinician.

74. The Efficacy of the WaveOne Reciprocating File System Versus the ProTaper Retreatment System in Endodontic Retreatment of Two Different Obturating Techniques

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Objectives: This ex vivo study evaluated the efficacy of retreating GuttaCore and warm vertically condensed gutta-percha in moderately curved canals with two different systems: ProTaper retreatment and WaveOne.

Methods: Eighty mesial roots of mandibular molars were prepared using the WaveOne primary file. The canals were obturated in one of two different techniques: warm vertical or GuttaCore. The warm vertical group was obturated using a continuous wave technique of gutta-percha compaction, and the GuttaCore group was obturated according to manufacturers' instructions. The teeth were subdivided into 4 experimental groups (n=20), each with the same mean root curvature: Group 1 — Warm Vertical retreated with the ProTaper, Group 2 — Warm Vertical retreated with the WaveOne system, Group 3 — GuttaCore retreated with the ProTaper, and Group 4 — GuttaCore retreated with WaveOne. After allowing the sealer to set, each specimen was retreated with either ProTaper retreatment files D1, D2, and D3, or the WaveOne primary file to the predetermined working length. The time needed to reach working length (T1) was recorded. Instrument fatigue and failures were recorded for each system.

Results: The preliminary results indicate that there is no statistical significance in the time to reach working length during retreatment with the two systems. Instrument failure occurred at a higher rate with WaveOne than with the Protaper instruments. Retreatment of GuttaCore was faster and led to fewer instrument failures than retreatment of Continuous wave with both instruments.

Conclusions: WaveOne is not a safe file for use in retreatment. GuttaCore is removed more efficiently and places less stress on instruments than Continuous wave.

Supported by: Department of Endodontics, College of Dentistry

75. Reliability of E4D Compare Software: An Inter-Rater Evaluation

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Purpose: To evaluate the reliability of the E4D Compare software program as a tool to compare two digital-scanned images of dental tooth preparations.

Materials and Methods: Ideal crown preparations were performed on 3 different plastic teeth; a maxillary center incisor (#8), a maxillary canine (#11), and a mandibular first molar (#19) by one dentist. All prepared teeth were scanned, using the E4D scanning machine, and the data were used to serve as standard preparations (control). An additional 5 crown preparations of each tooth type (test) were done and scanned in the same manner as described above, but by a different dentist. The test preparation images were compared to the standard preparations, and areas within tolerances were calculated. Each tooth was compared to the corresponding standard in triplicate. Reliability was evaluated using the intra-class correlation.

Results: The data provided evidence of statistically significant ($p < 0.0001$) but moderate levels of reproducibility, based on an estimated intra-class correlation coefficient of 0.678. Examination of patterns of variability suggested that there was greater reliability among measurements taken on incisors (#8) and molars (#19), relative to those taken on canines (#11). These preliminary observations warrant further investigation.

Conclusions: The E4D compare software has been shown to exhibit some variability in the results, but it is nonetheless a reliable tool for student education.

76. Caregivers' Comfort Levels Regarding Physical Resistance during Oral Care Delivery

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Purpose: Investigate perceived comfort levels, behaviors, and barriers reported by group home caregivers while providing oral health care to consumers with special health care needs (SHCN) who physically resist the care.

Methods: A 24-item survey was sent to 884 caregivers employed at six care facilities in Iowa. Bivariate analyses and logistic regression models were used to analyze the data (alpha=0.05).

Results: The overall response rate was 52%. Caregivers reported that 32% of consumers were incapable of brushing independently, while 37% required assistance; 61% of them felt "somewhat to very comfortable" providing oral care for consumers who physically resisted the care; while 39% felt "very to somewhat uncomfortable." Bivariate and multiple logistic regression analyses indicated that caregivers who felt more comfortable providing oral care for consumers who physically resisted the care had experienced a higher frequency of consumers not opening their mouths (P=.0003), pushing the caregiver away (P=.0002), moving their heads uncontrollably (P=.0004), spitting at (P=.0099), hitting and/or kicking the caregiver (P=.0011). Furthermore, these caregivers provided direct care for a greater number of consumers weekly (P=.0044), received training from their current facility on providing oral care for consumers with SHCN (P=.0424), brushed the teeth of uncooperative consumers at least 75% of the time (P<.0001), felt "somewhat to very comfortable" flossing their teeth (P<.0001) and providing oral care for the cooperative consumers (P<.0001).

