
The University of Iowa
College of Dentistry & Dental Clinics
Iowa Section
of the
American Association
for Dental Research
(AADR)
62nd Annual
Meeting
2015

Keynote Address:

A New Model for Bioadhesion

Biomaterials represent opportunities and a challenges for engineers. The biological environment initiates conditioning of all materials upon their introduction. The process, known as biofouling, is a complex process that involves adsorption of molecular, cellular, and organismal components. Biofouling occurs across a wide range of conditions — including harsh environments with extreme pH levels, salinities, temperatures, pressures, and complex loading conditions. It can initiate, proceed, and persist over short or long time spans. Whenever designs involve a material in the biological environment, the nature of the environment and intended exposure conditions must be considered. We have been investigating biofouling mechanisms and the fundamental response of materials to biofouling for over a decade. We have discovered a unique surface topography, i.e., the Sharklet Topography, that can be manipulated to both inhibit and promote bioadhesion. The keynote address will present examples of bioadhesion from biomedical and marine environments to illustrate the fundamental physics of biofouling processes. Our newly published SEA Model will be discussed in terms of its predictive power for the influence of surface topography/energy.

Our Keynote Speaker

Anthony B. Brennan
PhD, DSc
Margaret A. Ross Professor of Materials Science & Engineering
Professor of Biomedical Engineering

Professor Brennan earned a PhD from Virginia Polytechnic Institute in Materials Engineering Science in 1990. He is currently the Margaret A. Ross Professor of Materials Science and Engineering and Professor in Biomedical Engineering. He received an honorary Doctor of Science from the State University of New York in 2012. Dr. Brennan is co-founder and Chief Technology Officer for a start-up company, Sharklet Technologies, Inc. that uses his patented technologies. His research focuses on biomaterials, specifically the design, fabrication and characterization of biointerfaces, which mimic naturally occurring surfaces. These materials, which include a variety of bioneutral and bioactive materials, are chemically modified to facilitate the study of the interactive nature of both physical and chemical stimulation by substrates on cellular function. He has mentored 27 PhDs, 33 MScs and 5 Post-doctoral fellows. He has also published 1 book, over 100 refereed articles, book chapters and abstracts and 13 U.S. patents as well as multiple international patents.

Prof. Brennan served as chair of the faculty senate and is a trustee-emeritus. He and his wife, Kathy, reside in Gainesville, FL and have three children and two grandchildren.

Dental research images for the cover were provided by Chris Barwacz, Austin Foster, So Ran Kwon, Steve Bullard, Andrew Lidral, Rodrigo Rocha Maia, and Mark Sullivan.

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Dear Colleagues:

Thank you for your participation in the 62nd Anniversary of the University of Iowa College of Dentistry's Local Research Day on February 10, 2015. 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.

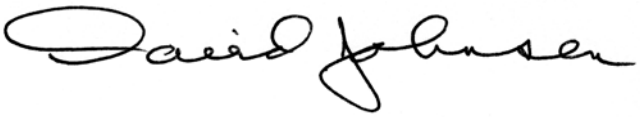
We are honored to host Dr. Anthony B. Brennan as our keynote speaker. Dr. Brennan is the Margaret A. Ross Professor of Materials Science and Engineering at the University of Florida, Gainesville.

Our College has been very successful in recruiting 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 fresh 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 showcases the people and the spirit of discovery that continually fuel outstanding education, service, research, and patient care within our College.

Local Research Day and this program booklet offer many opportunities to learn about fascinating research within our College. We commend the event's planning committee and research presenters for their hard work. Thank you for being a part of this important event.

Best wishes,



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

THE UNIVERSITY OF IOWA
COLLEGE OF DENTISTRY
& DENTAL CLINICS

February 10, 2015 Dental Research participants and Iowa Section of the AADR:

The University of Iowa College of Dentistry (CoD) is committed to advancing science in our laboratories and clinics. This commitment is integral to the discovery of new drugs and improvments in health science and patient care. Interdisciplinary collaboration between CoD scientists and other UI researchers are regarded by us as essential to the training of future dentists and dental researchers.

The CoD engenders language and methodology fundamental to the evolving disciplines of biotechnology, environmental health, commercialization, and the transfer of new data from bench to clinic to industry. Research at the CoD promotes the translation of basic life sciences, including genomics and proteomics, to dental and medical sciences.

This is an exciting time for the CoD as we enhance our dental research programs. We have a highly visible position within the University of Iowa, and we continue to improve our standing through competitive dental research programs.

The CoD is pleased to support our dental research programs and the AADR through this research day — our occasion to honor the talents and commitment of our students, residents, faculty, and staff. We take great pride in their success and believe that their contributions, insights, vision, determination, and dedication will shape the future of dentistry.

This year we are honored to have Dr. Anthony B. Brennan as our featured keynote speaker. Dr. Brennan is the Margaret A. Ross Professor of Materials Science and Engineering at the University of Florida, Gainesville. He has published over 100 refereed articles, book chapters and abstracts and he is also an inventor and co-inventor on six U.S. patents. Dr. Brennan's research interests include the design, fabrication and characterization of tissue constructs with an emphasis on biointerfaces, which mimic natural biofaces.

Warmest Regards,

Brad A. Amendt, Ph.D.
Associate Dean for Research
College of Dentistry and Dental Clinics

Kim Brogden Ph.D.
Professor
Director, Dows Institute for Dental Research
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), it is our pleasure to welcome you to The University of Iowa College of Dentistry & Dental Clinics Annual Research Day.

This year marks the 62nd consecutive session whereby colleagues and students are provided an open forum to present their exciting research accomplishments to the larger research community. Findings ranging from basic, translational, clinical, health policy and services research underscore the breadth of our collegiate research. Research Day represents a unique moment each year to observe and invigorate the research conducted at the College of Dentistry.

It is our honor this year to welcome Dr. Anthony B. Brennan as the keynote speaker. Dr. Brennan is the Margaret A. Ross Professor of Materials Science and Engineering at The University of Florida, Gainesville. He is a co-founder and the Chief Technology Officer for Sharklet Technologies, Inc., a start-up company that uses his patented technologies. Dr. Brennan's innovative research has focused on biomaterials with an emphasis on the design, fabrication and characterization of biointerfaces, which mimic naturally occurring surfaces (biomimicry).

We would like to thank the presenters, volunteering judges, and support staff for their cooperation and support in making this event successful. Finally, we would like to sincerely thank all of the sponsors who have generously contributed to this year's Research Day Meeting, without whose support this day would not be possible.

Sincerely,

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

Veerasathpurush Allareddy BDS PhD
Associate Professor
Department of Orthodontics
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)
62nd Annual Meeting, Tuesday, February 10th, 2015

7:30 a.m.	**Reception with Coffee and Rolls** (Oral-B Classroom N212)
8:00 a.m.	**Welcome Address** (W220 A & B) Dr. David Johnsen **Keynote Speaker Introduction** Dr. Chris Barwacz
8:20 a.m.	**Keynote Address** (W220 A & B) Dr. Anthony Brennan
9:20 a.m.	**Break**
9:30 a.m. - 11:30 a.m.	**Oral Presentations** Session One (Oral-B Classroom N212) Session Two (W220 A) Session Three (W220 B)
11:30 a.m. – 12:40 p.m.	**Poster & Table Clinic Presentations** (Dows Institute & 4th Floor Link)
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

9:30 a.m. - 11:45 a.m., Oral-B Classroom N212

(a) Max Smith Pre-Doctoral Competition
(b) Max Smith Graduate and Post-Doctoral Competetion
(c) Dentsply Implants Competition
(g) Iowa Society of Periodontology Pre-Doctoral Award
(h) Iowa Society of Periodontology Post-Doctoral Award
(i) Post-Doctoral Specialty Award

1. [a,g] **E. Pantzlaff**, T.D. Busch, D.V. Dawson, C.L. Fischer, G. Avila Ortiz, S. Elangovan, J.C. Murray, *C.M. Stanford*, K.A. Brogden, *A. Butali*

   Systemic Inflammation and the Impact of Obesity on Gingival Inflammation

2. [b,f] **J. Hemsath**, *A.E. Williamson*, R. Chu

   Treatment of External Cervical Resorption Among American Association of Endodontists Members: A Web-based Survey

3. [a] **T.M. Schramm**, *C.B. McKnight*, *K.A. Brogden*

   Detection of Oral Microorganisms on Disposable Clinic Coats using HOMINGS

4. [b,c,h] **M. Gubler**, C.A. Barwacz, V. Allareddy, C.L. Nicholas, *G. Avila-Ortiz*

   Efficacy of Socket Grafting for Alveolar Ridge Preservation: A Randomized Clinical Trial

5. [b,c,i] **C. Garcia**, F. Qian, *M.A. Vargas*

   Effect of Lingual Bevel in the Fracture Strength of Class IV Composites

6. [b] **C.L. Fischer**, D.V. Dawson, D.R. Blanchette, D.R. Drake, P.W. Wertz, *K.A. Brogden*

   Sapienic Acid Modifies *Porphyromonas gingivalis* Metabolism Initiating a Lethal Event

7. **K.A. Brogden**, T. Abbasi, S. Vali, D. Parashar, S.S. Pillay, S. Radhakrishnan, C.L. Fischer

   An *in silico* Keratinocyte/Dendritic Cell/Tcell Predictive Inflammatory Response Model

8. **A.R. Hallberg**, *R.A. Cornell*

   Exploring the Mechanism of Cleft Palate in Patients with Branchio-Oculo-Facial Syndrome: *TFAP2A* in the Neural Crest Gene Regulatory Network

9. **M.J. Kanellis**, A. Owais, D.V. Dawson, J.J. Warren, K. Weber-Gasparoni, G. Wehby, D.R. Drake, A. Gasparoni, M.K. Geneser, M.C. Skotowski

   Amish Silver Nitrate Clinical Trial: Study Design and Subject Recruitment

Oral Session 2

9:30 a.m. - 11:30 a.m., W220 A

(a) Max Smith Pre-Doctoral Competition
(b) Max Smith Graduate and Post-Doctoral Competetion
(c) Dentsply Implants Competition
(f) Endodontic Michel Fuller Post-Doctoral Award
(g) Iowa Society of Periodontology Pre-Doctoral Award
(h) Iowa Society of Periodontology Post-Doctoral Award
(i) Post-Doctoral Specialty Award

10. [b,c,h] **K.M. Smith**, *K.A. Brogden*, G. Avila-Ortiz, C.L. Fischer, A.M. Bates, F. Qian, *S. Elangovan*

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

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9:30 a.m. - 11:30 a.m., W220 B

(a) Max Smith Pre-Doctoral Competition
(b) Max Smith Graduate and Post-Doctoral Competetion
(c) Dentsply Implants Competition
(i) Post-Doctoral Specialty Award

18.[b] **D.J. Lynch**, A.L. Villhauer, D.V. Dawson, J.J. Warren, T.A. Marshall, K.R. Phipps, D.E. Starr, *D.R. Drake*

Genotypic Diversity of *Streptococcus sobrinus* in American Indian Children

19.[b,c,i] **A. Singhal**, E.T. Momany, M.P. Jones, R.A. Kuthy, D.J. Caplan, C.B. Buresh, *P.C. Damiano*

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21. **S. Geisinger**, *S.R. Kwon, F. Qian*

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23. **R.A. Kuthy**, J.C. Reynolds, S.C. McKernan

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24. **S.C. McKernan**, A. Singhal, E.T. Momany, R.A. Kuthy

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(e) ADA Table Clinics Award
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Graduate, Faculty & Staff Posters & Table Clinics

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(i) Post-Doctoral Specialty Award

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58.[i] **S.J. Christensen**, *M.J. Kanellis*, F. Qian

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59.[i] **M. AlRefeai**, *J.L. Kolker*, F. Qian, G.E. Denehy

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60.[i] **A. Ingleshwar**, *S.C. McKernan*, E. Momany, S. Bentler, *P.C. Damiano*

Effect of Chronic Physical and Mental Conditions on Dental Utilization

61.[i] **V. Axelsen**, *A. Owais*, F. Qian, C. Perigo, *K. Weber-Gasparoni*

Bedsharing and Nighttime Oral Health Habits among Children 0-3 years

62.[i] **A. Fencl**, *K. Weber-Gasparoni*, J.J. Warren, K. Pagan-Rivera, D.V. Dawson

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63.[i] **K.M. Duncan**, A. Erives, *R.A. Cornell*

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Longitudinal Analysis of *Streptococcus mutans* Genotypes in American Indians

Abstracts

1. Systemic Inflammation and the Impact of Obesity on Gingival Inflammation

E. Pantzlaff[1], T.D. Busch[1], D.V. Dawson[1], C.L. Fischer[1], G. Avila Ortiz[1], S. Elangovan[1], J.C. Murray[1], *C.M. Stanford*[44], K.A. Brogden[1], *A. Butali*[1]

[1]University of Iowa, Iowa City, IA; [44]University of Illinois, Chicago, Chicago, IL

Background: C-Reactive Protein (CRP) is an acute-phase response marker used to measure inflammatory status. Elevated levels of CRP have been detected in the gingival crevicular fluid (GCF) and may be related to either oral or systemic inflammation. In this study, GCF concentrations of CRP, IL-1β, IL-8, IL-10, and TNF-α in obese versus normal subjects were obtained to determine whether a correlation exists between CRP levels in serum versus GCF samples. In addition, we investigated the association of Single Nucleotide Polymorphisms (SNPs) in CRP genes and CRP levels in GCF.

Methods: Recruitment consisted of 15 normocentric and 15 obese subjects of predominantly European descent. Anthropometric and clinical measurements (BMI, waist circumference, vitals, blood glucose, blood samples) and a periodontal exam (GCF, gingival index, plaque index, and probing depths) were performed. Concentrations of CRP and cytokines were determined using commercial multiplexed fluorescent bead-based immunoassays. We selected 6 SNPs reported to be genome-wide significant from a previous CRP GWAS study in European Americans. Genotyping was completed using taqman probes. Nonparametric statistical methods and exact tests were emphasized.

Results: GCF CRP levels differed significantly between obese versus non-obese subjects (p=0.0096). GCF CRP correlated moderately with BMI (r=0.46; p=0.01) and waist circumference (r=0.49; p=0.0062). Departure from Hardy-Weinberg proportions was noted only for SNP rs4129267 (p=0.019). We observed a significant association between GCF CRP level and genotype for two of the SNPs (rs4129267, p=0.034 and rs4420638, p=0.032).

Conclusion: Obesity related inflammation influences the physiologic processes of the oral cavity. Further research is warranted to determine the potential for genetic variation to influence oral inflammatory markers. Understanding the dynamics of inflammatory markers in the oral cavity will provide insight for better understanding of the pathogenesis of chronic inflammatory conditions and to facilitate development of diagnostic markers for such conditions.

Supported by: NIH CTSA grant U54TR001013 and NIH NIDCR grant R01 DE014390.

2. Treatment of External Cervical Resorption Among American Association of Endodontists Members: A Web-based Survey

J. Hemsath[1], *A.E. Williamson*[1], R. Chu[47]

[1]University of Iowa, Iowa City, IA; [47]University of Manitoba, Winnipeg, MB

The purpose of this study was to evaluate current trends in treatment of external cervical resorption (ECR) or invasive cervical resorption among endodontists. An invitation to participate in a web-based survey (Qualtrics) was e-mailed to 4,424 members of the American Association of Endodontists. Survey participants were asked between 18 and 27 questions based on their individual responses. Preliminary data shows that a total of 4,424 survey invitations were successfully delivered by e-mail of which 476 participants responded with an overall completion rate of 10.8%. Our data showed that 86% of participants responded that they were currently treating external cervical resorption, of which 67% were obtaining CBCT prior to treatment.

Results : showed that 74% of participants felt that endodontists were the specialty most adequately trained to manage cases of ECR. Majority of endodontists (>85%) are treating cases of external cervical resorption within their practice with the most significant reason preventing them from providing treatment being practitioner comfortably. In addition, more than half had received continuing education on management of external cervical resorption.

Supported by: AAE foundation grant

3. Detection of Oral Microorganisms on Disposable Clinic Coats using HOMINGS

T.M. Schramm[1], *C.B. McKnight*[1], *K.A. Brogden*[1]

[1]University of Iowa, Iowa City, IA

Disposable clinic coats are used in lieu of white clinic coats with the idea of improving infection control protocols. However, there are no reports in the literature investigating the bacterial presence (or with specific species analyzed) on disposable lab coats. Such information may be important to policies regarding the repeated use of these lab coats ith the clinic.

Objective: The objective of this study was to develop a technique to measure Oral-Bacterial contamination and develop methods to extract DNA directly from disposable coats worn in a clinical dentistry setting.

