

2016



THE
UNIVERSITY
OF IOWA

COLLEGE OF DENTISTRY
& DENTAL CLINICS



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

63rd Annual
Meeting



Keynote Address:

Innovative Polymeric Scaffolds for Bone Tissue Engineering: Collaborative Progress with Faculty Members of the University of Iowa College of Dentistry

In this presentation, Dr. Salem will provide an overview of his research developing scaffolds for bone and dental regeneration over the last fifteen years. His talk will include the development of injectable scaffolds that self-assemble at the site of injection, the use of microfabrication methods to provide localized and spatial control over cell binding, the use of biodegradable micro and nanoparticles to deliver therapeutics that promote bone cell differentiation, the use of natural materials such as collagen and chitosan as scaffolds for bone regeneration, and the delivery of microRNA, siRNA, chemically modified RNA and plasmid DNA within these scaffolds to promote bone cell proliferation, differentiation and regeneration. The research presented in this talk represents collaborative research developed in partnership with University of Iowa College of Dentistry investigators such as Drs. Schneider, Elangovan, Hong, Amendt, and others.

Our Keynote Speaker

Dr. Salem studied applied chemistry at Aston University of Science and Technology, Birmingham, UK; received his Ph.D. in pharmacy at the University of Nottingham, UK; then completed postdoctoral training at the Johns Hopkins School of Medicine in Baltimore.

He currently leads the Pharmaceutical and Translational Therapeutics (PTT) division at the University of Iowa College of Pharmacy. Since 2012, he has also been leader of the Experimental Therapeutics Program at the Holden Comprehensive Cancer Center. From 2009 to 2013, Dr. Salem was an American Cancer Society Research Scholar.

His research explores the synergistic application of new polymers and nanotechnology for regenerative medicine and cancer vaccines. Dr. Salem has authored over 200 scholarly publications, patents, and presentations, and has published in several journals, including Proceedings of the National Academy of Sciences (PNAS), Nature Materials, Advanced Materials, and Biomaterials.



Aliasger Salem, Ph.D
Professor and Head,
Division of Pharmaceutics and
Translational Therapeutics,
University of Iowa
College of Pharmacy

He has been nominated for the College of Pharmacy's collegiate teacher of the year every year, and received the award in 2012. Dr. Salem also received the 2006 College of Pharmacy Teacher of the Year, and the 2008 UI Council of Teaching Instructional Improvement Award.



Dental research images for the cover were provided by Sherri Chyi, Sheila Daniels, and Hanan Elgendy.

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Dear Colleagues:

Thank you for your participation in the 63rd Anniversary of the University of Iowa College of Dentistry's Local Research Day on February 16, 2016. 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 Professor Aliasger Salem as our keynote speaker. Dr. Salem is the Bighley Professor and Head of the Division of Pharmaceutics and Translational Therapeutics (PTT) at the University of Iowa College of Pharmacy. Professor Salem has a joint appointment in Dentistry with many active collaborations.

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

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

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

Best wishes,

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



February 16, 2016 Dental Research participants and Iowa Section of AADR:

The University of Iowa College of Dentistry (CoD) is committed to advancing science in our laboratories and clinics. Science in the clinics and research laboratories is focused on several thematic areas for the improvement of oral health and patient care. Interdisciplinary collaboration between CoD scientists and other University of Iowa researchers are essential to the training of future dentists and dental researchers.

The CoD engenders language and methodology fundamental to the evolving disciplines of bio technology, 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. Aliasger Salem, Ph.D. as our featured keynote speaker. Dr. Salem is the Bighley Professor and Head of the Division of Pharmaceutics and Translational Therapeutics (PTT) at the University of Iowa College of Pharmacy. Dr. Salem is the Leader of the Experimental Therapeutics Program at the Holden Comprehensive Cancer Center at the University of Iowa. Dr. Salem's research is focused on the synergistic application of new polymers and nanotechnology for regenerative medicine and cancer vaccines. He is a friend of the College of Dentistry and works with multiple faculty members to promote oral health. He has received numerous awards for research teaching and service and is an NIH funded researcher.

Warmest Regards,

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

Kim Brogden Ph.D.
Director, Iowa Institute for Oral Health
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 AADR, we are pleased to welcome you to the University of Iowa College of Dentistry & Dental Clinics' 63rd annual Research Day.

This open forum event offers colleagues and students an opportunity to present their exciting research findings and accomplishments to the larger research community. Findings in basic, translational, clinical, health policy, and services research underscore the breadth of research being conducted within our College. Research Day represents a unique moment each year to observe and invigorate our investigative activities.

We are honored to welcome Dr. Aliasger Salem as our keynote speaker. Dr. Salem is the Bighley Professor and Head of the Division of Pharmaceutics and Translational Therapeutics (PTT) at the University of Iowa College of Pharmacy. His innovative research is currently focused on exploring the synergistic application of new polymers and nanotechnology for regenerative medicine and cancer vaccines.

We thank the presenters, volunteering judges, and support staff for making this event successful. We would also like to express appreciation to our Research Day sponsors, without whose support this day would not be possible.