Conclusions: Comfort level in providing oral health care to consumers with SHCN who physically resist the care appears to be significantly associated with training and experience working with this population.

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77. Perceptions of Pediatric and General Dentists on Placement of Stainless Steel Crowns on the Teeth of Ethnically Diverse Patients

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Purpose: The purpose of this study was to investigate whether pediatric and general dentists believe it is more challenging to place stainless steel crowns (SSCs) in primary molars on non-Caucasian, ethnically diverse, teeth.

Methods: A 22-item electronic survey was sent to 5,535 active members of the American Academy of Pediatric Dentistry. Descriptive and bivariate analyses were used to analyze the data (alpha=0.05).

Results: The overall response rate was 15%. Of the 824 respondents, the mean age of participants was 44.9 years and 54% were male, including 93% pediatric dentists. On average, respondents saw 32.4 patients a day. Compared to Caucasian children, the greatest percentage of respondents (56%) believed there is a difference in primary tooth size for African American children, and not for other ethnicities. In addition, the majority of them (88%) did not find it to be more challenging to place SSCs on the teeth of non-Caucasian children. Most of practitioners also did not report additional chair time when placing SSCs on African (75%), Latino (80%), and Asian (74%) children. Only 17% of respondents would consider purchasing a unique set of SSCs for to improve efficiency when placing SSCs in non-Caucasian children.

Conclusions: Respondents do not report challenges when it comes to fitting pre-cut, pre-crimped SSCs on the primary teeth of non-Caucasian children. Bivariate analysis is in-progress to explore factors related to placing SSCs in non-Caucasian, ethnically diverse, patients.

78. Reduction in Bone Density Necessary for the Detection of Periapical Pathosis

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Objective: The aim of this study was to determine the percent loss of bone density necessary for detecting periapical lesions. Additionally, we compared the results obtained between and within the groups of evaluators.

Methods: Digital radiographs from nine cadaver jaws were altered to simulate a lesion at the apex of a single tooth. Each jaw produced images at seven different modification levels, correlating with the percentage of bone loss for each lesion. This resulted in a total of 63 different images for participant evaluation. Images were presented in a PowerPoint slide show in a randomized order. Participants indicated whether a lesion was definitely present, definitely absent, or possibly present on the identified tooth.

Results: Images were evaluated by twelve participants, including four endodontic faculty, four endodontic residents, and four radiology residents. Preliminary data suggest there is a significant positive correlation between bone loss and lesion detection. With 6% bone loss, approximately 8% of participants were able to detect a lesion, while at 12% and 18% bone loss, approximately 43% and 77% were able to detect a lesion, respectively. There was no significant difference in responses between the groups of evaluators, although there was a significant difference between evaluators within each of the three groups.

Conclusions: The ability to detect a periapical lesion on a digital radiograph depends on the extent of bone loss. In addition, there is significant subjectivity in radiographic interpretation of the presence or absence of periapical pathosis, not only among different evaluators but among the same evaluators.

Supported by: AAE Foundation

79. Factors Associated with Early Childhood Caries Incidence among African-American Children in Alabama

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Objectives: To assess the relationships between behavioral factors and Early Childhood Caries (ECC) in African-American pre-school children.

Methods: Ninety-six African-American children were recruited by word of mouth from Perry County, Alabama (non-fluoridated community) at 12 months of age, and followed for three years. Cavitated level dental examinations were conducted annually (baseline, 1st, 2nd and 3rd follow-up) following World Health Organization (WHO) criteria. Three-year caries incidence was calculated. Parents provided detailed oral hygiene and dietary information every six months by questionnaires. Cumulative calculations using area-under-the-curve (AUC) were made for all the independent variables assessed on the follow-up questionnaires. Bivariate and multivariable relationships between caries incidence and different behavioral factors defined three ways (at baseline, as the AUC and at 2nd follow-up) were assessed using logistic regression for dichotomous dependent variables and negative binomial modeling for count dependent variables.

Results: Relatively high percentages of children at baseline (about one year old) reportedly brushed their teeth (41.5%) and used toothpaste (33.3%). All children (100%) reportedly brushed their teeth and used toothpaste at the 2nd follow-up (when approximately three years old). Almost all children (99%) consumed sugar-added beverages at the 2nd follow-up. Greater baseline frequency of toothbrushing and 100% juice consumption (AUC composite) were associated with lower incidence of dental caries (ORs=0.34 and 0.37, P-values=0.01 and 0.049, respectively). More frequent consumption of sweetened foods (AUC composite) and having a previous visit to a dentist (2nd follow-up) were associated with greater incidence of ECC (ORs=9.22 and 4.57, P-values=0.002 and 0.03, respectively). Presence of a regular dentist (2nd follow-up) was associated with greater ECC counts incidence (IRR=3.63, P-value=0.03).