Methods: Methods were first developed for recovery oral microorganisms and DNA extraction using new clinic coats spotted with known concentrations of *Porphyromonas gingivalis*, *Streptococcus mutans*, Aggregatibacter actinomycetemcomitans, and Tannerella forsythia.

Methods were then developed to extract genomic DNA directly from excised fabric samples, purified and amplified using whole genome amplification. Using these techniques, used and unused disposable clinic coats (controls) were then collected and samples were removed from the placket, chest pocket and sleeve adjacent to the cuff. The Human Oral Microbe Identification using Next Generation Sequencing (HOMINGS) platform was used to identify oral species present in DNA samples.

Results: Methods developed to recover oral microorganisms; to extract genomic DNA directly from excised fabric samples; purify DNA; and amplify DNA using whole genome amplification often resulted in greater than 70% recoveries. HOMINGS analysis identified between 35 and 292 bacterial taxa present per sample site.

Conclusions: Techniques developed i) to recover oral microorganisms directly from excised fabric samples and ii) recovery of oral microbial DNA allowed us to detect oral microorganisms on disposable clinic coats. Such techniques will now allow us to qualitatively and quantitatively assess the extent of oral microbial contamination — information important to policies regarding their repeated use in clinics.

Supported by: National Institute of Dental and Craniofacial Research Grants R01 DEO14390; Dows Student Research Award

4. Efficacy of Socket Grafting for Alveolar Ridge Preservation: A Randomized Clinical Trial

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Objective: This study aimed at assessing whether the use of a ridge preservation technique minimizes alveolar ridge resorption following tooth extraction.

Methods: Healthy patients requiring the extraction of a single-rooted tooth, excluding mandibular incisors, were recruited. Patients were randomly assigned to either the control group, consisting of extraction alone, or the experimental group, which consisted of tooth extraction and socket grafting using an allograft and a membrane (dPTFE). Linear measurements using a stent were obtained immediately after extraction (baseline) and at 14 weeks. All measurements were completed by a single calibrated periodontist. Linear mixed model statistical analysis was used to compare mean change in the measurements between the grafted and control groups.

Results: A total of 59 subjects were recruited, of which 53 patients (27 control and 26 experimental) completed the study. There were no differences between groups at baseline for any of the parameters analyzed. At 14 weeks, mean buccal plate height loss was 0.64mm and 0.23mm for the control (CG) and experimental (ARP) groups, respectively, showing no statistical significance (p=0.409). The lingual plate height was reduced 1.0mm in CG and 0.69mm in ARP with no statistical significance (0.384). Reduction of the buccal-lingual dimension of the alveolar ridge was noted in both groups, 1.28mm in CG and 0.60mm in ARP, with no significant difference between them (p=0.182). A statistically significant correlation was noted between buccal bone plate width and loss of buccal bone height (95% CI, p=0.029). Changes in apico-coronal width of the keratinized tissue (KT) were minimal and not significant between groups (p=0.965).

Conclusions: According to the linear measurements, it appears there is minimal benefit in ARP compared to extraction alone in maintaining alveolar ridge dimensions. Thin buccal plate at time of extraction should be carefully considered as a predictor of buccal height loss.

Supported by: Osteogenics, clinicaltrials.gov registry number: NCT01794806

5. Effect of Lingual Bevel in the Fracture Strength of Class IV Composites

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Resin-based composite for Class IV restoration is a conservative treatment, providing both physical and optical properties. However, chipping and adhesive failure are reported in the literature as frequent failures on these restorations. Improved fracture resistance may be achieved through optimal lingual margin configuration of the tooth preparation.

This *in vitro* experiment compared the mean fracture strength among four types of lingual margin configurations (butt joint, 45° bevel, 60° bevel and chamfer) for Class IV resin-based composite restorations. A total sample size of 100 human extracted lower incisors were selected; specimens were randomly assigned to one of the four lingual margin configuration groups (n=25/per group) and restored to original anatomy with resin-based composite. After thermocycling (5000 cycles, 5ºC-55ºC with 30 seconds dwell time), they were subjected to inter-incisal static load (135° angulation) until failure (Newton). Failure modes were determined.

Descriptive statistics and one-way ANOVA with post-hoc Tukey's HSD test were used for statistical analysis (alpha=0.05). Results revealed no significant effect on the fracture strength for the four lingual margin configurations (p=0.9435). Mode of failure revealed that 71% of the total sample size resulted in complete tooth fracture (intact restoration), 11% in total adhesive failure, 7% in adhesive only facial, 6% in total cohesive, 4% in cohesive only facial, 1% in avulsion. Fischer's exact test revealed no statistically significant difference (p=0.784) among the four margin configurations related to failure mode.

Within the limitations of this *in vitro* study, it can be concluded that any of the four lingual margin configurations are acceptable in Class IV cavity preparations in terms of fracture strength under static load.

6. Sapienic Acid Modifies *Porphyromonas gingivalis* Metabolism Initiating a Lethal Event

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Oral mucosal lipids exhibit potent but variable antimicrobial activity in *Porphyromonas gingivalis*, an important colonizer of the oral cavity implicated in periodontitis. We previously demonstrated that treatment with the fatty acid, sapienic acid (SA, C16:1Δ6), kills *P. gingivalis* within 6 minutes. SA treatment alters both protein and lipid composition relative to controls, suggesting the plasma membrane as the likely target of antibacterial activity; however, mechanisms of antibacterial action have not yet been explored.

Objective: Our objective was to extensively examine whole cell protein differences in sapienic acid-treated bacteria and utilize these data to explore potential mechanisms for the antimicrobial activity of SA.

Methods: Comparison of proteins extracted from untreated and SA-treated *P. gingivalis* cultures were examined using two-dimensional difference in-gel electrophoresis (2D-DIGE). Fifty spots showing differences in protein concentrations were sequenced via mass spectroscopy and identified using NCBInr BLAST searches of the *P. gingivalis* protein database. Analyses were completed using the DAVID functional annotation clustering tool, KeggCharts, and DomainCharts.

Results: Treatment with SA induces the upregulation of proteins involved in several KEGG pathways including fatty acid biosynthesis; glycolysis/gluconeogenesis; propanoate, porphyrin, fructose, and mannose metabolism; and the citric acid cycle. Additionally, both the 50S and 30S ribosomal proteins were upregulated. Down-regulated proteins were associated with fatty acid biosynthesis; metabolism of cysteine, methionine, and proteins associated with protein processing, cell adhesion, and *P. gingivalis* virulence. Functional enrichment analyses showed enrichment in several cellular processes associated with fatty acid biosynthesis, protein processing and pathogenesis, glycolysis/gluconeogenesis, and components of the plasma membrane.

Conclusions: SA treatment induces a unique stress response in *P. gingivalis* resulting in differential expression of proteins involved in a variety of metabolic pathways and subsequent cell death. SA may have potential for prophylactic or therapeutic intervention of infection.

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7. An *in silico* Keratinocyte/Dendritic Cell/Tcell Predictive Inflammatory Response Model

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Molecular pathways involved in oral inflammation and the effects of prophylactic treatments are not well characterized. Here, we work toward the development and validation 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: Our objective 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 co-cultured cells treated with the actual agonists.

Methods: A combined functional simulation model for keratinocytes, dendritic cells, and CD4+ Tcells was developed from manual information aggregation of published data on signaling pathways and intermediates, transcription factors, enzyme kinetics, and gene regulations. To validate this model, we developed a novel cell culture model in which $2.0x10^4$ cells of keratinocytes, dendritic cells, and CD4+ Tcells were cultured simultaneously in Transwell plates containing stacked membrane inserts (Corning Inc.) before treatment with 0.01M PBS; 10.0μg/ml *Escherichia coli* LPS, 50.0ng/ml IL4; 10.0μg/ml Pam3CSK4; 5.0μg/ml TGFβ; 200ng/ml IL10; or 200ng/ml IFNγ for 64 hours. Samples were taken at 16, 32, and 64 hours and concentrations of GM-CSF, MIP-1α, MIP-1β, 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 each agonist with the observed responses of these cells exposed in culture to the same agonists.

Conclusion: These results provide the first validation of an oral inflammatory simulation model. This will be a powerful tool that can be used to delineate molecular pathways involved in the oral inflammation process and eventually predict potential therapeutic treatment outcomes prior to laboratory testing.

Supported by: Cellworks Group, Inc.

8. Exploring the Mechanism of Cleft Palate in Patients with Branchio-Oculo-Facial Syndrome: *TFAP2A* in the Neural Crest Gene Regulatory Network

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Cleft lip and/or palate (CL/P) can result from defects in the patterning of the neural crest, a population of embryonic precursor cells which gives rise to bones and cartilage of the jaw. Genome wide association studies reveal that DNA polymorphisms that underlie risk for CL/P most frequently reside in non-coding, presumably regualtory DNA. A subset of such polymorphisms most likely disrupt the function of regulatory elements that drive gene expression in the neural crest. However, we have very poor understanding of such regulatory elements. We are examining this question in the context of *TFAP2A*, encoding the transcription factor Activator Protein 2 alpha. Mutations in *TFAP2A* cause Branchio-Occulo-Facial syndrome (BOFS) whose cardinal features include CL/P. *TFAP2A* is expressed in neural crest and is essential for neural crest specification at the neural plate border and for survival and normal gene expression in the neural crest. To identify regulatory elements that drive *TFAP2A* expression in the neural crest, we are isolating conserved, non-coding DNA elements nearby zebrafish *Tfap2a* and testing them in reporter assays in transgenic zebrafish. We have identified two such elements, conserved to humans, which drive reporter expression in the neural crest. These elements contain binding motifs for transcription factors implicated in neural crest biology (e.g., *TCF*, *TWIST*, *SOX10*), which we are currently testing for necessity. These studies will help reveal the sequence "grammar" of neural crest enhancers, facilitating the identification of pathogenic polymorphisms.

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9. Amish Silver Nitrate Clinical Trial: Study Design and Subject Recruitment

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The medical management of caries in the primary dentition utilizing silver nitrate and fluoride varnish has gained in popularity in recent years despite a paucity of research supporting its effectiveness. This randomized controlled trial compares the medical management of caries in the primary dentition with traditional restorative treatment in Amish children ages 2-11, from Kalona, Iowa. This presentation will describe study design and subject recruitment.

Supported by: Delta Dental of Iowa

10. Body Fat Indices and Biomarkers of Inflammation in Saliva: A Cross-Sectional Analysis with Implications for Obesity and Peri-Implant Oral Health

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Purpose: To determine the association between obesity as measured by the body fat indices (body mass index (BMI), waist circumference (WC), and body fat percent) and the levels of inflammatory biomarkers in saliva. In addition, this study explored the correlations between the levels of these biomarkers in saliva versus their corresponding levels in peri-implant sulcular fluid (PISF) and gingival crevicular fluid (GCF) samples collected from the same subjects.

Methods and Materials: Periodontal maintenance patients (N=73) were enrolled in this cross-sectional study. Anthropometric measurements (BMI, WC, and body fat %), intraoral assessment (full mouth plaque index, periodontal, and peri-implant comprehensive examinations) and unstimulated whole saliva samples were collected from the subjects. Peri-implant sulcular fluid (PISF) and gingival crevicular fluid (GCF) were also collected. Levels of interleukin (IL)-1α, IL-1β, IL-4, IL-6, IL-8, IL-10, IL-12(p40), IL-17α, tumor necrosis factor (TNF)-α, osteoprotegerin (OPG), letpin, RANKL and C-reactive protein (CRP) in saliva, GCF and PISF were analyzed using multiplex immunoassays. Statistical analyses were performed to explore the correlations of interest.

Results: Data from 69 subjects were included in the analysis. No statistically significant correlations were noted between any of the body fat indices and any of the biomarkers measured in saliva ($p>0.05$ in all instances). A significant positive correlation was noted between salivary and GCF levels of IL-1α ($r=0.29$, $p=0.0232$), IL-8 ($r=0.29$, $p=0.0207$) and between saliva and PISF levels of leptin ($r=0.32$, $p=0.0284$). The employed linear model also revealed the significant impact of tooth brushing frequency on the salivary levels of IL-1α, IL-1β and TNF-α ($p<0.05$).

Conclusions: In this study, there was no statistically significant correlation noted between salivary inflammatory biomarkers and any of the obesity measures. However, the levels of key inflammatory markers in saliva strongly correlated with their corresponding levels in GCF/PISF.

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11. Novel Salivary Biomarkers' Correlations with Periodontitis and Obesity

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Background: Recent studies point to the clinical utility of using saliva as a diagnostic aid for both oral and systemic diseases. It was recently shown that levels of sCD40L, Granzyme B, IL-1ra, and Alpha-fetoprotein are significantly elevated in gingival crevicular fluid (GCF) samples of patients with peridodontitis. The aims of this study were to determine the presence/concentrations of these biological mediators in saliva from subjects on regular periodontal maintenance and to assess correlations among periodontal and obesity measures and levels of these four biomarkers in these subjects.

Methods: Saliva was collected after clinical examination of 63 subjects. The levels of sCD40L, Granzyme B, IL-1ra, and Alpha-fetoprotein were determined using multiplex proteomic immunoassays. Spearman rank correlations were used to assess associations among periodontal status, obesity measures (waist circumference, BMI, and fat%), and these four biomarker concentrations. Bivariate associations were re-evaluated after adjustment for clinical covariates (brushing frequency, flossing, fasting blood glucose, days since professional cleaning, and plaque index) using regression methods. Multiple comparisons adjustment was made by the standard Bonferroni method.

Results: Positive correlation was observed between fat% and Granzyme B levels (r=0.292; p=0.020) and negative correlation was observed between BMI and sCD40L (r=-0.256; p=0.043). Positive correlation existed between periodontal severity and levels of IL-1ra (r=0.253; p=0.046), and negative correlation existed between periodontal severity and sCD40L salivary levels (r=-0.272; p=0.031). After adjustment for clinical covariates, the relationship between sCD40L and periodontal severity remained suggestive (p=0.081). None of the above correlations remained statistically significant after multiple comparisons adjustment.

Conclusions: This pilot study shows that levels of four novel biomarkers of periodontitis are detectable in saliva of subjects enrolled in a periodontal maintenance program. They also correlated with some obesity and periodontal measures. Prospective studies with larger sample sizes and other populations are warranted to explore the diagnostic applicability of these markers.

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12. Comparison of Mechanical and Indirect-Ultrasonic Placement Technique on MTA Retrofill Density in Simulated Root End Surgery

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Objectives: To evaluate the density of MTA root-end filling placed by either (a) manual condensation or (b) manual condensation with indirect ultrasonic activation under simulated root-end surgery conditions *in vitro*.

Methods and Materials: Extracted mandibular teeth with developed apices were obtained and decoronated (n=50). Canals were instrumented to an apical size of 45 with .04 taper and obturated with a warm vertical technique. The coronal end of each root was embedded in resin.

A root-end resection was performed 3mm from the apex and root-end preparation was completed with an ultrasonic tip. Gutta percha was condensed. Weight of all samples was allowed to stabilize. Samples were randomly assigned to receive root-end fillings with ProRoot MTA by one of two techniques: (A): manual condensation or (B): manual condensation with indirect ultrasonic activation. Samples were weighed immediately before and after filling placement. MTA was removed from all samples without changing the volume of the root-end preparation and each sample was then subjected to the opposite filling technique to create a crossover design. Samples were again weighed immediately before and after placement of MTA.

Weight of MTA filling for each technique was obtained by subtraction of pre- and post-filling weight. Weights for each technique were statistically analyzed utilizing a two-way ANOVA, taking into account the crossover design with repeated measures.

Results: Preliminary data indicates that application of indirect ultrasonic activation with manual condensation shows an increase in MTA density over mechanical condensation alone under simulated root-end fill conditions.

Conclusions: Indirect ultrasonic condensation of MTA root-end fillings may improve the fill density, possibly by reduction of voids.

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13. Denture Adhesive Inhibits Antimicrobial Peptide Activity against *Candida albicans*

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Introduction: *Candida* species infections can cause complications for individuals with dentures. Recently, conventional minimal inhibitory concentration (MIC) assays showed *C. albicans* are more resistant to antimicrobial agents in 1% denture adhesive than in water. This suggests denture adhesive may inhibit activity of innate immune mediators in the oral cavity, therefore increasing the risk of fungal infections.

Objective: The objective of this study was to test *C. albicans* susceptibility to antimicrobial peptides and antifungal agents in 1% denture adhesive.