Sincerely,

Veerasathpurush Allareddy BDS PhD
Associate Professor
Department of Orthodontics
President, Iowa Section of AADR

Sreedevi Srinivasan BDS, ScD
Assistant Professor
Department of Orthodontics
Vice-President, Iowa Section of AADR

Sharon Seydel
Department Administrative Manager
Iowa Institute for Oral Health
Secretary/Treasurer Iowa Section of AADR

Program

Iowa Section of the American Association for Dental Research (AADR) 63rd Annual Meeting, Tuesday, February 16th, 2016

- 7:30 a.m.** **Reception with Coffee and Rolls** (1st Floor)
- 8:00 a.m.** **Welcome Address** (Galagan A/B/C)
Dr. David Johnsen
- Conferment of Centennial Research Professorship
to Dr. Brad Amendt**
- Keynote Speaker Introduction**
Dr. Veerasathpurush Allareddy
- 8:20 a.m.** **Keynote Address** (Galagan A/B/C)
Dr. Aliasger Salem
- 9:20 a.m.** **Break**
- 9:30 a.m. - 11:45 a.m.** **Oral Presentations**
Session 1 (Galagan A)
Session 2 (Galagan B)
Session 3 (Galagan C)
Evidence-Based Research Session (Oral-B Classroom N212)
- 11:30 a.m. – 12:40 p.m.** **Poster & Table Clinic Presentations**
(Iowa Institute for Oral Health, 4th Floor Link, W220 A/B)
- 5:00 p.m.** **Awards Banquet Reception with Cash Bar** (Coralville Radisson)
- 6:00 p.m.** **Awards Banquet Dinner & Awards** (Coralville Radisson)

Presentation Assignments

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

Oral Session 1

9:30 a.m. - 11:45 a.m., Galagan A

- (a) Max Smith Pre-Doctoral Competition
- (b) Max Smith Graduate and Post-Doctoral Competition
- (c) Dentsply Implants Competition
- (g) Endodontic Michel Fuller Post-Doctoral Award
- (h) Iowa Society of Periodontology Pre-Doctoral Award
- (i) Iowa Society of Periodontology Post-Doctoral Award
- (j) Operative Dentistry Post-Doctoral Award
- (o) Pediatric Dentistry Post-Doctoral Award

1. ^{a,h} **M.P. Gomez Hernandez**, *K.A. Brogden*, E.A. Lanzel, C.N. Treinen, A.M. Bates, C.L. Fischer, G.K. Johnson, J.M. Guthmiller, T. Abbasi, S. Vali
Detection of PD-L1 Expression on HNSCC Cells
2. ^{a,h} **T.M. Schramm**, C.B. McKnight, *K.A. Brogden*
Detection of Viable Oral Microorganisms on Disposable Clinic Coats Using HOMINGS
3. **J.J. Warren**, J. VanBuren, S.M. Levy, J.E. Cavanaugh, T.A. Marshall
Caries Trajectories and Associated Risk Factors in Children and Adolescents
4. ^{b,j} **A. Jain**, *S.R. Armstrong, J.A. Banas*, F. Qian, R. Rocha Maia, E.C. Teixeira
Biofilm-Based Degradation of Dental Adhesive Microtensile Bond Strength
5. ^{b,g} **P.P. Lundine**, *B.C. Justman*, A.E. Williamson, F. Qian
Cyclic Fatigue Failure of EdgeFile X7 Series File
6. ^{b,c,i} **V.P. Abhyankar**, C.L. Fischer, A.M. Bates, P. Nair, R. Vidva, S. Chandrashekaraiyah, G.K. Johnson, J.M. Guthmiller, T. Abbasi, A. Progulsk-Fox, S. Vali, *K.A. Brogden*
Cytokine Responses of Transwell Co-Cultures Treated with *Porphyromonas gingivalis* Hemagglutinin B
7. ^{b,j} **A. Alshehri**, *S.R. Kwon*, D.V. Dawson, M.A. Vargas, *P.W. Wertz*
Effect of Double-Layer Treatment on Nitrate Penetration and Color Change
8. ^{b,o} **P.J. Stanley**, *M.K. Geneser*, F. Qian, J.J. Warren, *K. Weber-Gasparoni*
Factors Associated with Non-Cavitated Lesions among Very Young WIC-Enrolled Children

Oral Session 2

9:30 a.m. - 11:45 a.m., Galagan B

- (a) Max Smith Pre-Doctoral Competition
- (b) Max Smith Graduate and Post-Doctoral Competition
- (h) Iowa Society of Periodontology Pre-Doctoral Award
- (j) Operative Dentistry Post-Doctoral Award
- (n) Orthodontics Post-Doctoral Award
- (o) Pediatric Dentistry Post-Doctoral Award
- (r) Basic Science Post-Doctoral Award

9. ^{b,n,r} **C. Da Fontoura**, B.A. Amendt, S. Eliason, *L.M. Moreno Uribe*
Functional Analysis of Malocclusion Candidates TWIST1 and SNAI3
10. ^{a,h} **C.N. Treinen**, M.M. Hernandez, A.M. Bates, E.N. Recker, E.A. Lanzel, C.L. Fischer, G.K. Johnson, J.M. Guthmiller, T. Abbasi, S. Vali, *K.A. Brogden*
Determination of Immune Evasion Phenotypes of HNSCC
11. ^{a,h} **E.N. Recker**, C.L. Fischer, A.M. Bates, G.K. Johnson, J.M. Guthmiller, S. Elangovan, *K.A. Brogden*
Novel Biomarkers of Periodontitis Produced in Cultured Oral Cells
12. **A. Butali**, A.I. Owais, D.V. Dawson, D.R. Blanchette, K.M. Kluesner, A.L. Marolf, L.R. Schaul, M.J. Kanellis, K.A. Brogden, B.A. Amendt, G. Avila Ortiz
Establishing a Dental and Craniofacial Biorepository in Iowa Integrated with Medical Records
13. ^{b,n,r} **Z. Sun**, C. Da Fontoura, M. Moreno, N.E. Holton, D.R. Thedens, F.B. Bidlack, P. Nopoulos, J.F. Martin, L.M. Moreno Uribe, *B.A. Amendt*
FoxO6 Regulates Hippo Signaling to Control Face Morphology
14. ^{b,r} **W. Yu**, X. Li, S. Eliason, Z. Sun, *B.A. Amendt*
Loss of Irx1 Function in Mice Leads to Neonatal Lethality and Tooth Defects
15. ^{b,r} **A.M. Bates**, C.L. Fischer, V.P. Abhyankar, G.K. Johnson, J.M. Guthmiller, A. Progulsk-Fox, T. Abbasi, S. Vali, *K.A. Brogden*
Matrix-Metalloproteinase Response of Transwell Co-cultures Treated with *Porphyromonas gingivalis* Hemagglutinin-B
16. ^{b,j} **H.A. Algamaiah**, C. Sampaio, L. Rigo, M. Janal, N. Tovar, P.G. Coelhoa, *R. Hirata*
Micro-Computed Tomography Evaluation of Bulk Fill Composites in Class II MOD Cavities
17. ^{b,o} **K.J. Beulke**, *M.K. Geneser*, B. Levy, J. Murph, J.M. Daly, *K. Weber-Gasparoni*
Iowa Family Physicians and Pediatricians Oral Health Knowledge and Practices