Conclusion: For those living in a non-fluoridated community, frequency of sweetened food consumption (greater), 100% juice consumption (lower), toothbrushing (lower), previous visit to a dentist, and presence of a regular dentist were associated with more ECC incidence.

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80. Identification of Human Craniofacial, Thyroid and Heart Enhancers at the FOXE1 Locus

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Mutations in FOXE1 cause the congenital Bamforth-Lazarus syndrome comprised of agenesis or dysgenesis of the thyroid, cleft palate and hair anomalies. Three common diseases, isolated cleft lip and cleft palate (CLP), hypothyroidism and thyroid cancer all map to the FOXE1 locus. However, very few coding mutations have been found, suggesting that the common risk alleles reside in nearby regulatory elements that have yet to be identified. Using a combination of zebrafish and mouse transgenesis, we screened 15 conserved non-coding sequences for enhancer activity, identifying 3 that regulate expression in a tissue specific pattern consistent with endogenous foxe1 expression. These 3 are all active in the developing jaws and branchial arches. Two of these, are also active in the heart and one furthermore directs expression in the developing thyroid and contains the SNP rs7850258 that is the most significantly associated marker at this locus with both hypothyroidism and thyroid cancer. Our previous studies of CLP have indicated the presence of three different FOXE1 risk haplotypes, two of which correspond with facial enhancers discovered here. Based on the correlation between thyroid and facial genetics and biology, we hypothesized that there may a shared risk for both diseases within families or a population. To this end, we evaluated the frequency of thyroid diseases amongst pedigrees segregating for CLP. In a family based approach, there was a greater frequency, albeit nonsignificant, of thyroid cancer in cleft families (2.89%) than control (2.43%). In a Danish national population cohort, there was a greater risk for hypothyroidism amongst males with CLP and a reduced risk for hyperthyroidism amongst females. There was not a difference in cancer rates between cases and controls. In conclusion, we have demonstrated there are genetic, biological and clinical links between orofacial clefting and thyroid disease at the FOXE1 locus.

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81. Caries Prevalence in American Indian Children at Age 36 Months

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Objectives: Early childhood caries (ECC) is rampant among American Indian children, but there has been relatively little study of this problem. This paper reports on the prevalence of caries at the person, tooth and tooth surface level for a group of American Indian children at age 36 months.

Methods: Pregnant women from a Northern Plains tribal community were recruited to participate in a longitudinal study of ECC and risk factors. Standardized dental examinations were completed on children and questionnaires were completed by mothers at baseline and when children were 4, 8, 12, 16, 22, 28 and 36 months of age. The exams were surface-specific for frank decay, and the presence of non-cavitated "white spot" lesions was recorded at the subject level.

Results: The sample size was 232 mother-child pairs, and for the 36 month examinations, the mean age of the children was 35.4 months. As reported previously (IADR 2013), frank caries prevalence at 22 months was 49.6%. By 36 months of age, frank caries prevalence was 80.1%, with an additional 14.7% having only non-cavitated lesions. The maxillary incisors were most commonly affected, with individual maxillary incisor prevalence ranging from 44.8% to 53.0%. The mandibular molars were also commonly affected, with the range of individual mandibular molar caries prevalence ranging from 34.1% to 44.4%. In total, 10.9% of all erupted surfaces were affected by frank decay. The mean dmfs was 9.62, and of the total dmfs, nearly 62% was decayed, 31% was missing, and only 7% was filled.

Conclusions: By the age of 36 months, dental caries is nearly universal in this population of American Indian children. Future analyses of these data will assess bacterial, behavioral, dietary and demographic variables as risk factors for ECC in this population.

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82. Developing an Assessment Tool to Review Electronic Patient Education Materials

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Objectives: With the rising use of computers and tablet devices in the dental office, dentists are increasingly using electronic education materials to help their patients make treatment-related decisions. The goal of this project was to develop a tool that can be used by practitioners and educators to assess content and design of these electronic resources.