Methods: Radial diffusion assays (RDA) were used to assess the susceptibility of *C. albicans* to nine antimicrobial peptides and five antifungal agents. The RDAs were performed using *C. albicans* ATCC-64124 and HMV4C in underlay agar with 0.01M sodium phosphate, pH 7.4 with or without 1% denture adhesive. Two-fold dilutions of antimicrobial peptides or antifungal agents in 0.01% acetic acid were added to each well. After incubation (37°C, 3hrs), an overlay of 1% agarose in 10mM phosphate buffer with RPMI-1640 was added and incubated overnight. Zones of clearance were measured and MICs were determined.

Results: *C. albicans* were susceptible to HNP-1, HBD-2, HBD-3, IP-10, LL-37 (only one strain), Histatin-5 (only one strain), Lactoferrin-B, and SMAP28 in buffer; but were significantly (<0.05) resistant to HNP-1, HBD-2, HBD-3, IP-10, LL-37 (both strains), Histatin-5 (both strains), Lactoferrin-B, and SMAP28 in 1% adhesive. Both strains were resistant to HBD-1 in both conditions. MICs were greater in 1% adhesive than in buffer in antifungal agents: nystatin, amphotericin-B, chlorhexidine gluconate, and chlorhexidine dihydrochloride. ATCC-64124 was resistant to fluconazole in 1% adhesive and buffer while HMV4C were susceptible in both.

Conclusions: RDA results suggest that denture adhesive may inactivate innate immune mediators in the oral cavity increasing the risk of *C. albicans* infections. Inclusion of antifungal agents to denture adhesive may aid in prevention of fungal infections.

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14. Identification of Functional Risk Variants for Cleft Lip with or without Cleft Palate near FGFR2 and NOG

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Objectives: Nonsyndromic cleft lip with or without cleft palate (CL/P) is a common birth defect with complex inheritance. Genome-wide association studies have identified a number of regions, but the disease variants have not been identified, which is the **purpose** of this study. The strategy used was to obtain a complete catalog of variants at 13 regions which was accomplished by targeted sequencing of 1500 families with CL/P, which revealed a number of *de novo* mutations and some highly-associated common variants in non-coding regions. Our **hypothesis** is that these risk variants disrupt the function of enhancers and cause CL/P

Methods: Based on genomic marks of enhancer activity, we chose to test elements containing one *de novo* mutation near FGFR2 and one highly associated common risk variant near NOG, using both cell based and zebrafish gene expression reporter assays.

Results: Our cell-based dual luciferase assays confirmed the FGFR2 wild-type element exhibited enhancer activities in both oral epithelia cells and mesenchyme cells, and also had strong enhancer activity in neural tube and neural crest cells in zebrafish embryos. Moreover, the *de novo* mutation significantly reduced the enhancer activity in both cells and zebrafish embryos. The common variant in the downstream of NOG is located in a region containing two potential regulatory elements. We found that both NOG elements showed enhancer activity in oral epithelial cells and one element also exhibited strong epithelium enhancer activity in zebrafish embryos. Interestingly the CL/P associated variant within one of these elements significantly reduced activity of both enhancers when tested *in vitro*.

Conclusions: Using palate-related cell lines and zebrafish as a model organism, we demonstrate the *de novo* FGFR2 mutation and common NOG risk variant alter enhancer activity and contribute to the etiology of CL/P.

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15. Edentulism Is Associated with Time-to-Death among Nursing Facility Residents

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Objective: To assess the relationship between dental status and time-to-death among nursing facility residents.

Methods: From 2006-08, screening forms were completed for 586 residents of 10 nursing facilities in four eastern Iowa counties. Demographic, general and oral health information was obtained, including number of natural teeth and having/using dental prostheses. Information from the screening forms was linked with death certificate data from the Iowa Department of Public Health. The study outcome (time-to-death) was defined as the time between screening and death. Univariate and bivariate distributions were assessed, and multivariable Cox proportional hazards regression models were generated to evaluate associations between explanatory variables and time-to-death.

Results: The 586 residents had a mean (SD) age of 83.8 (10.8) years at screening. About 69% were female, and about 30% were edentulous. By September 2013, 503 (85.8%) had died, and among these individuals the median time-to-death was 1.65 years. The final Cox model included data from 429 residents, and statistically significant relationships with time-to-death were observed for the seven variables noted in the table below.

Conclusions: Controlling for other significant variables including age, sex, cooperativeness with care providers, renal disease, and cardiovascular conditions other than congestive heart failure and hypertension, edentulous nursing facility residents died statistically significantly sooner after screening than did dentate residents. These findings could have important implications with respect to dental treatment planning for the institutionalized elderly.

Table: Final Cox Proportional Hazards Regression Model Describing the Association Between Edentulism and Time-to-Death

Characteristic	Hazard Ratio	95% Confidence Interval	p-value
Age ≥80 years	2.34	2.00-3.49	<0.001
Male	1.46	1.15-1.87	0.002
Difficulty cooperating with nursing staff (in general)	1.32	1.05-1.66	0.016
Difficulty cooperating with dental staff during screening exam	2.00	1.55-2.57	<0.001
Renal disease	1.61	1.27-2.04	<0.001
Cardiovascular conditions other than congestive heart failure or hypertension	1.30	1.05-1.61	0.016
Edentulous	**1.54**	**1.23-1.92**	**<0.001**

Supported by: Delta Dental of Iowa Foundation.

16. Exome Sequence Analysis of a Multiplex Family with Cleft Palate Only

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Background: Exome sequencing studies have been successfully conducted for Mendelian traits and Complex traits. Risk loci as well as candidate genes have also been identified in some of these studies. In the present study, we conducted exome sequencing using samples from five individuals in a multiplex family with cleft palate only (CPO). Aim: To identify an autosomal dominant variant that segregates in all affected individuals.

Methods: The Ilumina HiSeq platform was used for sequencing and Agilent SureSelect for enrichment capture. Quality control (QC) steps we applied include: aligning raw sequence to the human genome build hg19 using BWA software, SNP and In/Dels analyses using PICARD, SAMTOOLS and GATK. ANNOVAR was used to annotate the SNPs and In/Dels. We applied a number of filtration methods to identify variants with low minor allele frequencies that segregate in affected individuals. Sanger sequencing was used to validate identified variants in affected and unaffected relatives.

Results: A yield of 3.4Gbases per sample passed the quality control step. We identified a new probably damaging missense variant in exon 15 of *ARHGAP29* (pSer552Pro) which segregates in all 5 individuals. This variant is not in all known databases and has never been previously reported. This variant was validated using Sanger sequencing and none of the 3 unaffected (spouses) and control CEPH sample carried the variant. Sanger sequencing around the pSer552Pro mutation will be conducted on unaffected offsprings. Functional studies to understand the biological effect of the variant are ongoing using the zebra fish model. Additional filtration of the exome data is also ongoing to identify variants with MAF <5% that segregates in all affected individuals.

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17. Primary Tooth Eruption Patterns: Comparison of Three Ethnic Groups

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Objectives: This objective of this study was to examine tooth eruption patterns during the first 36 months of life, comparing American Indian (AI) children to two other ethnic groups.

Methods: Data were derived from a birth cohort of 239 AI children from a Northern Plains tribe participating in a longitudinal study of early childhood caries (ECC), using examination data at target ages of 8, 12, 16, 22, 28, and 36 months of age (+/- one month). Numbers of erupted teeth at each age were compared via Kruskal-Wallis tests to children of the same age drawn from a study of dental caries patterns in Arizona children; these represented examinations from 547 White non-Hispanic and 677 Hispanic children. Eruption patterns in AI children were further characterized and sex comparisons accomplished using interval-censored survival methodology. Multiple comparisons adjustment was made using the Holm-Bonferroni method with an overall 0.05 significance level.

Results: AI children had significantly more teeth present at 8 months than either White non-Hispanic ($p<0.0063$) or Hispanic ($p<0.0001$) children (medians of 3, 2, and 2 erupted teeth, respectively). This was also true at 12 months ($p<0.001$; medians 8, 6, 7) and 16 months ($p<0.001$; medians 12, 11, 11). Less pronounced differences were seen at 22 months ($p<0.0001$). There was no evidence of differences between White non-Hispanic and Hispanic children at any time considered ($p>0.05$). Characterization of time to achievement of various milestones, including eruption of the complete primary dentition, the incisors, and the molars, provided no evidence of sex differences in AI children.

Conclusions: These results provide evidence of earlier tooth eruption in American Indian children than in the other two ethnicities. Although the underlying etiology of the severity of early childhood caries in AI children is likely to be multifactorial, earlier tooth eruption may be a contributing factor.

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18. Genotypic Diversity of *Streptococcus sobrinus* in American Indian Children

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Objectives: Severe early childhood caries (SECC) is a debilitating form of tooth decay and is prevalent among lower socioeconomic groups. American Indian children exhibit some of the worst tooth decay of all socioeconomic groups. *Streptococcus mutans* (SM) and *Streptococcus sobrinus* (SS) are major etiologic agents in SECC. While SS is less common than SM, it is more closely associated with high caries activity. We are conducting a study focusing on the transmission of SM and SS in American Indian children from a Northern Plains tribe with rampant caries. Here, we report on preliminary analysis of genotypic diversity of SS colonization in 36 month old children from this study.

Methods: Whole mouth plaque samples were collected from 36 month old American Indian children from a subset of our cohort. Plaque samples were cultured on selective agar to isolate SM and SS colonies. DNA was then extracted from putative SM or SS for species identification by PCR and the SS isolates were then genotyped by AP-PCR. Gel images, from AP-PCR were analyzed and dendograms were created using GelCompar®IIv6.5 gel analysis software.

Results: Approximately 93% of children harbor SM, SS or both species and roughly 30-35% of all isolated mutans streptococci colonies are SS. *Streptococcus sobrinus* isolates were recovered from children as young as 12 months. Preliminary results show that there are multiple SS genotypes in this population.

Conclusions: While plaque is a highly complex microbial community and caries is a multifactorial process, the presence of SS could play a vital role in SECC that is rampant in this population. More comprehensive analyses of genotypic diversity, commonality and stability of SS in children, mothers and caregivers, as well as, the relationship between SS and caries are currently underway.

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19. Continuity of Care after Dental ED visits by Medicaid-Enrolled Adults

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Objectives: To examine follow-up care patterns among Medicaid-enrolled adults who visited an emergency department (ED) for dental problems. We hypothesized that those with a dentist visit in the year prior to the dental-related ED visit (DRED) would be more likely to visit a dentist in 6 months after the DRED visit.

Methods: Using Iowa Medicaid enrollment and claims data, adults who had a DRED visit in 2011 were followed up for 6 months after and 1 year prior to the index DRED visit. The primary diagnosis code was used to identify dental ED visits. Outcomes of interest during follow-up were dentist visit and repeat DRED visits. Survival analyses were conducted using SAS version 9.3.

Results: We identified 3306 Medicaid-enrolled adults who had at least one DRED visit in 2011. The first ED visit was established as the index visit. Almost 70% of these visits were made by 21-35 year olds. Most common dental diagnosis was “other dental diseases” (43%), followed by “dental caries” (20%) and “pulpal and periapical diseases” (17%). Within 6 months, 52.4% of them had a dental follow-up visit, 12% lost Medicaid eligibility and 35.6% did not have a dental follow-up by the end of the study. Medicaid-enrolled adults with Non-White race (HR=0.79, 95% CI=0.65 - 0.95), one additional repeat ED visit (HR=0.53, 95% CI= 0.44 - 0.64), two or more repeat ED visits (HR=0.65, 95% CI= 0.46 - 0.93) and no dental visit in past year (HR=0.56, 95%CI=0.50 - 0.63) had a lower rate of dental follow-up after the index ED visit.

Conclusion: Almost half of the Medicaid enrolled adults who visited an ED for dental problem did not see a dentist in the next 6 months. Past access to dental care was associated with follow-up dental care after the DRED visit.

20. Differences in Microcrack Formation Following Ultrasonic Root-End Preparation with Two Different Surgical Tips with and without Water Spray Irrigation

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Objectives: The aim of this study was to compare the incidence of microcrack formation and quality of the cavity margin in apical root-end preparations when two different ultrasonic tips were used with and without water spray irrigation as coolant.

Methods and Materials: Forty extracted single-canaled human premolars were used. Canals were instrumented using ProTaper™ Universal files to size F3 and obturated with corresponding gutta percha cones using the continuous wave technique. The apical 3-mm of each root was resected with a straight fissure bur under copious water irrigation. Following root-end resection, the teeth were stained for 48 hours and assessed for microcracks using a stereomicroscope. The teeth were then randomly divided into 4 experimental groups of 10 teeth for root-end cavity preparation using diamond-coated and smooth Carr-Kanter Back-Action Tips (SybronEndo, USA) with and without water irrigation. Ultrasonic tips were used for 5 preparations and discarded. Root-end replicas were fabricated using low-viscosity resin and examined using scanning electron microscopy (SEM) under x30 - x200 magnification. The number of microcracks and quality of the cavity margin were determined and scored on a 0-3 scale.

Results: Root-end preparations completed under water irrigation yielded higher quality cavity margins than those without irrigation. Additionally, there was a marginally significant difference in rating scores between diamond and smooth tip preparations in the incidence of microcrack formation, with diamond tips being less likely to form microcracks.

Conclusions: Within the confines of this study, diamond-coated ultrasonic tips created fewer microcracks than smooth tips, and constant water-spray irrigation led to better cavity margins than preparations without water.

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21. Employment of Reservoirs in Trays: Efficacy and Efficiency in Tooth Whitening

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Objectives: This study aimed to determine the efficacy of trays made with and without reservoirs, in conjunction with time and cost evaluations, by measuring color change with home whitening procedures.

Methods: Extracted human maxillary teeth (central incisors n=20; canines n=20; molars n=20) and 60 artificial teeth (lateral n=20; premolar n=40) were mounted into ten typodonts. Tray fabrication was completed such that a block-out resin reservoir was placed on half of the buccal surface of the tray, while the other half remained without a reservoir. Whitening with custom fabricated trays was performed based on two different whitening regimens, where each regimen was assigned to five typodonts: Night-time: Opalescence PF 10% carbamide peroxide for 8 hours daily and Day-time: Philips DayWhite 9.5% hydrogen peroxide for 30 minutes, twice daily. Both systems were applied for one week. To evaluate tooth shade, the VITA Easyshade® Advance 4.0 spectrophotometer was used. Color measurements were obtained at baseline (T1), 1-day post-whitening (T2), and 1-month post-whitening (T3). One-way ANOVA, followed by post-hoc Tukey's HSD test, was used to detect significant difference in the overall color change (ΔE) among the four groups at T2 and T3. Additionally, paired-sample t-test was used to assess difference in ΔE between T2 and T3 treatment within each of four techniques of tray fabrication.

Results: No significant difference in ΔE was found among the four groups at T2 and T3 ($p>0.05$ in each instance). There were significant differences in mean ΔE between T2 and T3 treatment for the DayWhite treatment groups with reservoir (6.96 vs. 10.19 respectively; $p=0.0026$) and without reservoirs (6.23 vs. 9.79 respectively; $p=0.0031$). This was not observed in the Opalescence treatment groups.

Conclusions: The use of reservoirs does not have a significant effect on whitening efficacy, regardless of type of whitening material and regimen.

Supported by: Dows Student Research Award

22. A Novel Synthetic Method for Preparing Substituted Cyclic Ether Oligomers for Mucoadhesive Films and Enhanced Drug Delivery in the Oral Cavity

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Objective: The epithelial surface in the oral cavity is lined with various carbohydrate-based macromolecules in the form of polysaccharides chains and glycoproteins. Mucoadhesive films of various types are well known to bond to surface carbohydrate chains present in the oral cavity for the purpose of drug delivery. However, diseased tissue is known to have altered properties compared to normal healthy mucosal surfaces. The current research is directed to a synthetic method of producing novel cyclic ether oligomers which may be tuned to adhere to diseased tissue states present in the oral cavity (i.e. mucositis, squamous cell carcinoma, etc.) for the purpose of targeted drug delivery. The current synthetic method allows the polarity and length of these cyclic ether oligomers to be altered to accommodate bonding to various types of mucosal surfaces. Further, these novel biomaterials are similar in structure to traditional carbohydrates, yet more resistant to hydrolysis and the harsh chemical conditions in the oral cavity because they are linked together via carbon-carbon bonds instead of carbon-oxygen bonds.

Results: A transition metal catalyst was added to various substituted 3,4-dihydropyran monomers to form carbon-carbon bonded oligomers of substituted cyclic ethers. The reaction was conducted in the presence of atmospheric water and oxygen, and proceeded with high yields.