Oral Session 3

9:30 a.m. - 11:45 a.m., Galagan C

- (a) Max Smith Pre-Doctoral Competition
- (b) Max Smith Graduate and Post-Doctoral Competition
- (c) Dentsply Implants Competition
- (g) Endodontic Michel Fuller Post-Doctoral Award
- (h) Iowa Society of Periodontology Pre-Doctoral Award
- (i) Iowa Society of Periodontology Post-Doctoral Award
- (n) Orthodontics Post-Doctoral Award
- (p) Preventive and Community Dentistry Post-Doctoral Award
- (r) Basic Science Post-Doctoral Award

18. **R.J. Ries**, *B.A. Amendt*
Use of a Plasmid-Based microRNA Inhibitor System (PMIS) as a Platform for Adjuvant Treatment of Oral Cancers
19. ^{a,h,r} **R.P. Pesavento**, E.C. Boosalis, H.M. Nguyen, K.A. Brogden
Substituted Tetrahydropyran Polymers as Potential Drug Releasing Agents in the Oral Cavity
20. **C. Hogden**, L. Zhang, G.D. Martini, H.T. Rube, H. Bussemaker, *M.A. Pufall*
The N-Terminal Domain of the Glucocorticoid Receptor Modulates DNA-Binding Specificity
21. **A. Butali**, L.J. Gowans, T. Busch, J.C. Murray
Replication of Genome-Wide Association Candidate Genes in Three Sub-Saharan African Populations
22. T.S. Ghazal, H.J. Cowen, **D.J. Caplan**
Restoration Longevity among Nursing Facility Residents: A 30-Year Retrospective Study
23. ^{b,n,r} **M.E. Sweat**, Z. Sun, W. Yu, S. Eliason, N.E. Holton, J.F. Engelhardt, Z. Chen, *B.A. Amendt*
Sox2 Is Required for Periderm Formation to Inhibit Oral Adhesions and a Pitx2:Sox2:Lef-1 Network Regulates Incisor Development and Stem Cell Renewal
24. ^{b,g} **C.D. Heslington**, W. Liu, *A.E. Williamson, F. Teixeira*, D.J. Caplan, D.V. Dawson
The Condition of Teeth Referred to Endodontists: A Retrospective Study
25. ^{b,r} **A. Akkouch**, T. Sharp, B. Khorsand, C.L. Fischer, S. Eliason, A. Salem, K.A. Brogden, *B.A. Amendt, L. Hong*
microRNA-200c Directly Targets and Represses IL-6, IL-8, and CCL-5 Expression and Enhances Osteogenic Differentiation
26. ^{b,c,i} **C.L. Nicholas**, M. Gubler, C.A. Barwacz, V. Allareddy, *G. Avila Ortiz*
Post-Extraction Alveolar Ridge Bone and Mucosa Volumetric Changes Show Non-Correspondence

Pre-Doctoral Posters

11:30 a.m. - 12:40 p.m., Iowa Institute for Oral Health, 4th Floor Link, W220 A

- (d) Procter and Gamble Award
- (e) ADA Table Clinics Pre-Doctoral Award
- (h) Iowa Society of Periodontology Pre-Doctoral Award

27. ^{d,e,h} **A.M. Supowitz**, E.N. Recker, V. Allareddy, *S. Elangovan*
An Assessment of Trends in Periodontal Randomized Clinical Trials
28. ^{d,e} **D.J. Knight**, *C.L. Nicholas*, N.E. Holton, T. Yokley, T.E. Southard
An Examination of Integration Across the Units of the Nasal Septum
29. ^{d,e} **A. Vermeer**, E.S. Kopec, *R.N. Staley*, F. Qian
Antero-Posterior Measures in Normal & Class II Occlusions: Mixed-Permanent Dentitions
30. ^{d,e} **K. Bohn**, *R.N. Staley*, T. White, F. Qian
Antero-Posterior Measures in Normal and Class II Occlusions: Primary-Mixed Dentitions
31. ^{d,e,h} **E. Pantzlaff**, V. Allareddy, G. Avila Ortiz, *C.A. Barwacz*
Assessment of the Current Status and Trends of United States CODA-Accredited Post-Doctoral Periodontics Graduate Programs' Integration of Implant Provisionalization into Core Curricula
32. ^{d,e} **S. Resnick**, W. Liu, D.J. Lynch, *T.A. Marshall*, J.J. Warren, D.V. Dawson, K.R. Phipps, D.E. Starr, D.R. Drake
Associations Between Beverage Characteristics and Cariogenic Bacteria in American-Indian Children
33. ^{d,e} **M.T. Lam**, *D.R. Blanchette*, A. Alshehri, W. Ariyakriangkai, R.A. Alammari, *S.R. Kwon*
Comparison of Visual and Digital Assessment: Evaluating Common Wax-up Errors
34. ^{d,e} **E. Glenn**, *S.R. Armstrong*, F. Qian, J. Jessop
Effect of Nanoparticles on Conversion and Mechanical Properties of Dental Adhesives
35. ^{d,e} **D. Yu**, S.R. Armstrong, *E.C. Teixeira*
Effect of Polydopamine Root Dentin Coating on the Bonding of Glass-Ionomer
36. ^{d,e} **C.E. Bohn**, *M.R. McQuistan*, F. Qian
Enhancing Patient and Caregiver Education via Print and Multimedia Devices
37. **T.J. Crary**, *S.R. Armstrong*, F. Qian, R. Maia, S. Geraldeli
Evaluation of a Novel Fixation Method for Microtensile Testing of the Resin-Dentin Bond
38. ^{d,e} **S.Y. Park**, *S.R. Kwon*, F. Qian, P.W. Wertz
Evaluation of Various In-Office Tooth-Whitening Systems on Overall Color Change