Methods: We reviewed previously published literature regarding patient education to identify factors that effectively improve patients' health literacy. Since there are no currently published articles regarding patient dental education software, we adapted themes and factors from other health literature for the assessment of electronic patient education materials. We relied on previous software assessments and results from patient focus groups to identify additional relevant factors.

After drafting the assessment tool, six patient education programs were selected for review. These programs were chosen as representative of currently available options, based on price, procedures and conditions included, and organization of information. In order to minimize personal subjectivity, the research team independently reviewed programs and collaboratively refined the assessment tool through an iterative process. The assessment tool was then pilot tested by faculty practitioners at the University of Iowa College of Dentistry.

Results: Development and application of an assessment tool revealed large discrepancies among currently available electronic patient education materials. Some programs are significantly more extensive in content, organization, and adherence to principles of health literacy, thereby increasing their effectiveness.

Conclusions: Practitioner and educators should carefully evaluate educational programs in order to select patient education programs that suit their needs. This assessment tool offers an evidence-supported framework that can assist in that decision.

83. Longitudinal Course of Caries in Young Native American Children

D.R. Blanchette[1], D.V. Dawson[1], J.J. Warren[1], K.R. Phipps[5], D.R. Starr[6], T.A. Marshall[1], D.R. Drake[1]

[1]University of Iowa, Iowa City, IA; [5]Consultant, Morro Bay, CA; [6]Indian Health Service, South Dakota

Objectives: This is a 36-month birth-cohort study examining rampant early childhood caries (ECC) among American Indian children from a Northern Plains tribal community. Regular oral exams, plaque samples, and caregiver interview questionnaires serve as a rich analytical source for ECC investigation. This paper reports on the prevalence of caries, as well as dmfs and its composition over the 36 month time course.

Methods: A total of 239 mother-child dyads participated in a longitudinal study of early childhood caries (ECC) and risk factors. Surface-specific exams for frank decay and non-cavitated white spot lesions occurred at baseline (approximately one month of age (±30 days) and target ages of 4, 8, 12, 16, 22, 28, and 36 months.

Results: Decay was first seen in seven teeth (6 maxillary incisors and 1 mandibular incisor) from five children at 8 months. The progression of caries prevalence was: 2.1% (N = 233, 8 mos), 14.9% (N = 235, 12mos), 31.8% (N = 233, 16 mos), 49.6% (N = 234, 22 mos), 69.2% (N = 227, 28 mos), and 80.2% (N = 232, 36 mos). Mean dmfs and its composition (D=decayed, M=missing, F=filled) were: 0.03 (8 mos: 100% D), 0.51 (12 mos: 100% D), 1.45 (16 mos: 90.5% D, 9.5% M), 3.66 (22 mos: 87.9% D, 10.7% M, 1.4% F), 7.00 (28 mos: 76% D, 19.7% M, 4.3% F), and 9.62 (36 mos: 61.7% D, 31.4% M, 6.9% F).

Conclusions: In the period from 8 to 12 months, caries prevalence increased by more than 600%. Teeth missing due to decay were common, accounting for 31.4% of total dmfs at 36 months, while only 6.9% was filled. In conclusion, caries is highly prevalent and is mostly either untreated or treated by extraction in this population.

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84. Neighborhood and Family Social Capital and the Oral Health of Children in Iowa

J. Reynolds[1], *P. Damiano*[1], J. Glanville[1], J. Oleson[1], M.R. McQuistan[1]

[1]University of Iowa, Iowa City, IA

Objectives: A growing body of evidence supports the impact of social factors on oral health disparities in children in the US. The goal of this study is to examine the relationship between two components of social capital — family and neighborhood — and oral health in Iowa's children.

Methods: A statewide representative data source was analyzed cross-sectionally for parent-reported oral health status of children as the outcome. A four-item index of neighborhood social capital and four separate indicators for family social capital — religiosity, number of children in the household, parent structure, and family frequency of eating meals together — formed the independent variables. Data were analyzed using a mixed linear regression with a random effect for zip code in order to account for clustering of responses about neighborhood social capital by geographic area.

Results: Significant positive associations were found between oral health status and neighborhood social capital (p=0.005) and family frequency of eating meals together (p=0.02) after adjusting for covariates. A one standard deviation increase in neighborhood social capital was equivalent to a $15,000 increase in household income. The mean difference in child oral health status between families eating meals together everyday or most days and those eating together some days or never approximates the mean difference in oral health status between children drinking zero cans of pop per day and those drinking one or more per day.