Essential Results: 1H NMR spectroscopy and low resolution mass spectrometry (LRMS) of the reaction products revealed the formation of cyclic ether derivatives.

Conclusions: A novel synthetic method was developed using a transition metal catalyst, which allows the formation of substituted cyclic ether oligomers having varying polarity and length. These biomaterials may be useful in applications such as targeting various states of oral pathology for enhanced drug delivery.

Supported by: University of Iowa Dental Research Grant

23. Employee Benefits for Dental Hygienists

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Objective: To study the relationship between fringe benefits with time worked per week, pay per hour, years of practice, and employment location (metro/non-metro) among dental hygienists.

Methods: This was a 20-item survey mailed in 2012 to all licensed Iowa dental hygienists, of which one question asked about 12 employee benefits received. Logistic regression models were developed for each benefit, using whether or not the dental hygienist responded favorably for receiving the employee benefit as the dependent variable. Each benefit was regressed with time worked per week, pay per hour, years of practice, and employment location. Full time status was operationally defined as working 32 or more hours per week, on average. Metropolitan versus non-metropolitan counties were determined by Rural-Urban Continuum Codes. Statistical significance was set at $p < 0.05$.

Results: The modified response rate for this survey was 53%. More than half of the dental hygienists worked full time. Mean number of employment benefits was 5.1 (s.d., 2.6). The most frequent fringe benefits offered were paid vacation (79.8%), paid holidays (74.7%), and continuing education costs (70.0%). Conversely, the least offered benefits were liability insurance (11.5%), disability insurance (11.4%), and maternity leave (11.2%). Dental hygienists who work full time were significantly more likely than part-time hygienists to receive professional dues (OR=1.39), medical insurance (OR=3.97), disability insurance (OR=2.97), paid sick leave (OR=2.15), liability insurance (OR=1.97), retirement plan (OR=2.55), paid holidays (OR=3.99), and maternity leave (OR=1.84), controlling for the other variables. Moreover, there were statistical interactions between hours worked and paid vacation and participating in a profit sharing plan. No fringe benefit was influenced by employment location.

Conclusion: Although salary is frequently mentioned for recruitment and retention of dental hygienists, one must consider employee benefits in the mix. However, full time hygienists have a greater likelihood in receiving individual fringe benefits.

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24. Characteristics of Dentists Treating Children under Age Two

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Objectives: To describe characteristics of dentists in Iowa who provide care to privately insured children ages 0 through 23 months.

Methods: Dental claims data from Delta Dental of Iowa (DDIA) for CY2012 were used to identify dentists who treated any children ages 0 through 17 years, and children ages 0 through 23 months. Data were merged with the Iowa Dentist Tracking System (IDTS), which provided information about dentists' age, sex, specialty, and dental school. Practice location was categorized as metropolitan or non-metropolitan using 2013 zip code based Rural-Urban Commuting Area codes.

Results: Of the 1,191 dentists who provided care to DDIA-enrolled children in 2012, 21% (n=248) treated at least one child under age 2. Bivariate analyses demonstrated that pediatric dentists ($p<.0001$), younger dentists ($p<.0001$), female dentists ($p=.001$), dentists living in metro areas ($p<.0001$), and graduates of the University of Iowa College of Dentistry ($p=.008$) were significantly more likely to treat children under age 2. Multivariable logistic regression revealed a statistically significant interaction between age and sex ($p=.023$); female dentists in Iowa are significantly younger than the male workforce ($p<.0001$). Among male dentists, University of Iowa graduation, younger age, metro location, and specializing in pediatric dentistry were all positively associated with treating children under age 2. Among female dentists, the only variable associated with treating children under age 2 was being a pediatric dentist.

Discussion: All children in our study population had private dental benefits; however, only 7% of children under age 2 had a dental visit despite professional recommendations for a visit by age 1. Given that approximately only 1 in 5 providers treated children this young, it is reasonable to assume that workforce availability may present a barrier to care for children under age 2.

Supported by: Delta Dental of Iowa Foundation

25. Time-Course Penetration of Potassium Nitrate and the Effect on Whitening-Efficacy

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Objectives: This study aimed to evaluate the time course penetration of potassium nitrate (PN) in the pulp cavity and whether PN application prior to whitening would affect whitening efficacy.

Methods: Human molar teeth (n=100) were randomized into five groups of twenty specimens each. Relief ACP (Philips Oral Health Care, USA) was applied for 0, 5, 15, 30 and 60 minutes for groups 1 to 5, respectively. A nitrate/nitrite assay kit (Sigma-Aldrich, USA) was used for colorimetric determination of nitrate. Whitening was performed with Zoom White Speed (Philips Oral Health Care) for 60 min. Color measurements were performed with Vita Easyshade Compact Advanced (Vita Zahnfabrik, Germany) at baseline (T1), 1-day post potassium nitrate application (T2), 1-day post-whitening (T3), and 1-month post-whitening (T4). Nonparametric Kruskal-Wallis test was used to assess group differences in penetration. Pairwise comparisons of groups were made using a modification of the Tukey method. One-way analysis of variance procedure was used to assess whether baseline L*, a* and b parameters varied among groups. Wilcoxon signed rank test was used to assess color change between time points. Kruskal-Wallis test was used to assess group differences. For each change variable, pairwise comparisons of groups were made using the modification of the Tukey method with an overall 0.05 level of Type I error.

Results: PN penetration values were found to differ significantly among all groups with the exception of groups 2 and 3. There were no differences among groups for any baseline color parameters ($p > 0.30$). At T2 there is no change relative to baseline in individual components L*, a* and b*. At T3 and T4 there is significant color change relative to baseline for L*, b* and overall color change (ΔE), in all groups.

Conclusion: PN penetration into the pulp cavity is time dependent. PN does not affect whitening efficacy.

26. Minimally Invasive Management of Missing Maxillary Lateral Incisors

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Introduction: Missing maxillary lateral incisors create an esthetic challenge, and usually require an interdisciplinary approach. Proper diagnosis of the amount of space and malocclusion is key to success. There are two common treatment approaches: space opening and space closure. Each approach has its advantages and drawbacks. The major advantage of orthodontic space closure is the permanence of the results with minimal intervention. This case report describes the treatment of a patient with bilateral congenitally missing maxillary lateral incisors managed with orthodontic treatment, followed by canine substitution with direct resin composite buildups.

Treatment Plan Sequence:

1. Collection of chief complaint and history of patient
2. Baseline photographs and impressions for smile analysis and diagnostic wax-up
3. Tooth whitening to establish color balance of central incisors and canines.
4. Recontouring of maxillary canines to facilitate composite buildups.
5. Direct resin composite buildups of #5, #6, #8, #9, #11, and #12 to close spaces and establish proper anterior teeth proportions.
6. Fabrication of retainer and mouthguard to provide retention of existing occlusion and protect teeth.

Summary: This case report described the treatment of a patient with bilateral congenitally missing maxillary lateral incisors managed with orthodontic treatment, followed by canine substitution with direct resin composite buildups. A major key to success in this case was the clinicians' ability to properly address the patient's esthetic concerns. Multiple spaces in the esthetic zone were managed by a careful smile analysis to meet all esthetic parameters. Special emphasis was placed upon contouring the shape of the canines to mimic and facilitate the buildups to lateral incisors. During the composite buildups, the occlusal scheme was altered to lateral excursive movements in an anterior group function. The authors expect that the minimally invasive management with canine substitution will serve the patient as a long- lasting esthetic and functional treatment.

27. *Streptococcus mutans* Diversity and Transmission in 3-Year-Old American Indian Children

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Objectives: Analyze genotype profiles of American Indian children at 36 months of age in order to demonstrate the fidelity of transmission, commonality, and diversity of *Streptococcus mutans* (SM) genotypes in a population of Northern Plains American Indians. We hypothesize that SM genotype profiles at 36 months of age will reveal complex patterns of commonality within families and across families as well as distinct genotypes that are unique to certain individuals.

Methods: Whole mouth plaque samples were collected from 36 subjects: 18 children at 36 months of age and their mothers. 18 children and 12 mothers were colonized with SM at the time of sample collection. 225 SM isolates from the plaque samples were identified by PCR and genotyped with AP-PCR using OPA-2 primer. Electrophoresis was conducted to obtain specific banding patterns that were then analyzed using GelCompar II v6.5. Dendrograms were generated for comparison between specific isolates, subjects, and mother-child dyads to assess fidelity of transmission. Genetically distinct isolates from each subject were selected for a ìglobalî comparison to assess commonality in the sample set.

Results: 1-3 distinct genotypes were identified in individual subjects. 2-4 distinct genotypes were identified when comparing children to their mothers. Dendrogram analysis identified 10 distinct genotypes in the global comparison of all mother-child dyads. Fidelity of transmission was observed in 7 out of the 18 mother-child dyads analyzed. Of the mother-child dyads where both mother and child harbored SM, fidelity of transmission was observed in 7 of the 12 dyads.

Conclusions: These results show the presence of fidelity of transmission between mother-child pairs, as well as commonality between non-related individuals. The presence of commonality between non-related individuals indicates commonalty of SM genotypes in this population of American Indians. Ongoing studies are looking at associations between genotype profiles and caries.

Supported by: University of Iowa Dental Research Grant

28. An Experimental Analysis of Interproximal Tooth Wear as a Baseline for Studying Long-Term Masticatory Function

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Objective: While there is a predictable relationship between masticatory function and craniofacial form, little is known regarding the long-term interaction between jaw function and craniofacial growth. Given that interproximal tooth wear is influenced by long-term masticatory function, the interproximal wear facet area, measured *in vivo* in patients, could serve as a long-term functional proxy. Our goal is to assess the relationship between function and interproximal wear using an *in vitro* model. We examined a), variability in interproximal wear in teeth under identical wear conditions, and b), whether wear facet area is a reliable proxy for volume of enamel loss.

Methods: We selected a sample of n=10 impacted third molars, sectioned and embedded *in silico*n with interproximal surfaces exposed. Teeth were mounted on a custom tooth-wear machine with mesial surface mounted opposing its distal surface. Samples were subjected to 650,000 cycles with an applied weight of 5.0 lbs. Positive replicas of impressions were scanned using a 3M optical scanner and analyzed to measure wear facet area and volumetric changes using AnSur software.

Results: There was average volume loss of 0.054 mm^3 and average wear facet area of 1.71 mm^2. Variation was high in both variables with 176% difference between maximum and minimum volume loss values and 138% difference between maximum and minimum wear facet area values. There was non-linear relationship between wear facet volume and area. Wear facet area predicts volume loss up to approximately 0.090mm^3 beyond which the curvilinear relationship becomes asymptotic.

Conclusion: Our results indicate a) that experimentally produced interproximal wear is highly variable and b) there is a limited predictable relationship between wear facet area and volume loss. This suggests that other factors (e.g., enamel properties) affect wear magnitude and may limit the ability to predict function from *in vivo* interproximal wear on narrow levels of functional variation.

Supported by: University of Iowa Dental Research Grant

29. Repeatability in Color Measurements of a Spectrophotometer Using Different Positioning Devices

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Objectives: This study aimed to evaluate the repeatability of color measurements of an intraoral spectrophotometer with the use of three different methods by two operators.

Methods: A total of sixty teeth were obtained, comprising 30 human maxillary teeth (central incisors n=10; canines n=10; molars n=10) and 30 artificial teeth (lateral incisors n=10; premolar n=20). Multiple repeated color measurements were obtained from each tooth using three measuring methods by each of the two operators. Five typodonts with alternating artificial and human teeth were made. Measurements were taken by two operators with the Vita EasyShade spectrophotometer using the custom tray (CT), custom jig (CJ) and free hand (FH) method, twice, at an interval of 2-7 days. Friedman test was used to detect difference among the three color measuring methods. Posthoc Wilcoxon signed-rank test with Bonferroni correction applied was used for pairwise comparison of color measurements among the three methods. The level of significance was set at 0.05.

Results: For Operator A, mean overall color change-ΔE* (SD) perceived for FH, CT and CJ were 2.21(2.00), 2.39(1.58) and 2.86(1.92), respectively. There was statistically significant difference in perceived ΔE* in FH vs. CJ (p=0.0107). However, there were no significant differences between FH and CT (p=0.2829) or between CT and CJ (p=0.1159). For Operator B mean ΔE* (SD) for FH, CT and CJ were 3.24(3.46), 1.95(1.19) and 2.45(1.56), respectively. There was a significant difference between FH and CT (p=0.0031). However, there were no statistically significant differences in ΔE* in FH vs. CJ (p=0.3696) or CT vs. CJ (p=0.0809)

Conclusions: The repeatability of color measurements was different among the three measuring methods by operators. Overall the CT method worked well for both operators.

Supported by: Dows Student Research Award

30. Ontogenetic Scaling of Nasal Shape in Males and Females

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Objectives: There is evidence to suggest that sexual dimorphism in the size of the nasal region is related to variation in energetically relevant variables during ontogeny. Relative to body size, males exhibit a disproportionate increase in the size of the nasal region when compared to females. This pattern mirrors sexual dimorphism in oxygen consumption requirements during development. While the influences of energy demands on the size of the nose have been examined, the purpose of the current study was to evaluate whether developmental increases in body size are associated with male-female differences in the nasal shape.

Methods: We collected coordinate landmark data from lateral cephalograms from a total of n=290 longitudinal observations from the Iowa Facial Growth study. Landmarks were superimposed using generalized Procrustes analysis. We then examined how nasal shape changed with increasing body size, measured as sitting height, within the male and female samples using multivariate regression. Additionally, we examined the principal components of allometry-corrected shape variation to determine which aspects of nasal shape are independent of body size.

Results: Relative to sitting height, male facial development is characterized by a disproportionate increase in relative nasal cavity height that was independent of other relative facial height dimensions. Females, in contrast did not exhibit an allometric increase in relative nasal dimensions. In spite of different allometric patterns of nasal shape, non-allometric nasal shape variation in males and females was generally similar and correlated with larger patterns of craniomandibular shape (e.g., vertical facial dimensions).

Conclusions: Our results indicate that there is a significant difference in allometric variation in nasal shape between males and females. This result is consistent with the hypothesis that at least part of the variation in nasal morphology between males and females is responding to sexual dimorphism in oxygen consumption associated with body size and composition.

Supported by: University of Iowa Dental Research Grant

31. Food Insecurity, Caries and Growth in Children Aged 2-5

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Purpose: Food insecurity (FI) is defined as limited or uncertain access to a nutritionally adequate and safe food supply. FI is associated with low socioeconomic status, which is associated with caries risk and obesity. The objective of our ongoing study is to identify the relationship between FI, caries experience and obesity in children.

Methods: Subjects were recruited from patients aged 2-5 years presenting to the University of Iowa's Pediatric or Muscatine Dental Clinics for new or recall exams. Subject's parents completed a survey on family demographics, family food program (i.e., food assistance, Head Start, school breakfast) and WIC participation, and their child's food security (USDA Survey). Dental charts were reviewed to identify caries experience and weight and height measures. Bivariate analyses were conducted to evaluate associations between FI and caries experience or BMI (alpha=0.05).

Results: Subjects (n=207) were 56.5% female and 52±13 months old. Fifty-three percent identified as White, mean±SD household size was 4.5±1.5 individuals, and 36.5% reported a household income of <$20,000. Sixty-nine percent of households participated in food programs with a mean±SD of 2.4±1.1 programs/family. Twenty-four percent of children received WIC benefits. Fifty-two children were FI without hunger, 9 were FI with moderate hunger, and 5 were FI with severe hunger. Fifty-eight percent of children had caries; mean±SD caries experience was 3.4±4.5 dmft. Caries presence was not significantly associated with FI without hunger (p=0.973), FI with moderate hunger (p=0.736), FI with severe hunger (p=1.00), or food program participation (p=0.153). The number of caries present was not significantly associated with BMI (p=0.260).

Conclusion: The results of our study suggest that caries is not associated with food insecurity, food program participation or BMI in this population. Further study is ongoing.

Supported by: University of Iowa Dental Research Grant

32. The Role of Activation Function-1 in Glucocorticoid Receptor Sequence Specificity

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Objectives: Corticosteroids, or glucocorticoids (GCs), are a mainstay in medicine for their potent anti-inflammatory and immunosuppressive effects. In dentistry, GCs are used for the treatment of conditions affecting the oral cavity, including non-infectious inflammatory mucosal diseases, and for surgical procedures. Both endogenous and synthetic GCs exert their functions through the glucocorticoid receptor (GR). When GR, a transcription factor, binds GCs it translocates to the nucleus, binds DNA and nucleates the assembly of signaling proteins to regulate gene expression. Which genes are controlled by GR is determined by where GR binds the genome. Where GR binds, and therefore what biological function it exerts, is dependent on the signals that impinge on the receptor. We hypothesize that cellular signals impinging on other domains of GR influence sequence specificity, altering genomic localization and target gene regulation. Our goal is to understand the GR genomic targeting mechanism in order to aid in development of selective GR modulators that segregate the beneficial and deleterious effects of steroids.