39. **J.M. Colvin**, *L. Marchini, D.V. Dawson, W. Liu, H. Gu*
Expectation and Satisfaction among Different Prosthetic Therapies and Relationships with Other Patient-Related Variables
40. **M.M. Fulton**, *S.M. Levy, P.M. Polgreen*
Exploratory Descriptive Study of Digital Searches Concerning Fluoridation Terms
41. ^{d,e} **I.P. Newcomer**, *M.K. Geneser, T.A. Marshall*
Food Programs, Dietary Habits and Caries in Children Aged 2-5
42. **J. Szewczyk**, *H. Zhang, J.A. Banas*
Magnolia Plant Extracts with Selective Toxicity against Oral Streptococci
43. ^{d,e} **S. Howes**, *S. Srinivasan, S. Elangovan, V. Allareddy*
Marginal Ridge Discrepancy Post-Orthodontic Treatment and Changes in Crestal Bone Level - A Cross-Sectional Study
44. ^{d,e} **J. Gradoville**, *T.A. Marshall, D.R. Blanchette, J.J. Warren, D.V. Dawson, K.R. Phipps, D.E. Starr, D.R. Drake*
Nutrient Intakes Associated with Caries in American Indian (AI) Children
45. ^{d,e} **M.L. McCunniff**, *W. Liu, D.V. Dawson, L. Marchini*
Patients' Esthetic Expectations and Satisfaction of Complete Denture Therapy
46. ^{d,e} **A.R. Schell**, *A.I. Owais, W. Liu, D.V. Dawson, K. Weber-Gasparoni*
Premature Birth and Early Childhood Caries among Children 0-3 Years
47. ^{d,e} **L.N. Barshinger**, *F. Qian, J.J. Warren, K. Weber-Gasparoni*
Risk Factors Associated with ECC-Surface Location among Low-Income Young Children
48. **S.D. McGivern**, *S.M. Levy, P.C. Damiano*
State-Level Relationship between Dentists' CHIP Participation and Reimbursement Rates
49. ^{d,e} **T.R. Austin**, *D.J. Lynch, A.L. Villhauer, W. Liu, D.V. Dawson, J.J. Warren, T.A. Marshall, K.R. Phipps, D.E. Starr, D.R. Drake*
***Streptococcus sobrinus* Genotyping in American Indian Mother-Child Pairs**
50. ^{d,e} **E.C. Boosalis**, *H. Nguyen, R.P. Pesavento, K.A. Brogden*
Substituted Tetrahydropyran Polymers as Polysaccharide Mimics and Scaffolds for Design of Novel Antimicrobial Polymers
51. ^{d,e} **W.D. Clark**, *M.K. Geneser, A.I. Owais, M.J. Kanellis, F. Qian*
Success Rates of Hall Technique Crowns in Primary Molars: A Retrospective Pilot Study
52. ^{d,e} **Z.S. Goettsche**, *R.L. Ettinger, F. Qian*
Teaching of Geriatric Dentistry in the United States- Preliminary Results

- 53.^{d,e} **M. Hemming**, *S.R. Kwon, F. Qian, R.A. Alammari, P.W. Wertz*
The Effect of Dentin Location on Erosion Depth on Acid-Challenge
- 54.^{d,e} **H.A. Rinehart**, *S.F. Miller, T.E. Southard, N.E. Holton*
Third Molar Agenesis and Dental Arch Form: A Three-Dimensional Geometric Morphometric Analysis
- 55.^{d,e} **S. Chyi**, *S.R. Kwon, F. Qian, P.W. Wertz*
Time-Course Reaction of Blue Dye after Treatment with Hydrogen Peroxide
- 56.^{d,e} **M.E. Penticoff**, *A.I. Owais, W. Liu, D.V. Dawson, M.J. Kanellis, K. Weber-Gasparoni*
Traumatic Dental Injuries in Children: Experience of the College of Dentistry at the University of Iowa Pediatric Dentistry Clinics

Graduate, Faculty & Staff Posters & Table Clinics

11:30 a.m. - 12:40 p.m., Iowa Institute for Oral Health, 4th Floor Link, W220 A/B