Conclusions: Neighborhood social capital and family function, a component of family social capital, may influence child oral health outcomes. This is the first study to assess the relationships between family and neighborhood social capital and oral health at the state level in the USA. It provides further evidence that family and community characteristics are important in order to understand the full complement of factors that are related to child oral health.

85. Evaluation of Keratinocyte and Fibroblast Cellular Dynamics on Innovative Coated Surfaces

D. Seabold[1], K. Walters[1], C. Allamargot[1], *C.M. Stanford*[1]

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Objective: To compare the biocompatibility of a novel PLL+collagen coating on experimental titanium surfaces with two reference surfaces, a machined cpTi surface and Tissue Culture Plastic (TCP). Human derived keratinocytes (hTERT cells) as well as human dermal fibroblasts were used to evaluate the influence of the surfaces on adhesion, proliferation and gene expression under *in vitro* conditions.

Methods: Changes in expression for Keratin1 (KRT1), Keratin 10 (KRT10), Matrix Metallopeptidase9 (MMP9) and Focal Adhesion Kinase (FAK) were analyzed using real time Real Time PCR. Cells were plated onto discs in triplicate with plastic as a control at high cell density. After 1 hr of attachment, wells were flooded with supplemented KSFM (keratinocytes serum free medium), 10% FBS (fetal bovine serum) or supplemented basal media. At Days 0, 1, 4, 8 and 14, total cell RNA was extracted with RNeasy Mini Kit (Qiagen). Immunofluorescent samples were prepared using the same macrodot technique as described for gene expression. Samples were grown for either four or eight days. Mouse monoclonal [RCK108] to Cytokeratin 19(ab9221) primary antibody from Abcam was used to immunostain the keratinocyte cells and procollagen type I(M-38) from the University of Iowa Hybridoma Facility was used for the fibroblast cells as well as 1:100 Alexa Fluor Phalloiden-Fluorescein (FITC) from Life Technologies was used for both cell lines. The Alexa Fluor Far Red(GAM) secondary antibody from Life Technologies was used at 1:500. Samples were then viewed using a fluorescent microscope.

Results: When compared significantly (p<0.05) elevated levels of MMP9 were observed after 14 days for the PLL+collagen coating on experimental titanium surface for both keratinocyte and fibroblast cells.

Conclusion: The elevated MMP9 expression for the PLL+collagen coating on experimental titanium surface could indicate that matrix components are degrading for those samples more so than the controls. Overall there is not a significant difference in cell adhesion, proliferation and gene expression between the three surfaces.

Supported by: Dentsply IH AB

86. Genotypic Diversity and Transmission of *Streptococcus mutans* in American Indians

A.L. Villhauer[1], D.J. Lynch[1], D.V. Dawson[1], J.J. Warren[1], T.A. Marshall[1], K.R. Phipps[5], *D.R. Drake*[1]

[1]University of Iowa, Iowa City, IA; [5]Consultant, Morro Bay, CA

Objectives: *Streptococcus mutans* (SM) is a primary microbiological agent of dental caries, a very prevalent chronic disease of childhood. Children from populations with lower socioeconomic status, particularly Hispanic, African-American, and American Indian, display a significantly higher incidence of caries. Our current study is focusing on transmission of SM genotypes from mother (or other designated primary caregiver) to child in an American Indian population. We are reporting here on the genotypic diversity and transmission of SM in 40 family groups (mother/child or mother/child/caregiver) from a Northern Plains tribe. We are focusing on SM profiles of babies from birth to 16 months of age.

Methods: Whole mouth plaque samples were collected from mother/child pairs and designated primary caregivers every four months. Samples were spiral plated onto selective and non-selective agars to obtain total flora, lactobacillus, and SM counts. SM isolates were identified by sugar fermentation profiles and genotyped with AP-PCR using OPA2 primer. Gels were analyzed and dendograms generated using GelComparÆIIv6.5.

Results: Individual subjects display a range of 0-4 SM genotypes. Family groups show a range of 0-6 SM genotypes. In our data set, 62.5% of the children (25/40) have established SM colonization by 16 months. Of these children, 44% share at least 1 genotype with the mother and/or caregiver. In 8 of the 13 families with a designated primary caregiver, the mother and caregiver share at least one SM genotype.

Conclusions: Our data show that there is homology of some SM genotypes in mother/child pairs and mother/child/caregiver groups. There are some genotypes observed in children that are not shared with mothers and/or primary caregivers and some shared within and across families. We continue the analyses of our data set focusing on SM genotype profiles and transmission in this population.