Methods: We have developed a robust method (SELEX-seq) to study the DNA binding specificity of any transcription factor. This method has allowed us to determine sequence preference of GR:DNA binding domain (GR-DBD). In this work, we added the N-terminal activation function-1 domain (AF1) to the GR-DBD to determine the effect of this frequently modified domain on DNA binding specificity.

Results: We expressed and purified the AF1-DBD fragment of GR, measured its DNA binding affinity and measured its specificity by SELEX-seq. We observe an altered DNA sequence specificity with the addition of AF1.

Conclusions: Modulation of DNA binding specificity by AF1 suggests that other domains of the protein, which are either post-translationally modified or bound by ligand, can influence where GR binds and what genes it regulates.

Supported by: University of Iowa Dental Research Grant

33. Predicting Rural Practice among New General Dentists

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Objectives: To analyze how educational debt and other factors affect where recently graduated general dentists practice.

Methods: In May 2013, a survey was sent to the University of Iowa College of Dentistry's graduating classes of 2007-2010. The survey, which focused on education and employment since graduation, linked individuals to previous predoctoral surveys. Chi-square test explored factors related to urban versus rural practice location of general dentists.

Results: 142 of 290 (49.0%) dentists responded to the survey. 56.7% of new dentists (n=80) immediately entered private practice after dental school. Of those immediately entering private practice, 29% practiced in rural areas. Dentists originally from rural areas of (<50,000 population) were more likely to immediately enter private practice after dental school (p=.041) and to work in rural communities (p<.0001). These dentists were also more likely to continue to work in rural areas 3-5 years after graduation (p=.003). Despite these associations, dentists originally from rural areas were less likely as a dental student to indicate that they were planning to practice in a rural community (p=.033). Educational debt was not significantly associated with the practice location of recent graduates. However, male gender (p=.051), job security (p=.037), and family support (p=.028) were significant factors related to practice in a rural community.

Conclusion: Students from rural areas were more likely to immediately enter private practice, immediately practice in rural communities, and continue to practice in rural communities 3-5 years post-graduation. Educational debt was not associated with practice location of recent graduates. Dentists in rural areas rated family support and job security significantly greater than their urban counterparts as factors contributing most toward practice location choice.

Supported by: University of Iowa Dental Research Grant

34. Influence of Self-Perception of Facial Attractiveness on Rating the Attractiveness of Others

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Objectives: Previously, we showed that objective 3-dimensional measures of facial shape are associated with subjective ratings of facial attractiveness. In this study, we evaluate the extent to which raters' perceptions of their own facial esthetics are associated with their ratings of others' facial attractiveness, to evaluate raters' bias based on self-perceptions of attractiveness.

Methods: Eight volunteers (Female=5; Male=3) were asked to rate facial attractiveness of 325 adults on a 5-point Likert-scale and a Visual Analogue Scale (VAS). Ratings were based on frontal and profile images derived from 3dMD photos. Raters then rated self-attractiveness before and after viewing their own frontal and profile images derived from 3dMD photos. Multivariate regression was utilized to test the association between raters' self-perception of attractiveness prior to viewing their self-images and their ratings of others' attractiveness.

Results: Average self-attractiveness rating on the VAS before viewing self-images was 59.9 (range: 46-72). Approximately one-third of raters rated themselves as attractive. Raters had less variability in self-attractiveness ratings after viewing self-images, and all rated themselves as being of average overall attractiveness. Preliminary regression analyses showed higher self-rating on the VAS and considering oneself attractive were associated with an increased likelihood of rating others as unattractive (p=0.001, p=0.06). Rating oneself as attractive was associated with rating attractiveness of others lower on the VAS (p=0.01).

Conclusion: Preliminary results indicate raters' bias in rating facial attractiveness of others based on self-perceptions of attractiveness. Considering oneself as more attractive may result in underrating others' attractiveness. However, asking raters to evaluate their attractiveness on self-images reduced variability in perceived self-attractiveness. This suggests asking raters to rate their attractiveness based on self-images prior to rating others' images may reduce rater bias. In subsequent analyses, we will explore whether self-rating of attractiveness modifies the association between objective measures and subjective ratings of others' facial attractiveness.

Supported by: University of Iowa Dental Research Grant

35. Emergency Department Utilization for Nontraumatic Dental Conditions in Iowa

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Objectives: This study examines emergency department (ED) utilization in Iowa for non-traumatic dental conditions (NTDCs). Patient characteristics associated with ED visits for NTDCs and characteristics associated with multiple dental ED visits are reported.

Methods: This study analyzed 2012 data from the State Emergency Department Database for Iowa. Patient characteristics available in the data base were included in bivariate and multivariable analyses to predict the odds of having dental ED visits versus non-dental ED visits, and having repeated dental ED visits within a year. This study was approved by the University of Iowa Institutional Review Board.

Results: ED visits for NTDCs comprised 1.41% (N=15,019) of all ED visits in Iowa during 2012 and cost on average $559.55. Patients who were young adults (21-45 years), enrolled in Medicaid, low-income, or uninsured were associated with an increased likelihood to present at EDs for NTDCs. Patients were more likely to present at EDs on the weekend for NTDCs (36.2%) than for non-dental problems. Of patients presenting for NTDCs, 35.8% of them presented multiples times.

Conclusions: Patients presenting to EDs in Iowa for treatment of NTDCs resulted in total charges of $8.4 million. Our findings support those of previous studies that young adults, Medicaid-enrolled patients, and uninsured patients are more likely to seek care in EDs for NTDCs. Of note was the high percentage of patients who presented multiple times. This study provides baseline data regarding ED utilization for NTDCs in Iowa that can be used to evaluate the impact of current and future programs.

Supported by: University of Iowa Dental Research Grant

36. Norms for Occlusal Cant in Angle Class I Normal Subjects

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Objective: The purposes of this study were to assess in Class I normal occlusion (CIN) subjects (1) cant of the occlusal plane between the most buccal images of the right & left upper and lower second molars in posterior-anterior (PA) cephalograms compared to a cranial reference horizontal, determined by the intersection of the floor of the anterior cranial fossa at the lateral walls of the orbits, (2) difference between the occlusal and reference planes, and (3) gender differences. These data will aid in PA cephalometric assessment of patients.

Methods: Twenty males and 18 females with CIN occlusions were selected from the University of Iowa Facial Growth Study. Selection criteria: (1) appropriate PA cephalogram, (2) permanent first and second molars in occlusion, and (3) no orthodontic treatment prior to date of PA cephalogram. Two measurers, each at two separate measuring times, measured the occlusal cant and the cranial reference horizontal using Dolphin™ software. An average of two measurements was used for data analysis. Statistical analyses included one and two-sample t-tests. Inter- and intra-observer reliabilities were analyzed with intra-class correlation.

Results: Intra-class correlation coefficients for inter-and intra-observer agreement were 0.92 and 0.89, respectively. The mean (SD) difference between the occlusal cant and the cranial horizontal was 0.18 (1.31) degrees. Mean differences between the occlusal cant and cranial horizontal did not differ significantly from zero (p=0.4071), and no significant difference existed between males and females (p=0.6868).

Conclusion: The angle between the occlusal cant and the cranial reference horizontal did not differ significantly from zero in patients with Class I normal occlusion in the permanent dentition. The mean (SD) was 0.3 (1.5) degrees in females, and 0.1 (1.2) degrees in males. These norms will be useful in the diagnosis of asymmetric deviations of the occlusal plane in the permanent dentitions of orthodontic patients.

Supported by: Dows Student Research Award

37. Success of Partial Pulpotomy Treatment in Crown-Fractured Young Permanent Incisors

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Objective: The purposes of this retrospective observational study were to assess the effectiveness of partial pulpotomy for the treatment of complicated crown fractures of young permanent teeth performed at the University of Iowa College of Dentistry, and to evaluate factors associated with clinical and radiographic success.

Methods: A retrospective analysis was performed using recorded data of patients with any young permanent incisor treated by partial pulpotomy between 2008-2013. The primary outcomes denoting successful treatment were categorized as clinical and radiographic success. Clinical success was defined as absence of symptoms such as pain, sensitivity, mobility, and tenderness to percussion, as well as positive thermal and electrical testing. Radiographic success was determined by continued root development in immature teeth, absence of any pathologic root resorption/periapical pathosis Data were analyzed using descriptive statistics and bivariate analyses.

Results: Of the 155 cases identified, 32 children aged 7 to 18 years (mean age=10.1±2.3 years, 22 males) fulfilled the inclusion criteria of at least two follow-up visits. Follow-up periods ranged between 5-24 months. The main marginally significant or significant results were as follows: (i) teeth treated under rubber dam were more likely to succeed clinically than those under cotton roll isolation (96.2% vs. 66.7%; $P<.083$), (ii)teeth with root development between Stages1-4 were more likely to achieve greater clinical success than stage 5 (100% for Stages1-3 vs. 86.7% for Stage4 vs. 41.7% for Stage5; $P=.063$), (iii)teeth treated with MTA were more likely to achieve radiographic success than those treated with Glass Ionomer (96.3% vs. 50%; $P=.037$), (iv)teeth treated in younger subjects were more likely to achieve clinical success than those in older subjects (9.8 vs. 10.8 years; $P=.036$).

Conclusions: These preliminary results provide significant information regarding the outcomes of young permanent teeth treated by partial pulpotomy. Additional investigation with a greater sample size and extended follow-up is ongoing.

Supported by: Dows Student Research Award

38. Evaluation of an Innovative Digital Assessment Tool in Dental Anatomy

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Objectives: The E4D Compare software is an innovative tool that provides immediate feedback to students' projects and competencies. It should provide consistent grades even when different scanners are used which may have inherent subtle differences in calibration. This study aimed to evaluate potential discrepancies in grading using the E4D Compare software based on four different NEVO scanners in dental anatomy projects. Additionally, correlation between digital and visual scores was evaluated.

Methods: Thirty-five projects of maxillary left central incisor were evaluated. Among these, thirty wax-ups were performed by four operators and five consisted of standard dentoform teeth. Five scores were obtained for each project: one from an instructor and four from NEVO scanners. A faculty involved in teaching the dental anatomy course was blinded and scored thirty-five projects. One operator scanned all projects to four NEVO scanners (D4D Technologies, Richardson, TX, USA). The images were aligned to the gold standard, and tolerance set at 0.3 mm to generate a grade. The grade reflected percentage match between the project and the gold standard. One-way ANOVA with repeated measures was used to determine whether there was significant difference in scores among four NEVO scanners. Paired-sample t-test was used to detect difference between visual grades and the average grades of four NEVO scanners. Pearson's correlation test was used to assess relationship between visual grades and average grades of NEVO scanners.

Results: ANOVA results revealed that there was no significant difference in scores among four NEVO scanners ($p=0.0852$). There was significant difference between visual and digital grades ($p=0.0217$). Mean visual scores were significantly lower than digital scores (72.4 vs. 75.1). Pearson's correlation coefficient of 0.85 indicated a strong correlation between visual and digital scores ($p<0.0001$).

Conclusion: The E4D Compare software provides consistent grades even when different scanners are used and correlate well with visual scores.

Supported by: University of Iowa Dental Research Grant

39. PCR Machine as a Novel Thermo-cycling Method for Microtensile Specimens

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Objectives: To evaluate the common polymerase chain reaction machine (PCR) as an efficient and adoptable approach to thermo-cycling individual resin-dentin specimens and ultimately to identify an appropriate regimen for aging acceleration to be proposed to the International Standards Organization (ISO).

Methods: Thirty human molars were each processed into four resin-dentin bonded (Optibond FL and 3M ESPE Z100) dumbell-shaped specimens and randomly assigned into one of four storage conditions: 24 hour water storage (control), 500-, 5,000-, or 10,000-thermo-cycles. Specimens were individually placed in Eppendorf tubes of buffered artificial saliva (pH 7.2) for thermo-cycling from 35°C-15°C-35°C-45°C (Gale & Darvell, 1999) for the designated number of cycles before tensile testing to failure at 1 mm/min in a passive gripping device (Dircks Device, University of Iowa). Failure pathways were determined by light microscopy (40X). A simple random effect in Mixed Model ANOVA as well as Weibull regresson models were conducted to evaluate the effect of the storage conditions on the microtensile bond strength. Failure modes and storage times were evaluated using Fisher's exact test. All tests utilized a 0.05 level of significance.

Results: Mean μTBS for 24 hr=58.69, 500 cycles=55.90, 5,000 cycles=54.35, and 10,000 cycles=54.70 MPa were not significantly different when considering specimen to tooth correlation [Mixed Model ANOVA ($p=0.6704$); Weibull regression with random effect ($p=0.1031$)]. No significant association exists between the storage condition and failure mode ($p=0.1895$).

Conclusions and Future Directions: PCR was shown to be an efficient method of thermo-cycling individual resin-dentin bonded specimens. Future work may prove this to be a valuable addition to durability testing of adhesion to tooth structure (ISO/DTS 11405). However, for the gold-standard E&R 3-step bonding system used, more than 10,000 cycles or a larger temperature gradient may be required to yield a significant drop in μTBS; however, a wider temperature range may go beyond clinical relevance.

Supported by: University of Iowa Dental Research Grant

40. Beverage Intakes and Caries Experience in American Indian (AI) Children

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Sugar sweetened beverages (SSBs) provide a substrate for Oral-Bacteria and increase susceptibility to dental caries.

Objective: To identify associations between early SSB exposures and later dental caries in AI children.

Method: This is part of an ongoing longitudinal study of risk factors for caries in young AI children (n=239; females=132, males=107) from a Northern Plains Tribal community. Associations between beverage intakes at 1, 4, 8, 12, 16, and 22 months and caries experience at 32 months were explored in these analyses. Beverage data were collected by questionnaires administered by trained staff members to the child's caregiver. Standardized dental examinations were completed by trained dental hygienists. The exams were surface-specific for frank decay. Associations between beverage intakes (oz consumed; % total beverage intake) and caries (presence or absence) were assessed using the Wilcoxon rank sum test (SAS version 9.3).

Results: Eighty percent of AI children had caries at 32 months. At 12 months, median water intakes (56 vs 84 oz/week; $p=0.0179$) and sugar-free beverage intakes (56 vs 84 oz/week; $p=0.0208$) were lower in children with caries than in children without caries. At 22 months 100% juice intakes (56 vs 84 oz/week; $p=0.0031$) were also lower in children with caries than in children without caries. At 22 months the percentage of total beverage intake from 100% juice (18 vs 24%; $p=0042$) was lower in children with caries than in children without caries. Neither milk nor added sugared beverage intakes were statistically different between children with and without caries.

Conclusion: In these subjects, higher intakes of water, other sugar free beverages, and 100% juice at younger ages offered protections against caries at 36 months.

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41. Prevalence of Dental Caries in Iowa City Head Start Children

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Purpose: The objective of this study was to identify the prevalence of dental caries experience and treatment urgency of 3-5 year olds participating in the University of Iowa College of Dentistry's Head Start Oral Health Program during a five-year time period.

Methods: Subjects were children aged 3-5 years attending Head Start centers in the Iowa City area with parental permission for dental screenings. Screenings were conducted by third year dental students supervised by a pediatric dentistry faculty member at the Head Start centers. Children were screened for previous caries experience and visually obvious untreated dental decay with the assistance of a lighted mouth mirror. No dental explorers were used. Children were categorized into one of three treatment categories: "no obvious problems," "requires dental care," or "requires urgent dental care." Records of children screened from 2009-2013 were reviewed for statistical analysis.

Results: Caries information and treatment status were available for a total of 791 children. Overall, 247 (31.2%) of the participating children had experienced dental caries and 168 (21.2%) had untreated dental decay. Among the 791 children, 622 (78.6%) were categorized as having "no obvious problems," 156 (19.7%) as "requires dental care," and 13 (1.6%) as "requires urgent dental care."

Conclusions: In children participating in the University of Iowa's Head Start Oral Health Program, the prevalence of dental caries and treatment urgency was lower than that reported for Head Start programs in other locations.