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- (g) Endodontic Michel Fuller Post-Doctoral Award
 - (f) ADA Table Clinics Post-Doctoral Award
 - (i) Iowa Society of Periodontology Post-Doctoral Award
 - (j) Operative Dentistry Post-Doctoral Award
 - (k) Oral & Maxillofacial Pathology Post-Doctoral Award
 - (l) Oral & Maxillofacial Radiology Post-Doctoral Award
 - (n) Orthodontics Post-Doctoral Award
 - (o) Pediatric Dentistry Post-Doctoral Award
 - (p) Preventive and Community Dentistry Post-Doctoral Award
 - (q) Prosthodontics Post-Doctoral Award
 - (r) Basic Science Post-Doctoral Award
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57. **R.A. Kuthy**, *S.C. McKernan, P.F. Hanley*
Dentist Practice Location Demand Threshold at the Community Level
58. **A.I. Owais**, *M.J. Kanellis, D.V. Dawson, J.J. Warren, G.L. Wehby, D.R. Drake, W. Liu, A. Gasparoni, R. Oweis, M.C. Skotowski, M.K. Geneser, K. Weber-Gasparoni*
Medical Management of Caries in Primary Dentition Using Silver Nitrate
59. **M. Romero-Bustillos**, *G. Avila Ortiz, G.K. Johnson, B.A. Amendt*
Analysis of RNA Expression Profile to Induce Cementum Producing Cells
- 60.^{f,g} **C.M. Waltz**, *F. Qian, A.E. Williamson, F.B. Teixeira*
Assessment of Solubility of Carrier Based Obturation Systems: Guttacore and EdgeCore
- 61.^{f,p} **N. Balakrishnan**, *R.A. Kuthy, S.C. McKernan*
Characteristics Associated with Dentists' Attrition in Iowa: 1997-2014
- 62.^{f,j} **H.A. Elgendy**, *R. Rocha Maia, F.N. Skiff, G.E. Denehy, F. Qian*
Comparison of Light Propagation in Dental Tissues and Resin Composites

63. ^{f,i,r} **A. Thorn**, B. Khorsand, A. Salem
Evaluation of Biodegradable PLGA Implants for Local Delivery of Antioxidants
64. ^{f,n} **G. Borget**, L.M. Moreno, N.E. Holton, T.E. Southard, S.F. Miller
Longitudinal Analysis in Infant Dental Arch Shape
65. ^{f,l} **S.L. Sousa Melo**, N.E. Holton, K.F. Vasconcelos, C.P. Tabchoury, A. Ruprecht
Micro-CT Validation of a Chemically Induced Method to Simulate External Root Resorption - Pilot Study
66. ^{f,k} **C. Desai**, J.W. Hellstein, R.A. Robinson, M.B. Zimmerman, S.L. Sousa Melo
Retrospective Histopathologic Evaluation of Fibroblastic versus Myofibroblastic Entities of the Oral Mucosa
67. ^{f,r} **J. Smith**, M. Zhu, J.A. Banas
The Susceptibility of Oral Streptococci to Anti-Microbial Agents
68. ^{f,g} **K.A. Morio**, D.R. Drake, F.B. Teixeira, A.L. Villhauer, D.J. Lynch, J. Goree
Novel Multi-Species Root Canal Infection Model in Extracted Human Teeth
69. **J.M. VanBuren**, J.E. Cavanaugh, T.A. Marshall, J.J. Warren, S.M. Levy
Utilizing AIC to Determine Best Representation of Longitudinal Dietary Variables
70. **M.N. Aimable**, T. Sharp, J. Wang, X. Li, H. Cao, S. Cao, M. Moreno, B.A. Amendt
Direct Conversion of Dental Epithelial Cells to Dental Mesenchymal Cells by Overexpressing Pax9 and Inhibiting microRNA-200a
71. **S.L. Eliason**, L. Hong, T. Sharp, B.A. Amendt
microRNA-26b-5p Regulates Molar and Incisor Development
72. ^{f,j,q} **W. Ariyakriangkai**, M.A. Vargas
CAD/CAM Ceramic Laminate Veneers: Fact or Myth
73. ^{f,o} **D.M. Pelzer**, A.I. Owais, W. Liu, D.V. Dawson, M.K. Geneser, K. Weber-Gasparoni, M.J. Kanellis, S. Kelly, K.S. Leary, T.R. Mabry, M.C. Skotowski
Efficiency and Satisfaction Regarding Isolation Techniques for Sealant Placement

Evidence-Based Research Session

Presentations by D3 students (Moderator: Teresa Marshall)

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

Abstracts

1. Detection of PD-L1 Expression on HNSCC Cells

M.P. Gomez Hernandez¹, K.A. Brogden¹, E.A. Lanzel¹, C.N. Treinen¹, A.M. Bates¹, C.L. Fischer¹, G.K. Johnson¹, J.M. Guthmiller⁵⁴, T. Abbasi⁸⁰, S. Vali⁸⁰

¹University of Iowa, Iowa City, IA; ⁵⁴University of Nebraska, Lincoln, NE;

⁸⁰Cellworks Group, Inc., CA 95070, USA

Objectives: The Programmed Death (PD) pathway, involving receptor PD-1 on T-cells and ligand PD-L1 on tumor cells is an important immunotherapeutic checkpoint to inhibit in the control of head and neck squamous cell carcinoma (HNSCC).

Methods: A computational simulation model was developed to predict immunosuppressive biomarker profiles, including PD-L1. HNSCC (UM-SCC) cells grown in culture were used to confirm the responses. 1.0×10^6 cells of SCC4, SCC15, SCC25, SCC19, SCC84, SCC92, and SCC99 were incubated in polypropylene tubes and culture plates for 24 hours. SCC cells in tubes were processed for microtomy, and treated with antibodies to PD-L1 in immunohistochemistry (IHC) procedures. SCC cells adhered to culture plates were lysed, and concentrations of PD-L1 in cell lysates were determined (ELISA, American Research Products, Inc., Waltham, MA). An analogous two-way fixed effect ANOVA was fit to the log-transformed concentrations of PD-L1 (JMP10, SAS, Cary, NC) and pairwise group comparisons were conducted at a 0.05 level using the method of Tukey's Honest Significant Differences.