Supported by: This work was supported by NIH grant 1-RO1 DE017736-01A5

87. Oral Health Training for Caregivers in Residential Care Settings

K. Anfinsen[1], *M. Geneser* [1], K. Weber-Gasparoni [1], G. Gilbaugh[1], F. Qian [1]

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Purpose: Individuals with special health care needs (SHCN) are often at high risk for experiencing oral health problems and many are dependent on caregivers to provide necessary daily preventive oral health care. Many caregivers in residential care settings have received limited, if any, oral health care training. This pilot study aimed to assess whether an oral health training session provided to caregivers improved the delivery of oral health care.

Methods: Pre-intervention data about these caregivers, including previous oral health training, comfort levels, and current practices, were collected. Immediately following the survey, a team of dental professionals delivered a live, ninety-minute long, training session focused on providing oral health care to adults with SHCN.

Results: Twenty-nine caregivers, mean age 35 years, completed the survey and the subsequent training. The average caregiver had been at the job for nearly 12 years and provided 19 hours of direct care each week. Pre-intervention, 41% of these caregivers had never received any form of oral health care training. Most, 83%, reported feeling comfortable providing oral hygiene for cooperative consumers, but 31% report that they would "always stop" oral hygiene when a consumer physically resisted. To facilitate care, only 14% of caregivers had ever utilized a mouth prop and only 17% had ever tried an adapted toothbrush.

Conclusions: Pre-intervention data revealed that oral health training and experience is lacking in this caregiver population. Statistical analysis is in-progress to determine how the training session affected comfort levels and practices.

Supported by: Research supported by the Delta Dental of Iowa Foundation.

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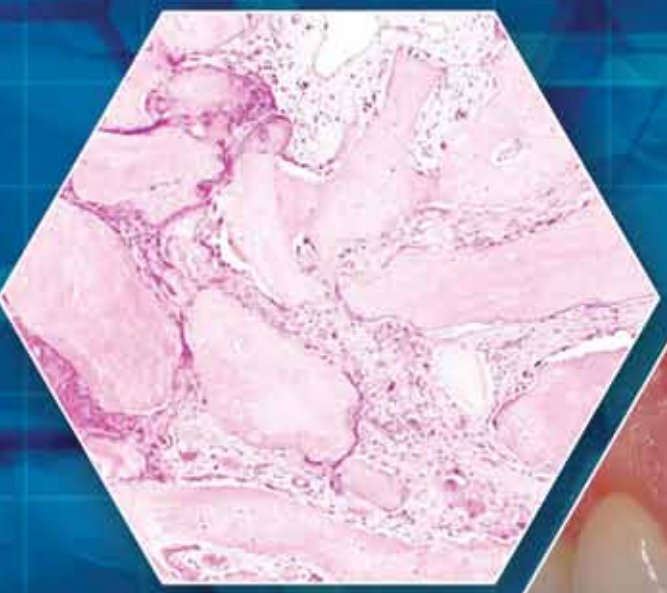

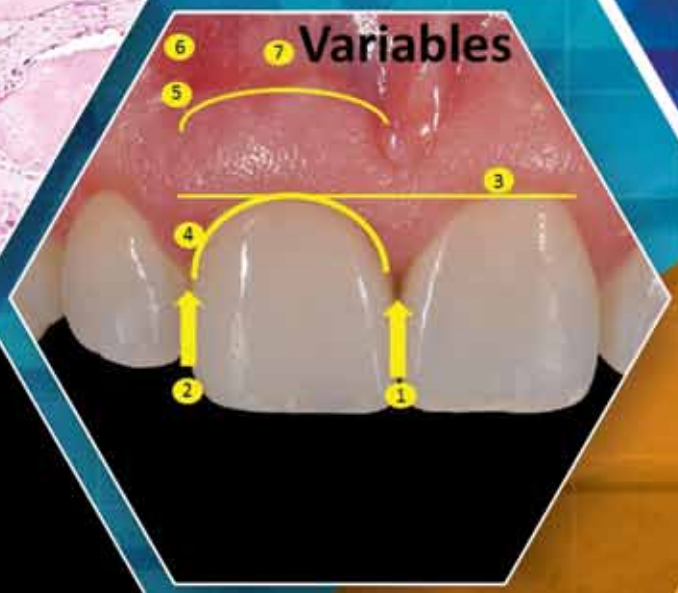
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