Supported by: Dows Student Research Award

42. High Throughput Assay for RPA-Protein Interactions

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Cancers occurring in the oral cavity and oropharynx are cause for grave concern due to the cancer impairing our ability to eat, chew, swallow, talk, and breathe. The common chemotherapeutics used in the treatment of oral cancers include: fluorouracil, carboplatin, cisplatin, paclitaxel, docetaxel, methotrexate, ifosfamide, and bleomycin. These drugs cause DNA damage which causes cell death and mutations in cancerous and normal cells. Replication protein A, RPA, is a nonspecific single-strand DNA-binding protein that is essential for DNA metabolism. RPA acts to help load proteins, including essential DNA polymerases, which are necessary for DNA replication, repair, and recombination. Studies by Dr. Marc Wold have shown that an interaction between a specific DNA polymerase (polymerase a) is essential for DNA replication but are not needed for DNA repair processes. The goal of this project is to identify small molecule inhibitors that block the RPA-polymerase α interaction. This could lead to new chemotherapeutics that have fewer side effects. In particular, such inhibitors would not disrupt DNA repair leading to a reduction in the occurrence of secondary cancers after chemotherapy. Such targeted drugs could make the treatment of oral cavity cancers safer by reducing resulting tooth decay, mouth sores, damage to mucous membrane and salivary glands. The initial objective of this study was to establish high-throughput assay for screening small molecules to identify inhibitors. After preliminary experiments with dye based assays, we determined that a FRET (fluorescence resonance energy transfer) based assay had the sensitivity and signal to noise ratio needed for this screen. We are currently optimizing the procedure for use in automated small molecule screens. In addition, we are carrying control studies to determine conditions that interfere with DNA synthesis (give non-specific inhibition). Once optimized it will be used to screen for small molecule inhibitors of RPA- polymerase α interactions.

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43. Third Molar Agenesis and Craniomandibular Form: A Geometric Morphometric Analysis

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Objectives: Researchers have documented a significant relationship between dental agenesis and craniomandibular form. Interestingly, while developmental absence of the third molars is the most common form of dental agenesis, little is known regarding the relationship between this phenotypic variant and the craniomandibular skeleton. In the present study, we used geometric morphometric techniques to provide a more detailed examination of skeletal morphology associated with third molar agenesis. Specifically we examined whether there are significant differences in the size and shape of the craniomandibular skeleton of our third molar agenesis sample when compared to a control sample.

Methods and Materials: We compared n=131 non-syndromic subjects missing at least one third molar to n=129 control subjects. We collected coordinate landmarks from the cranial base, upper face and mandible from lateral cephalograms and used Procrustes analysis to distill size and shape variables. We tested for differences in craniomandibular size between our samples using univariate t-tests. We then tested for shape differences using MANOVA of the principal components of shape variables, and discriminant function analysis.

Results: The agenesis sample exhibited a significant reduction in the size of the cranial base, upper face and mandible compared to the controls. Moreover, there was a significant difference in craniomandibular shape as evidenced by our MANOVA. Discriminant function analysis revealed a) that the two samples could be reliably distinguished based on craniomandibular shape and b), the agenesis sample exhibited a relative reduction in the anterior-posterior dimensions of the palate, increased anterior mandibular rotation, and a superior-posterior displacement of the midline cranial base relative to the facial skeleton.

Conclusion: Third molar agenesis is associated with a reduction in size and altered shape of the craniomandibular skeleton. The factors that influence the presence/absence of the third molars appear to have important developmental effects on other parts of the skull.

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44. Dental Professionals Recognize Importance of Preventive Screening in Dental Offices

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Objectives: 1. To explore the attitudes of Iowa dental professionals toward preventive blood pressure, tobacco, and oral cancer screening as part of routine dental practice. 2. To determine the level of knowledge regarding risk factors for oral cancer.

Methods: After implementation of preventive screening, 70 dental professionals (21 dentists, 28 assistants, and 21 hygienists) from 20 dental offices (12 in eastern Iowa, 8 in western Iowa) completed a follow-up survey. Descriptive statistics were used to describe attitudes toward blood pressure screening, tobacco monitoring and oral cancer screening in the dental office. Bivariate analyses were performed to assess the difference between practice locations and categories of dental professionals using chi-square test, Fisher's exact test, and non-parametric Wilcoxon rank-sum test.

Results: A majority of dental professionals (72%) believe blood pressure monitoring is an effective use of time in practice; 84% would recommend implementation in other offices. There were significantly more positive responses to both questions in western than in eastern Iowa ($p<0.0001$).

Although a majority of dental professionals (83%) believe tobacco screening is an effective use of office time, hygienists were least supportive of this (74% of hygienists vs. 86% of dentists vs. 88% of dental assistants; $p=0.0235$). 78% of dental professionals believe that tobacco screening and Quitline referral should be implemented in all practices.

Results from a 20-question assessment of oral cancer knowledge revealed no significant difference between screening dentists and hygienists. 75% of dental professionals believe they need additional training in oral cancer screening.

Conclusions: A majority of Iowa dental professionals approve of preventive screening for blood pressure and tobacco use as a productive and worthwhile service in the dental office, and recommend that other offices also participate in these screenings. Additional training in the area of oral cancer screening would benefit the knowledge and services provided by Iowa dental practitioners.

Supported by: University of Iowa Dental Research Grant

45. Correlations for Perimeter, Tooth-Widths, Discrepancy: Normal Mixed to Permanent Stages

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Objective: Clinicians predict crowding-spacing in the permanent dentition (PD) based on mixed dentition (MD) measurements. Hunter & Smith [1972] reported a correlation between MD and PD of r=0.78 for mandibular crowding. The purposes of this study were to evaluate correlations between MD and PD for arch perimeter (AP), tooth width sum (TWS), and their discrepancy (TWAPD) in both arches of a Class I normal (CIN) sample to determine their value as predictors.

Methods: Twenty males and twenty females from the Iowa Facial Growth Study with CIN occlusions were selected for the longitudinal study. Casts of MD and PD were measured twice with digital calipers. An average of two measurements was used for data analysis. Statistical analyses included Pearson's correlation coefficient and Intra-class Correlation Coefficient.

Results: Intra-class correlation coefficients for inter- and intra-observer agreement ranged from 0.96 to 0.99. In the maxilla, AP correlations between MD and PD were significant for all subjects (r=0.80; p<0.0001), females (r=0.82; p<0.0001), and males (r=0.74; p=0.0002). In mandible, significant correlations were found for all subjects (r=0.68; p<0.0001), females (r=0.58; p=0.0077), and males (r=0.75; p=0.0002). In the maxilla, TWS correlations between MD and PD were significant for all subjects (r=0.74; P<0.0001), females (r=0.74; (p=0.0002), and males (r=0.78; p<0.0001). In mandible, significant correlations were found for all subjects (r=0.74; p<0.0001), females (r=0.78; p<0.0001), and males (r=0.72; p=0.0003).

In the maxilla, TWAPD correlations between MD and PD were significant for all subjects (r=0.49; p=0.0015), females (r=0.50; p=0.0237), but not significant for males (p=0.1715). In mandible, correlations were significant for all subjects (r=0.42; p=0.0074), but not significant for females (p=0.0601) and males (p=0.1820).

Conclusion: Correlations for AP between MD and PD were strong in the maxilla and most promising for clinical prediction. Correlations for TWS and TWAPD between MD and PD were modest and not useful for clinical purposes.

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46. Development of Nasal Septal Deviation in C3H/HeJ Mouse Strain

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Objectives: There is debate regarding the role of the nasal septal cartilage as a facial growth center. Studies have documented a correspondence between septal growth and the facial skeleton in long-snouted animal models. Nevertheless, shorter-faced animals exhibit higher frequencies of septal deviation indicating modularized growth between the septum and other components of the facial skeleton. This suggests that the morphogenetic influence of the septum may vary across different facial bauplans. To better understand variation in septal-facial skeletal interaction, we examined the morphological relationship between septal and facial skeletal form in non-experimentally altered mouse models that exhibit variation in snout length.

Methods and Materials: We assessed C3H/HeJ (shorter-snouted) mice and C57BL/6J (longer-snouted) mice at age 3-weeks (n=10) and 9-weeks (n=10) using microCT. The septum was segmented and deviation was measured as a percentage of septal volume relative to a modeled "non-deviated" volume. We compared growth patterns for septal volume, deviation and snout length across strains.

Results: The C3H/HeJ mice exhibited reduced anterior growth of the nasal bones and premaxilla relative to the C57BL/6J mice. In contrast, the growth rate of the septum was similar in both strains, and there were no significant differences in septal volume at 3 weeks and 9 weeks. While there was no meaningful septal deviation in the C57BL/6J mice, the C3H/HeJ mice exhibited significantly greater deviation at both 3 weeks and 9 weeks ($P<0.001$).

Conclusion: Despite similar amounts of septal growth in C3H/HeJ and C57BL/6J, there was considerable variation in the interaction between the septum and other aspects of the facial skeleton. While there was correlated growth between the septum and facial bones in C57BL/6J mice, reduced facial bone growth in the C3H/HeJ mice resulted in a highly deviated septum. This suggests that even in closely related animal models, the morphogenetic influence of the nasal septum is heterogeneous.

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47. Comparison of Instruction and Provision of Clinical Implant Therapy in Pre-Doctoral Curricula in United States and Canadian Dental Schools

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Objective: To compare and contrast curricular characteristics and provision of implant therapy at the pre-doctoral level in the United States(US) and Canadian Dental schools.

Methods: A survey instrument was designed and electronically sent to pre-doctoral implant-program directors of all accredited dental schools in the US and Canada.

Results: Comparison of United States and Canadian pre-doctoral implant program director demographics will be summarized. In US schools, the predoctoral implant program was integrated in the "first year" in 9.6% of institutions, 59.6% in "second year," 80.8% in "third year," and 65.4% in "fourth year" (compared to 10%, 50%, 90%, and 70% in respective years in Canada). Direct patient care under supervision was done in 94.2% of US schools and 90% of Canadian schools. Restorative implant modalities taught were similar in US and Canadian schools (most frequently being posterior implant supported single crown and mandibular implant-tissue supported overdenture). Students were required to prepare a surgical guide prior to the surgical implant placement in 92.3% of US schools and 100% of Canadian schools. 25.5% of US schools routinely use guided surgery planning software in undergraduate implant curriculum (compared to 100% in Canadian schools). Closed tray technique was the impression technique primarily taught in US schools (71.7%). In Canadian schools, the open tray technique was primarily taught (70%). Cement-retained fixation modality was primarily taught in US schools (62.2%). Screw-retained fixation modality was primarily taught in Canadian schools (60%). 36.7% of US schools directors reported their predoctoral program adequately prepared students to provide routine dental implant therapy for tooth replacement upon graduation (compared to 20% of Canadian schools).

Conclusions: This study demonstrated that there are curricular differences between US and Canadian schools with regards to adopting guided surgery protocols, impression techniques, fixation modalities, and other more complex treatment modalities as part of their implant program curriculum.

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48. Tooth Widths and Arch Segments in Normal and Crowded Occlusions

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Objective: The objectives of this study were to compare individual tooth widths and arch segments in Class I Normal (CIN) and Class I crowded (CICR) malocclusions in the permanent dentition to explore crowding.

Methods: Eighty-three subjects, 15- to 27-years-old, 40 CIN (20 males, 20 females) and 43 CICR (24 males, 19 females) were selected. The CIN sample came from the Iowa Facial Growth Study, and CICR subjects came from Orthodontic Department pre-treatment clinical records. One investigator took duplicate measures with digital calipers of tooth widths and 12 arch length segments mesial to the first molars. An intra-class correlation coefficient of 0.98 indicated a strong agreement between two measures. An average of two measurements was used for the data analyses. A two-sample t-test was performed to detect differences in tooth widths and arch segments between CIN and CICR.

Results: Genders pooled: A significant difference ($p<0.05$) was found in the width of every tooth in both arches, the width was larger in the CICR group. All 8 posterior arch segments were significantly ($p<0.05$) shorter in the CICR group. No differences were found in the 4 anterior segments. Males: The width of every tooth was larger in the CICR group ($p<0.05$). All 8 posterior arch segments were significantly ($p<0.05$) shorter in the CICR group; no differences were found in the 4 anterior segments. Females: The width of each tooth was larger in the CICR group ($p<0.05$) except for teeth #4, #8, #13, and #27. Four arch segments, 3 canine areas, 11, 22, 27 and one posterior, 28-29 were significantly shorter in the CICR group ($p<0.05$); no differences were found in the other 8 segments.

Conclusion: Crowded occlusions have larger individual tooth widths, and shorter arch segments, except in the anterior regions of both arches. These new findings help explain crowding.

Supported by: Dows Student Research Award

49. Rationale and Proposal for a Modified Pink Esthetic Score (PES) Metric

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Introduction: The Pink Esthetic Score (PES), proposed by Fürhauser et al., has been widely employed in clinical trials as a system to assess subjective desirables that may contribute to dental implant esthetics. Limitations in PES accuracy have been identified in a recent clinical trial. A modification of the PES is proposed that permits directionality in scoring in order to assign more accurate PES values in specific clinical situations.

Methods: Five evaluators with different clinical backgrounds photographically evaluated peri-implant mucosa one year post-implant-placement in the anterior maxilla as part of a five-year, prospective, multicenter clinical trial. Evaluators used a tablet-based digital format to score clinical photos according to PES criteria. Clinical photographs in which the natural reference tooth had mucogingival defects that may impact scoring were identified and isolated.

Results: 649 clinical photographs of single-tooth implant restorations were reviewed and scored. A subset of clinical images will be presented in which two scenarios skewed sum PES values. The first was in situations where the reference tooth had a mucogingival defect that negatively influenced the scoring of the implant site's PES values. The second was in situations where the implant site possessed superior mucosal contours as compared with the natural reference tooth. As the PES assigns scores for individual parameters, discrepancies with the reference tooth, whether negative or positive, are scored identically. This limitation of the PES may result in skewed or inaccurate PES results for clinical trials with small sample populations. The authors propose modifying the PES to include directionality (+/-) to scores based on the reference tooth.

Conclusion: A modified PES index has the potential to more optimally standardize scoring, and thus lead to more accurate results in implant studies with small sample sizes, where these issues could be of greater significance.

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50. Erosion Potential of Whitening Regimens as Evaluated with Polarized Light Microscopy

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Objectives: Tooth whitening is a widely utilized esthetic treatment in dentistry. With increased access to over-the-counter systems, concerns have been raised about potential adverse effects associated with overuse of whitening materials. Therefore, this study aimed to evaluate enamel erosion due to different whitening regimens when used in excess of recommended guidelines.

Methods: Extracted human teeth (n=66) were randomly divided into eleven groups (n=6/group). Specimens were exposed to over-the-counter products: Crest Whitestrips, 5-Minute Natural White, and a do-it-yourself strawberry whitening recipe. Within each regimen, groups were further divided per exposure time: specimens receiving the recommended product dosage; 5 times the recommended dosage; and 10 times the recommended dosage. Negative and positive controls were treated with grade 3 water and 1.0% citric acid, respectively. Specimens were nail-varnished to limit application to a 1x4 mm window. Following treatment, specimens were sectioned and erosion (drop in μm) was measured using polarized light microscopy. A two-sample t-test was used to detect enamel erosion differences between negative and positive groups, while a one-way ANOVA, followed by post-hoc Dunnett's test and Tukey's HSD test, were used to detect differences between the sets of treatment groups and negative control groups, or among all experimental groups.

Results: There were significant differences in the mean amount of enamel erosion ($p<0.0001$). Mean erosion for the positive control group was significantly greater than the negative control group (23.50μm vs. 2.65μm). There was a significant effect for type of treatments on erosion ($F(9,50)=25.19$; $p<0.0001$). No significant difference between the negative control and each of the treatment groups ($p>0.05$ for all instances) was observed, except for the Natural White 10-times treatment group ($p<0.0001$) that was significantly greater than the negative control group (14.82μm vs. 2.65μm).

Conclusions: Caution is advised when using certain over-the-counter products beyond recommended guidelines as there is potential for enamel erosion.

Supported by: Dows Student Research Award

51. Appraisal of Systematic Reviews in the Top Ten Dental Journals

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Systematic reviews (SRs) summarize data from multiple studies and are considered the highest level of scientific evidence. However, the quality of SRs is variable. Guidelines for assessing the methodological quality of SRs, including the Assessment of Multiple Systematic Reviews (AMSTAR), have been developed to critique SRs. The relative quality of SRs in dental literature is unknown.

Objective: To identify the quality, using AMSTAR criteria, of SRs published in the top ten dental journals.

Methods: We identified the ten highest ranked dental journals in 2013 based on their 2012 impact factor in Journal Citation Reports. For each of the identified journals, two authors independently searched PubMed by journal title and limited articles to SRs; one author hand searched each journal to identify additional SRs. From the 10 journals, 55 SRs were identified. The quality of each SR was appraised independently by each author using the AMSTAR with disagreements settled by discussion.