Results: Overall, there was 85% correlation between predictive vs. experimental biomarker trends for SCC4, SCC15, and SCC25 when comparing 2 cell lines at a time. PD-L1 was detected by IHC and the staining of cells varied from 4.0-73.0% depending upon the cell-line (average staining, 30.7%). Cell lysates contained significantly different ($p < 0.05$) concentrations of PD-L1 and ranged from 92.65 pg/ml (+38.13 pg/ml, SEM) for SCC19 to 387.59 pg/ml (+38.13 pg/ml, SEM) for SCC25.

Conclusions: Expression of PD-L1 by HNSCC cell lines can be determined based on their profile of genomic aberrations using a computational approach. Predicting PD-L1 responses of patient HNSCC cells will be an important step in identifying the role of the PD pathway in the response of patients to immunotherapy.

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2. Detection of Viable Oral Microorganisms on Disposable Clinic Coats Using HOMINGS

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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 on disposable lab coats. Such information may be important to policies regarding the repeated use of these lab coats in the clinic.

Objective: The objective of this study was to detect and identify viable oral bacteria isolated from disposable clinic coats used for one day in a dental clinic setting.

Methods: Genomic DNA was extracted directly from excised clinic coat fabric samples and purified. Adjacent fabric excisions were swabbed and streaked onto blood agar, tryptic soy broth agar supplemented with hemin and vitamin K, and tryptic soy broth supplemented with 0.6% yeast extract. The plates were incubated in aerobic and anaerobic conditions. Colonies were collected and pooled, with genomic DNA extracted. The Human Oral Microbe Identification using Next Generation Sequencing (HOMINGS) platform was used to identify oral species present in DNA samples.

Results: Bacteria were grown into colonies from every clinic coat sample. HOMINGS analysis identified an average of 16,216 reads per sample that were species unique and 47,980 reads per sample that were unique to a genus. For all samples that were directly extracted and also cultured, all bacteria that were in the cultured samples were also found in the directly extracted sample.

Conclusions: Viable bacteria were cultured after removal from clinic coats. The species that make up this population are within the population of species found in total DNA collection from equivalent samples.

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3. Caries Trajectories and Associated Risk Factors in Children and Adolescents

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Objective: There has been little study of dental caries in adolescents, despite high prevalence, and little study of the longitudinal caries patterns and risk factors. The purpose of this study was to assess different caries trajectories and associated risk factors among members of the Iowa Fluoride Study (IFS) cohort.

Methods: The IFS recruited a birth cohort from 1992 to 1995, and has gathered dietary, fluoride and behavioral data at least twice yearly since recruitment. Examinations for dental caries were completed when subjects were ages 5, 9, 13 and 17 years. For these analyses, only participants with DFS caries data at age 9, 13, and 17 were included (N=413). The DFS counts for every person at age 13 and the DFS increment from 13 — 17 were used to identify distinct caries trajectories using Ward's hierarchical clustering algorithm. A number of multivariable models were developed to predict trajectory membership, using longitudinal dietary, fluoride and demographic/behavioral data from 9 to 17 years. Model selection was based on the Akaike Information Criterion (AIC).

Results: Several different trajectory schemes were considered, and a 3 trajectory scheme — no DMF (n=150), low DFS (n=151) and high DFS (n=112) — was chosen to balance sample sizes and interpretability. The model selection process resulted in averaging exposure data across the period from 9 to 17 years. The multinomial logistic regression model with the best fit included the variables maternal education level, 100% juice consumption, brushing frequency and gender. Other favored models also included water, milk, soda pop or sugared beverage consumption. The high caries trajectory group was most consistently associated with lower maternal education level, lower 100% juice consumption, lower brushing frequency and being female.

Conclusions: A number of factors were associated with caries trajectories, including dietary, oral hygiene and demographic factors.

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4. Biofilm-Based Degradation of Dental Adhesive Microtensile Bond Strength

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The objective of this work was to develop a short-term, clinically relevant, biofilm-based aging/storage model for lab testing of newer dental adhesives in order to predict their long-term performance. To do this we tested the hypothesis that 15 days of biofilm challenge with cariogenic bacterial species, *Streptococcus mutans* (SM) and *Streptococcus sobrinus* (SS), would produce similar reduction in microtensile bond strength (μ TBS) of dental adhesives as 6 months of water storage (WS). Thirty-one molars were flattened to dentin, restored using Optibond-FL and Z-100, sectioned and trimmed into four dumbbell-shaped specimens and randomly distributed according to aging conditions (n=31): A) WS for 6 months, B) WS for 5.5 months + SM-biofilm challenge for 15 days, C) SM-biofilm challenge for 15 days and D) SS-biofilm challenge for 15 days. Specimens were gripped centrally with respect to the test axis with a non-gluing passive gripping device. μ TBS testing was performed using a Zwick Material Testing Machine at a crosshead speed of 1 mm/min and failure modes were classified using light microscopy. Mixed model ANOVA and Weibull regression model revealed that types of storage conditions significantly affected the μ TBS ($p < 0.0001$). Mean μ TBS observed with group A (49.69 ± 15.53 MPa) was significantly higher than those in groups B (19.26 ± 6.26 MPa), C (19.92 ± 5.86 MPa) and D (23.58 ± 7.88 MPa). Also, μ TBS obtained with group D was significantly greater than that with groups B and C, while no difference was seen between the latter two groups. Chi-square test indicated that specimens from groups B (74.2%), C (83.9%) and D (80.6%) were more likely to have cohesive failures in dentin than from group A (54.8%).