Results: The mean score of all 55 SRs was 6.5 out of a possible 11 (59%). Journal mean scores (SRs published within a journal) ranged from 7.9 (71%) in JDR to 4.8 (44%) in *Oral Oncology*.

Conclusions: Considerable variability exists in the quality of published SRs both within and between journals. Completing SRs according to AMSTAR or similar guidelines could improve the quality and clinical usefulness of future SRs. Dental journals would benefit from establishing protocols for reviewing SRs to ensure high quality. Furthermore, clinicians must critique published SRs to ensure the highest quality of evidence based care.

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52. Dental Students' Assumptions Prior to Beginning Community-Based Clinical Experiences

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Objective: To determine what assumptions dental students have prior to beginning community-based clinical experiences.

Methods: All fourth-year students participate in community-based clinical experiences. At the end of their experiences, they must write a guided reflection paper detailing what assumptions they had prior to beginning their rotations, and how those assumptions were fulfilled and challenged. The papers from three graduating classes (2011-13, N=218) were analyzed by two researchers, using Dedoose software, for common assumption themes. IRB approval was obtained prior to conducting the study.

Results: Students had a variety of both positive and negative assumptions about their rotations. They were apprehensive about working with potentially challenging patients (e.g. elderly patients with complicated medical histories and disabilities, children, non-English speaking patients, difficult patient management), performing procedures for which they have had none to little experience, and working too slowly or treating several patients per day. In contrast, they looked forward to improving their clinical and patient management skills, knowledge, and speed. Many assumed they would enjoy treating underserved populations and looked forward to "making a difference for people." Other assumptions included those about the site, such as the equipment or facility would be outdated, protocols and procedures would be similar to the dental school, and that they would have more independence than at school.

Conclusion: Students expressed a variety of assumptions relating to their emotions, patients they expected to treat, procedures they would perform, and details about the specific site. Educators should consider assumptions students may have to help better prepare them for their community-based dental rotations.

Supported by: University of Iowa Dental Research Grant

53. Evaluating the Effectiveness of Dental Education Devices: A Qualitative Study Comparing iPad Apps to Print Materials and 3D Models

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Objectives: Numerous patient educational materials are available for use in the dental clinic setting, which may help improve oral health literacy. The purpose of this study was to determine: 1) preferences regarding various patient education materials, and 2) how participants would like these materials to be used by their dentist.

Methods: Six focus group sessions were conducted using participants recruited from University of Iowa College of Dentistry waiting rooms (N=25). During each session, a dentist described a dental bridge utilizing five patient education materials (i.e. flip-chart, ADA pamphlet, model, 3D4 Medical app narrated by the dentist, Solution 21 app with included narration). Participants' opinions pertaining to each material were explored using a semi-structured format. A survey was administered prior to the session to assess participants' baseline knowledge of dental bridges. A follow-up survey was conducted at the end of the session to evaluate changes in knowledge and demographic characteristics. Sessions were recorded, and responses were coded by themes using Dedoose software.

Results: All of the participants said that each item increased their understanding of a dental bridge and could be used individually. However, participants preferred that the dentist use a combination of materials, because their understanding improved with repetition and each material presented the concept in a different way. Many participants wanted the dentist to explain a bridge chairside, preferably with an app, but they also desired a pamphlet for reference after the appointment. Some participants appreciated the hands-on aspect of the model. Most participants preferred hearing detailed information about the steps involved with obtaining a bridge rather than learning only basic information.

Conclusion: Participants demonstrated improved understanding of dental bridges with each material. Dentists should ask patients their preferred method for learning and tailor their presentations to the amount of information desired by the patient.

Supported by: University of Iowa Dental Research Grant

54. Reliability of Different Techniques for Assessing Silver Nitrate-Treated Lesions

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Objectives: Silver nitrate has received much recent attention as a means of treating early childhood caries by arresting carious lesions. However, there is no standard means to assess whether lesions are arrested. The purpose of this *in vitro* study was to assess the reliability of different probes on both untreated and silver nitrate-treated carious lesions.

Methods: One hundred and twenty extracted teeth were selected to represent a variety of carious lesions. They were then randomly divided into two groups: silver nitrate and control. Each of these groups was further divided into three sub-groups for each of the probes tested: standard periodontal probe, WHO ball ended probe, and shepherds hook explorer. Using a small applicator, silver nitrate was applied several times to each lesion, allowing the lesions to air dry between applications. All lesions were probed by an experienced examiner and a 4th year dental student and scored on a 0 (hard), 1 (soft), 2 (very soft & leathery) scale. Inter-examiner and intra-examiner reliability was assessed for each type of probe using the kappa statistic. Only lesions treated with silver nitrate are reported here.

Results: For inter-examiner reliability, kappa scores were (first assessment, second assessment): .545 and .547 for the periodontal probe, .615 and .251 for the ball ended probe and .431 and .677 for the explorer. For intra-examiner reliability, the kappa scores were (examiner 1, examiner 2) .704 and .689 for the periodontal probe, .455 and .478 for the ball ended probe, and .500 and .518 for the explorer.

Conclusions: Results from this *in vitro* study suggest that use of the periodontal probe produces best combination of inter and intra- examiner reliability; however *in vivo* studies are need

Supported by: University of Iowa Dental Research Grant

55. Factors Influencing Parental Treatment Decisions Made For Pediatric Dental Patients

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Purpose: To determine what factors parents consider when making dental treatment decisions on behalf of pediatric patients as well as the characteristics of those individuals making the decisions.

Methods: A survey was administered to parents/guardians of pediatric dental patients at the University of Iowa Department of Pediatric Dentistry. The survey instrument consisted of 23 questions related to demographics, preferences in materials and dental treatments, as well as attitudes regarding decision making. Bivariate analyses and logistic regression models were used to analyze the data (alpha=0.05).

Results: Two hundred sixty three subjects completed the questionnaire. Responses were dichotomized into those who preferred a type of filling material and those who did not have a preference. Of the participants who did indicate a preference (n=117, 45%), a tooth-colored filling material was selected by 87 (74%), while 30 (26%) chose a silver filling material. Bivariate and logistic regression results indicated that those who had a preference for materials were more like to be older (p=0.02), female (p=0.0175), have children with less cavity experience (p=0.0039), have higher education (p=0.006) and income levels (p=0.0026) and be less concerned about out-of-pocket expenditures (p=0.0068).

Conclusion: Preference for dental filling materials appears to be significantly associated with a number of socio-economic factors.

56. Perineural Invasion in Mucoepidermoid Carcinoma

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Objectives: To retrospectively study the incidence of perineural invasion in cases of mucoepidermoid carcinoma, comparing current results with previous reports and whether accuracy would be increased by review of the original routinely hematoxylin and eosin stained sections. The study will also assess whether the adjuvant use of S100 immunohistochemical reactions in cases of mucoepidermoid carcinoma would increase detection of perineural invasion in cases where perineural invasion status had been previously reported and to assess whether perineural invasion is an appropriate means of grading mucoepidermoid carcinoma and assess if perineural invasion or its absence is associated with clinical outcome.

Methods: Following IRB approval, 33 cases of major and minor salivary gland mucoepidermoid carcinoma were reviewed for perineural invasion and compared to the perineural invasion status of the original pathology report when available. All original routinely stained slides were reviewed as well as S100-reacted sections of each case's tissue blocks that contained tumor. Patient demographics and clinical outcome was collected from electronic medical records.

Results: Data collection is nearly completed at this time with statistical analysis pending.

Conclusions: Preliminary data indicates that immunohistochemical enhancement improves the detection of perineural invasion status in mucoepidermoid carcinoma.

57. 8-Year Retrospective Study of Re-entry Status of Stepwise Excavation Procedure in a US Academic Setting

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Aims: Assess the proportion of patients that had a stepwise excavation procedure (SWP) re-evaluated at the University of Iowa College of Dentistry (UICoD) between 2004 and 2012, and evaluate the association between different variables and this outcome.

Methods: The primary outcome status was defined as whether or not there was completion of re-evaluation/ re-entry within 18 months of the SWP (Re-entry status), selecting one procedure per patient retrospectively from patient record data. Association was investigated between the Re-entry status and characteristics such as age, gender, miles traveled to UICOD, dental insurance, number of recall examinations and prophy visits, tooth type, number of surfaces treated, type of provider and tooth arch.

Results: Descriptive statistics showed a total of 1985 SWPs were performed in 1326 patients, with 518 patients having re-entry within 18 months. Both bivariate analysis and logistic regression modeling revealed strong associations between re-entry status and provider level, tooth type, patient age, number of recalls and the calendar year in which the SWP was done. There was also evidence of association with dental insurance status. In general, patients are more likely to have re-entry when seen by faculty or residents, when the procedure is performed in molars/pre-molars, when they are older, when they had more recalls and when seen earlier in the study period.

Conclusions: These results demonstrate that patient demographics and treatment characteristics can significantly affect the probability of SWP re-entry. The impact of treatment year may reflect program heterogeneity or temporal changes in external societal factors.

58. Mouthguard Thickness and Extension: A Pilot Study on Athlete Preference

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Objectives: The goal of this pilot study was to determine the effect of altering the thickness and extension of mouthguards on comfort and perceived protection by NCAA division 1 athletes.

Methods and Materials: Eleven field hockey players were recruited to take part in this study. At baseline, all participating athletes completed a survey on mouthguard use. Athletes were given four mouthguards to be worn for one week each. The mouthguards differed in thickness and extension. The four mouthguards were: 1) 4mm thick, covering the 2nd molar 2) 4mm thick, covering the 1st molar 3) 3mm thick, covering the 2nd molar 4) 3mm thick, covering the 1st molar. At the end of the week, each athlete completed a 7 question survey on issues related to comfort and perceived protection regarding the mouthguard they had worn for that week. Univariate and bivariate analyses were used to analyze data (alpha=0.05).

Results: Of the 11 female subjects (mean age=18.7), 27.3% suffered oral or dental injury that required treatment. No significant differences were found for all nine survey questions among the four types of mouthguards. Although not statistically significant, the data indicated that subjects (90%) were more likely to agree that the thick mouth guard was protective, and they (60%) were more likely to agree that they would wear the thick and short mouthguard again for future practice and competition.

Conclusions: Although not statistically significant, the results show a trend for a thicker, shorter mouthguard.

59. Survival Analysis of Anterior Composite Restorations at UICoD between 1995-2013

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Objectives: This retrospective cohort study aimed to assess the survival time and factors associated with survival of anterior composite-resin restoration placed at the University of Iowa, College of Dentistry (UICoD).

Methods: Patients at the UICoD who had anterior composite restorations placed between 1995-1997 and could be followed through 2013 were included in this study. Factors included: patient age and gender, tooth type (central or lateral incisor, or canine) and location (maxillary or mandibular), restoration size, provider type [dental student (DS), graduate student (GS), faculty (FA)], and clinic where the restoration placed. Survival time 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, veneer and/or crowns, root canal therapy, and extraction. One restoration per patient was used for the study. Statistical analyses consisted of the Kaplan-Meier analysis and Cox regression (alpha=0.05).

Results: Of the 668 subjects (mean±SD age=55±13 years and 60.8% females) who fulfilled the inclusion criteria, the mean±SD survival time of composite resin restoration was 11±7 years and an overall survival rate was 43.3%. Patients' gender, age, tooth location, and clinic type were not significantly associated with the survival time of composite resin restoration. Cox regression model indicated that significant differences in the restoration hazards were found on tooth type (p=0.002), provider type (p=0.003) and restoration sizes (p=0.0072). Central (HR=1.59; CI=1.23-2.07) and lateral (HR=1.36; CI=1.03-1.79) incisors had significantly higher hazard ratio (HR) than canines, and Faculty had significantly lower HR than undergraduate students (HR=0.68, CI=0.55-0.85). Restorations sizes one-surface (HR=0.6; CI=0.44-0.81) and two-surfaces (HR=0.65; CI=0.48-0.88) had significantly lower HR than four-or-more surfaces.

Conclusion: The mean survival time of anterior composite restoration at UICoD was over 11 years. Tooth type, provider type, and restoration size were significant predictors for the survival time of anterior composite-resin restoration.

60. Effect of Chronic Physical and Mental Conditions on Dental Utilization

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Objectives: To assess the impact of chronic physical and chronic mental conditions on dental utilization of adult Medicaid enrollees in Iowa.

Methods: Data from the 2013 Survey of Iowa Medicaid Enrollees were used to explore relationships between self-reported chronic physical and mental conditions (lasting = 3 months) and recent dental utilization (past 12 months). Other covariates included sociodemographic characteristics, oral health status (OHS), general health status, unmet dental need, and usual source of dental care. Anderson's Behavioral Model of Health Services Utilization was used as a conceptual framework. Logistic regression models examined association between dental care utilization and physical and mental conditions.

Results: Among 368 respondents, 51% visited a dentist in the past year and 33.5% reported oral health status (OHS) as excellent or very good. 83% of respondents had one or more chronic physical conditions and 62% had one or more chronic mental conditions. Adults with excellent or very good OHS had significantly greater odds of reporting a dental visit (p=0.01) than adults with poorer OHS. The following chronic conditions were associated with significantly lower odds of having a dental visit: bladder or bowel problems (p=0.04), and bronchitis/emphysema/COPD/other lung problems (p=0.04). Adults who reported an emotional/mental problem other than anxiety or depression were significantly less likely to report a dental visit (p=0.003).

Conclusions: Several chronic conditions were negatively associated with dental utilization among Iowa Medicaid-enrolled adults. Further research is required to fully understand if certain types of chronic conditions disproportionately affect utilization of dental care.

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61. Bedsharing and Nighttime Oral Health Habits among Children 0-3 years

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Objectives: Bedsharing is a controversial issue due to the possible increased risk of Sudden Infant Death Syndrome; however, national trends have increased over the past few decades. The purpose of this study was to investigate the association of bedsharing with nighttime oral health behaviors of children aged 0-3 years.

Methods: Data were collected from records of children attending the University of Iowa's Infant Oral Health Program. Data included maternal report of demographics, child temperament, child's nighttime dietary and oral hygiene habits, bedsharing frequency and methods to help child sleep. Also, clinical evidence of carious lesions and visible plaque on maxillary incisors were obtained. Bivariate analyses and logistic regression models were used to analyze the data (alpha=.05).

Results: Six hundred and twenty-nine child-mother dyads who either bedshared 7 nights per week (N=273) or did not bedshare (N=356) were included in the analysis. Of the 629 children, 49% were females, 50% non-White, 72% lived with both parents, and their average age was 21.55±12.11 months. The final logistic regression model revealed that children who bedshared with mothers 7 nights per week were significantly more likely to be: healthy (OR=6.78; P=.0082), older (OR=1.56; P=.0073), non-White (OR=2.96; P=.0001), live with single mother (OR=3.41; P<.0001), breastfed throughout the night (OR=4.33; P<.0001), and bottle-fed and breastfed to help the child sleep (OR=2.34; P=.0314; OR=3.27; P=.0316, respectively). Moreover, these children were more likely to be in the high caries risk category (OR=2.19; P=.0097) and be perceived as not having a calm temperament (OR=1.89; P=.0287). Bedsharing was not significantly associated with nighttime oral hygiene practices.

Conclusions: Results suggest that bedsharing is significantly associated with children who are healthy, older, live with mother only and of non-White racial background. Bedsharing appears to be significantly associated with nighttime feeding habits but not oral hygiene practices.

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62. Sources of Fluoride Exposure Among Young Low-Income Children

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Purpose: Daily exposure to fluoridated drinking water and brushing with fluoridated toothpaste are proven effective in preventing caries, readily accessible and low-cost to high-risk communities. Therefore, the purpose of this study was to assess fluoride exposure from drinking water and toothpaste among low-income high-caries risk Iowa children. An additional purpose was to assess whether there are relationships between fluoride source-specific exposures and child and maternal factors, specifically the child's age, race/ethnicity, and the caregiver's education and socioeconomic status.

Methods: Four dental studies were conducted among children 12 to 74 months of age. Eight hundred and seventy-six mothers completed a series of questionnaires, including detailed information regarding their child's main source of fluoridated water, as well as the frequency of fluoridated toothpaste used. Univariate and bivariate analyses were used to analyze data (alpha=0.05). Logistic regression models are currently under analysis.

Results: Of the 881 children, 50% were females with an average age of 30.77±13.7 months. Most children were Caucasian (61%) and 16% were Hispanic. Fluoridated toothpaste was not used at all among 37% of the children, while 75% of them were reported to drink fluoridated water. Bivariate analyses indicated a significant association between the use of fluoridated toothpaste and the child's race (P=0.0454) and age (P<0.0001), as well as annual household income (P=0.0010) and mother's marital status (P=0.0292). Significant associations between fluoridated water source and annual household income (P=0.0304) and mother's marital status (P=0.0166) were also observed.

Conclusions: Education regarding the benefits of daily use of fluoridated toothpaste should be targeted to mothers of low-income young children.

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63. Screen of Candidate Cis-Regulatory Elements Driving Gene Expression in the Oral Periderm

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Genome wide association studies (GWAS) have identified 18 loci where variation confers risk for non-syndromic cleft lip with or without cleft palate (NS CL/P). Only one of these loci includes exons, implying many risk-conferring polymorphisms disrupt non-coding sequence elements that regulate expression of nearby genes (i.e., enhancers and promoters). However, it is unclear how polymorphisms disrupt function of regulatory elements because we do not know how the sequence of such elements determines their tissue-specific activity. One tissue of relevance to CL/P is oral periderm, the most superficial layer of oral epithelium, because palate fusion depends on the integrity of this tissue. We hypothesize that a fraction of polymorphisms that increase risk for CL/P disrupt enhancers that are active in the periderm. We are identifying periderm enhancer candidates based on conservation, the presence of characteristic chromatin marks, the presence of binding motifs for transcription factors implicated in periderm differentiation (i.e., Interferon Regulatory Factor 6), and testing them in transgenic zebrafish reporter assays. We use the zebrafish periderm as our model because it differentiates early in embryonic development and zebrafish are a tractable vertebrate model. Together this initial screen has identified several cis-regulatory elements active in periderm. Ongoing analysis of the sequence features of these elements will improve our ability to distinguish pathogenic polymorphisms from those that are merely in linkage disequilibrium with them.

Supported by: NIDCR

64. Dental Hygiene Workforce and Education Programs in Iowa

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Objectives: To examine the current dental hygiene workforce in Iowa, including temporal and geographic trends related to dental hygiene education programs.

Methods: We used the following data sources to examine Iowa's dental hygiene workforce and education programs: a 2012 survey of all licensed Iowa dental hygienists, 2013 Iowa Dental Board relicensure data, and the American Dental Association Survey of Allied Dental Education Annual Reports from 1999-2011. Our study included descriptive and bivariate analyses and geographic mapping.

Results: In 2013, 87% of Iowa's 2074 licensed hygienists were actively practicing in Iowa. Iowa's practicing hygienists work a mean of 27 hours (SD=11) per week, and 51% work full time (≥32 hours/week). One quarter of Iowa's 99 counties have two or fewer practicing hygienists. Regarding educational attainment, a significantly lower proportion of younger dental hygienists had baccalaureate or higher degrees compared to older dental hygienists. There was substantial variation in the market share of the dental hygiene education programs. Forty-seven percent of hygienists who graduated from an Iowa program work within 30 miles of their alma mater.

Conclusions: This study identified several important factors to consider as part of future dental hygiene workforce and education program planning in Iowa: full- vs. part-time status, trends in educational attainment, the location of dental hygiene shortage areas, and geographic clustering near education programs.

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65. Dental Caries in School-aged African-American Children in Alabama: A Six-Year Longitudinal Study

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Objectives: To assess the prevalence and incidence of dental caries in school-aged African-American children.

Methods: A cohort of 98 low socioeconomic status, high caries risk African-American children with mean age of 5.85 years at baseline was recruited in Uniontown, Alabama from July 2007 to December 2008 and followed prospectively for six years. Oral examinations were done annually by one of three trained/calibrated dentists using portable equipment, including mirror, light and compressed air, without radiographs. Permanent and primary cavitated caries, missing due to caries and filled surfaces were recorded, using WHO criteria. Also, children received semi-annual fluoride varnish applications starting at baseline.

Results: The person-level prevalence of dmfs was: 61.2% at mean age 5.9 (n=98, mean dmfs=11.51); 63.8% at age 6.7 (n=80, mean dmfs=13.16); 70.6% at age 7.8 (n=68, mean dmfs=13.94); 63.6% at age 8.8 (n=66, mean dmfs=11.29); 57.9% at age 9.7 (n=57, mean dmfs=8.75); 48.4% at age 10.7 (n=31, mean dmfs=4.94); and 64.3% at age 11.7 (n=14, mean dmfs=5.14). The person-level prevalence of DMFS was 5.7% (n=70, mean DMFS=0.06); 3.8% (n=79, mean DMFS=0.04); 10.5% (n=67, mean DMFS=0.30); 16.4% (n=67, mean DMFS=0.64); 22.2% (n=63, mean DMFS=0.83); 24.2% (n=62, mean DMFS=0.94); and 29.0% (n=62, mean DMFS=1.15), respectively. The six-year person-level incidence of DMFS was 22.6% (mean DMFS=0.67) from ~age 5.9 to age 11.7 (n=62), while the two three-year person-level incidence rates were 16.4% (mean DMFS=0.79) and 11.3% (mean DMFS=0.50) from mean ages 5.9 to 8.7 (n=67) and 8.8 to 11.7 years (n=62), respectively.

Conclusion: In this prospective cohort study, in spite of the semi-annual fluoride varnish applications, there was substantial dental caries in this population. Additional studies evaluating risk factors for caries development are ongoing to determine foci for prevention of caries.

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66. Strengthening Techniques for Silicate-Based Glass Scaffolds

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Objectives: Glass and ceramic scaffolds with high mechanical integrity and adequate interconnected porosity are needed for producing bone graft substitutes. Our goal was to investigate the effect of different pre-coating agents and coating techniques on architectural characteristics and compressive strength of potassium alumino-silicate glass scaffolds produced via the polyurethane (PU) foam replica technique.

Methods: A proprietary silicate-based glass composition was used to prepare macroporous scaffolds (n=15/group). The control group (A) was prepared by impregnation of non-coated PU foam cylinders (10x12mm) with a silicate-based glass slurry, followed by sintering under vacuum at 795°C/2min. at 55°C/min. Scaffolds in Groups A were coated twice and heat treated. Scaffolds in Group B received a third coat and heat treatment. Scaffolds in groups C and D were pre-coated with either gelatin (Group C) or colloidal silica (Group D) and then coated twice with glass slurry, as for group A. The rationale for pre-coating is to round the sharp angles of the PU foam struts prior to applying the glass slurry. Scaffolds architectural characteristics were investigated by SEM. Total macroporosity was determined via He-pycnometry. The mean compressive strength was measured with a Universal Testing machine. Powdered scaffolds were analyzed by XRD.

Results: XRD confirmed the absence of crystallization for groups A, B and C. A small amount of cristobalite was present for group D. All groups presented fully interconnected porosity ranging from 78±5% (D) to 84±1% (A), with a significant difference only between groups A and D ($p<0.05$). The compressive strength of Groups B (2.15±0.44MPa) and C (1.69±0.24MPa) was significantly higher than that of group A (1.06±0.18MPa), group D (1.38±0.33MPa) was not significantly different.

Conclusion: Application of a third coating or pre-coating the PU foam with gelatin are both promising techniques for the fabrication of stronger silicate-based glass scaffolds while keeping a high level of interconnected macroporosity.

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67. Group-Based Trajectory Modeling of Caries Development during the First 36 Months of Life in a Native American Birth Cohort

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Objectives: This study applies group-based trajectory modeling to the development of rampant early childhood caries (ECC) among American Indian children from a Northern Plains Tribal community. The goal is to identify and characterize distinct groups of children with different patterns of disease progression during the first 36 months of life using regular oral exams, plaque samples, and caregiver interviews.

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 along with plaque sample collection occurred at target ages of 1, 4, 8, 12, 16, 22, 28, and 36 months of age. DMFS development was explored using group-based zero-inflated Poisson trajectory modeling. Covariates were examined for group differences using the Chi-square test, the Wilcoxon Rank sum test, and logistic regression. These included: child's gender, maternal age and education, annual family income, household size, maternal brushing and smoking frequency, maternal DMFS, and total maternal colony forming units (CFUs) for *Streptococcus mutans*, lactobacilli, and overall bacterial burden. Analyses are performed using SAS 9.3 (Cary, NC) and R 3.1.0 (Vienna, Austria) at the 5% level of significance.

Results: Group-based trajectory modeling identified two groups with distinct patterns of ECC. The larger group (n = 155) had a positive trajectory with an average DMFS of 4.79 (95% CI: 4.36, 5.18) at 36 months. The smaller group (n = 84) had an accelerated, positive trajectory with an average DMFS of 33.34 (95% CI: 31.19, 33.76) at 36 months. Maternal DMFS ($p = 0.0360$) was significantly different between groups.

Conclusions: The application of trajectory modeling to the development of DMFS identified two groups. Both groups exhibited DMFS progression, but at different rates. Increased disease progression was associated with higher levels of maternal DMFS in this population.

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68. Longitudinal Analysis of *Streptococcus mutans* Genotypes in American Indians

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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 a Northern Plains 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 the child's birth until 36 months of age.

Methods: Whole mouth plaque samples were collected from mother/child pairs and designated primary caregivers (n=94) at 8 time points between the child's birth and 36 months of age. Samples were spiral plated onto MSKB (Mitis salivarius-Kanamycin-Bacitracin) agar for SM counts and isolation. SM isolates were identified by sugar fermentation profiles and PCR. Isolates were genotyped by AP-PCR using OPA2 primer. Gels were analyzed and dendograms generated using GelComparII® v6.5.

Results: Individual subjects display a range of 0-5 SM genotypes. Family groups show a range of 0-7 SM genotypes. In our data set, 87.5% of the children (35/40) have established SM colonization by 36 months. Of these children, 74.3% share at least 1 genotype with the mother and/or caregiver. The majority of children were colonized by 16 months of age.

Conclusions: Our data show an increase in diversity of SM genotypes in children between 16 and 36 months of age and an increase in the percentage of children displaying fidelity of transmission. Multiple genotypes are shared between subjects within and across families. Further analyses of the genotypic diversity present across this cohort are in progress.

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69. Magnolia Plant Extracts With Selective Toxicity Against Oral Streptococci

J. Szewczyk[1], *J.A. Banas*[1]

[1]University of Iowa, Iowa City, IA

Objectives: To measure the selective toxicity of Magnolia plant extracts (Michelia genus) against *Streptococcus mutans* and *Streptococcus sobrinus* with priority given to a non-toxic or lesser toxic effect against *Streptococcus sanguinis*.

Methods: Extracts were tested in overnight planktonic cultures at concentrations of 0.178 or 0.089 mg/ml. Two extracts that reduced growth of *S. mutans* or *S. sobrinus* but had minimal activity against *S. sanguinis* were further tested by measuring reductions in the viability of planktonic or sucrose-based biofilm organisms following an exposure of one to three hours.

Results: Extract 10-F7-2 from *Michelia figo* reduced overnight *S. mutans* growth to one quarter of the control whereas *S. sanguinis* exhibited over 80% growth relative to the control. Similarly, the extract mzw-3 from *Michelia x alba* reduced overnight *S. sobrinus* growth to approximately one quarter that of the control whereas *S. sanguinis* grew to 90% of the control. Reductions in biofilm viability following two-hour exposures were more modest but increased when the two agents were combined.

Conclusions: Two magnolia plant extracts with selective toxicity were identified — one with activity against *S. mutans* and one with activity against *S. sobrinus*. Further purification and development of these substances may lead to clinically useful applications.

Supported by: University of Iowa Dental Research Grant

70. An Investigation of the Availability of Consumer Prices for a Single Tooth Implant

Z.S. Goettsche[1], *R.L. Ettinger*[1], F. Qian[1]

[1]University of Iowa, Iowa City, IA

Objective: The objective of this study was to assess the availability of cost of a single tooth implant in academic and private practice settings.

Methods: Two board certified prosthodontists in private practice from each state and the prosthodontics departments at all the dental schools in the United States were contacted. A standardized script was used to request an estimate of costs associated with a dental implant. Three calls on three different days were attempted before a responder was deemed unsuccessful. All data was recorded and a statistical analysis was performed using two sample t-tests, a one-way ANOVA with post-hoc Tukey-Kramer test, the nonparametric Wilcoxon rank-sum test, and the Krusal-Wallis test when appropriate.

Results: 80 private practice dentists and 64 dental schools were reached by telephone. Academic settings had a statistically significantly higher response rate for estimating the cost of an implant and crown ($p<0.0005$). Increased city size was found to be marginally statistically significantly ($0.05<p<0.10$) better at providing total cost amounts. Dental offices from the West and Southwest were more likely to provide implant cost estimates than any other region ($p<0.0117$).

Academic practices were found to have statistically significantly lower costs when compared to private practices ($p<0.0005$). Crown only costs were statistically significantly higher in the Northeast ($p<0.0002$).

Conclusions: Availability of pricing information to the consumer differ among practice settings and locations. Future research should be directed towards determining how consumers use this information to compare prices for dental procedures.

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Author–Abstract Index

Presenters are **underlined**.
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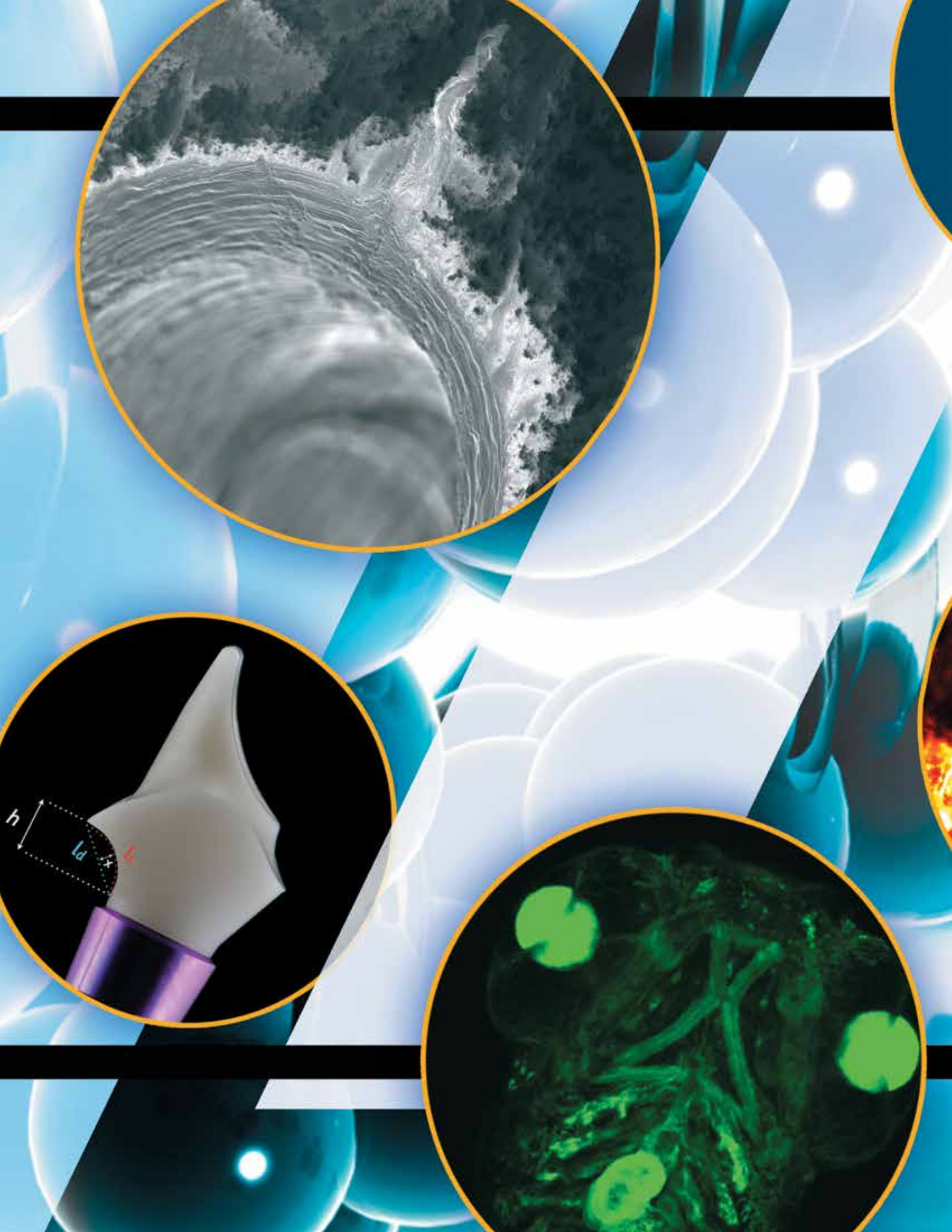
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