The findings of this study indicated that 15 days of SM- and SS-based biofilm challenge produced more reduction in μ TBS of dental adhesive than 6 months of WS and appear to be a promising *in vitro* aging model.

5. Cyclic Fatigue Failure of EdgeFile X7 Series File

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Introduction: A new nickel titanium (NiTi) rotary file system called EdgeFile has recently been introduced by EdgeEndo. This file offers a trademarked heat treated alloy named Fire-Wire, and claims superior cyclic fatigue resistance compared to other commercially available NiTi file brands. The purpose of this *in vitro* study was to compare the cyclic fatigue resistance of the EdgeFile X7 series with other commercially popular NiTi brands including Profile Vortex (PV; Denstply, Tulsa Dental Specialties, Tulsa, OK), Vortex Blue (VB; Denstply, Tulsa Dental Specialties, Tulsa, OK), K3XF (K3; Sybron Dental Specialties, Glendora, CA), EndoSequence (ES; Brassler, Savannah, GA) and HyFlex CM (HF; Coltene/Whaledent Inc, Cuyahoga Falls, OH).

Materials and Methods: Three hundred NiTi files of ISO size 30 with a constant taper of 0.04mm/mm (n=50/ per group) were rotated in a simulated canal until failure using the manufacturer recommended RPM and torque settings. The number of rotations to failure was determined to evaluate cyclic fatigue resistance. Descriptive statistics were computed for the number of rotations to failure. One-way ANOVA based on rank-transformed data followed by the post-hoc Bonferroni test was used to detect a significant difference in the cyclic fatigue resistance among six experimental groups ($\alpha=0.05$).

Results: Significant differences were noted between each of six experimental groups ($p < 0.05$ in each instance). The greatest to the least median and mean \pm SD number of rotations to failure were: EdgeFile-X7 (3417.04/3843.93 \pm 1817.18); HyFlex-CM (1706.08/1730.7 \pm 424.15); Profile-Vortex (1129.21/1146.05 \pm 179.89); Vortex-Blue (931.46/925.21 \pm 126.42); K3XF (703.79/710.2 \pm 143.36); EndoSequence (309.29/309.06 \pm 63.05).

Conclusions: Using a simulated canal model, cyclic fatigue resistance was greatest for EdgeFile X7, followed by HyFlex CM, Profile Vortex, Vortex Blue, K3 XF and lastly EndoSequence.

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6. Cytokine Responses of Transwell Co-Cultures Treated with *Porphyromonas gingivalis* Hemagglutinin B

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Introduction: Hemagglutinin (Hag)B, a virulent factor is a nonfimbrial adhesin expressed on the surface of *P. gingivalis*. Cytokine responses seen from single cells are not representative of the cytokine profiles seen in clinical samples.

Objective: To test the hypothesis that chemokine and cytokine responses will not only be influenced by *P. gingivalis* Hag B but also the co-cultured model containing dendritic cells, gingival epithelial (GE) keratinocytes, and T-cells.

Methods and Materials: Hag B was prepared by cloning Hag B of *P. gingivalis* in *E. coli* and isolating Hag B from *E. coli* lysates. Three-cell transwell co-cultures were assembled, treated with Hag B or the Hag B diluent as a control, incubated at 37° C and media was collected at 0, 2, 4, 8, 16, 32, and 64 hours.

Chemokine and cytokine biomarkers were determined using Milliplex immunoassays and statistical differences among groups determined.

Results: Buffers (e.g. Hag B diluent) did not induce a chemokine or cytokine response, however a gradual increase in responses from cells occurred at 64 hours. These were subtracted from Hag B induced responses.

Responses generally fell in 2 groups. In one group containing VEGF, IL-12 (p40), IL-6, RANTES and GM-CSF, there were no significant differences among groups (p>0.5)

In another group containing IL-1 α , IL-8, MIP-1 α , MIP-1 β and TNF- α , there were significant differences among groups. (P<0.05)

Some responses were driven by a particular cell type e.g. GM-CSF by dendritic cells, Hag B induced RANTES by T-cells, VEGF by T cells.

There were similar responses in Hag B-induced IL-8, MIP-1 β , MIP-1 α and TNF α responses by dendritic cells + keratinocytes and dendritic cells+keratinocytes+T cells

Conclusions: Co-culture models can more realistically determine chemokine and cytokine responses of cells to agonists and help in understanding the inflammatory process which is important for predicting and assessing novel therapeutic treatments of periodontal disease.

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7. Effect of Double-Layer Treatment on Nitrate Penetration and Color Change

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Objectives: Evaluate and assess the effect of an innovative double layer, single application desensitizing/whitening technique on nitrate penetration and total color change.

Methods: Specimens were prepared from extracted caries-free human molars (n=160). Teeth were randomly assigned into four groups: 100µl 25% hydrogen peroxide (Philips Zoom chairside) as control group (CTRL), double layer treatment of 20µl 5% potassium nitrate (Relief ACP, Philips oral care) and 100µl 25% hydrogen peroxide (DL20), double layer treatment of 40µl 5% potassium nitrate and 100µl 25% hydrogen peroxide (DL40), and one layer treatment of 40 µl 5% potassium nitrate (PN40). Spectrophotometric color measurements (Vita EasyShade) were done at base line (T0), one day (T1), and one month (T2) following the treatment. Nitrate penetration was measured using a nitrate/nitrite assay kit. Group comparisons of tooth color difference measurements, and nitrate penetration readings were made using the Kruskal-Wallis test. Adjustment was made for pairwise treatment comparisons using the Tukey method in conjunction with an overall 0.05 level of significance.

Results: 160 teeth were used. Color difference (ΔE) results at (T1) and (T2) showed no significant difference among the CTRL, DL20, DL40 groups. But there was a statistical significant difference between those groups and the single layer (PN40) group ($p < 0.001$, $p < 0.001$ respectively). Data provided strong evidence of differences in nitrate penetration among the four groups ($p < 0.0001$). Groups DL20, DL40, PN40 significantly differed from CTRL, but could not be said to differ from each other.

Conclusion: Double layer technique showed no effect on color difference at one day and one month. The application of hydrogen peroxide didn't affect the penetration of potassium nitrate.

Acknowledgment: Whitening materials were provided by Philips Oral Healthcare.

Key Words: Tooth Whitening, Double-Layer Technique, Potassium Nitrate Penetration, Hydrogen Peroxide, Total Color Change.

8. Factors Associated with Non-Cavitated Lesions among Very Young WIC-Enrolled Children

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Purpose: Identify and evaluate risk factors associated with non-cavitated lesions among children aged 9 to 47 months enrolled at the University of Iowa's Infant Oral Health Program (IOHP) at the Johnson County WIC Clinic.

Methods: Case-control data were obtained from a chart review of 174 children's first IOHP visit, with 87 having non-cavitated lesions (ECC Group) and 87 caries-free (caries-free group). Children were matched by age (± 1 year) and number of teeth (± 1). Caries were recorded using the d1d2-3 caries scoring criteria. Risk data included socio-demographic factors, dietary/oral hygiene habits, presence of visible plaque on maxillary incisors, maternal ECC awareness, and language barrier. Descriptive statistics, bivariate analyses, and logistic regression were used for the statistical analysis ($\alpha = 0.05$).

Results: Children's mean age (51% female and 61% non-Caucasian) was 27.4 ± 10.4 months, with an average of 16.2 ± 4.6 teeth. About 45% of the children had no dental insurance and 87% of them had never been to a dentist. When compared to children in the caries-free group, bivariate analyses indicated that children in the ECC group were less likely to be exposed to fluoridated water ($P = 0.0335$), but more likely to be non-Caucasian ($P = 0.0084$) and have visible plaque on their maxillary incisors ($P = 0.0077$). Final logistical regression analysis revealed that children in the ECC group were more likely to have parents with a language barrier ($OR = 4.62$; $P = 0.0002$) and have inadequate levels of fluoride (e.g. no regular use of fluoride toothpaste and/or non-fluoridated drinking water), ($OR = 4.61$; $P = 0.0124$).

Conclusions: Parental language barrier and children's exposure to fluoride were the most significant predictors of non-cavitated lesions in this group of very young children.

Supported by: University of Iowa Department of Pediatric Dentistry

9. Functional Analysis of Malocclusion Candidates TWIST1 and SNAI3

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Introduction: We recently identified significant associations ($p < 0.0001$) between SNPs rs9931509, 3'UTR of *SNAI3* with severe antero-posterior maxillo-mandibular discrepancies and rs2189000, 5' UTR of *TWIST1* with mandibular body length in malocclusion cases. *In silico* analysis predicted that transcription factor bindings sites (TFBS) for *PITX2* and *SOX2* exist upstream of *TWIST1* and that *TWIST1* SNP rs2189000 disrupts *PITX2* binding. Also various micro RNA binding sites were located within the 3'UTR of *SNAI3* which presumably regulate *SNAI3* post-transcriptionally. This study evaluates if associated SNPs regulate *SNAI3* and *TWIST1* function.

Methods: The 4.7 kb *TWIST1* 5' UTR region was cloned into a TK-Luciferase vector to test for changes in Luciferase expression in the presence of *PITX2* or *SOX2*. Also an 800 bp region in the 3' UTR of *SNAI3* was cloned into a pMIR-REPORT vector to test effects of predicted microRNAs on the post-transcriptional regulation of *SNAI3*. Further, a Luciferase transfection reporter plasmid and assays were performed in LS8 and CHO cell lines to uncover *TWIST1* and *SNAI3* regulation.

Results: Preliminary results indicate that in the presence of *PITX2*, the *TWIST1* promoter is activated. LS8 cells yielded ~7-fold greater activation while CHO cells yielded ~10-fold greater activation ($p < 0.05$) of the *TWIST1* promoter. Moreover, the presence of *SOX2* also increased the expression in both cell lines. We hypothesize that SNP rs2189000 rare allele may reduce *TWIST1* promoter's *PITX2* and *SOX2* responsiveness and are currently testing this. Also, we are testing whether predicted microRNAs can affect the *SNAI3* reporter construct and protein levels and if *SNAI3* SNP rs9931509 modulates these responses.

Conclusion: Results on mouse cell lines confirm *in silico* results suggesting that the *PITX2* and *SOX2* genes regulate *TWIST1* expression. Ongoing efforts will test if rare alleles of rs2189000 and rs9931509 will alter *TWIST1* expression and *SNAI3* post-transcription levels respectively and explain our association results.

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10. Determination of Immune Evasion Phenotypes of HNSCC

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Objectives: The programmed death (PD-1/PD-L1) pathway is the focus of immunotherapeutic checkpoint inhibition for the control of head and neck squamous cell carcinoma (HNSCC). However, it may be only part of the total immunosuppressive biomarker profile of these cells. The objective of this study was to determine immunosuppressive biomarker profiles to identify immune evasion phenotypes of HNSCC using a computational and experimental approach.

Methods: A computational simulation model was developed and used to predict immunosuppressive biomarker profiles and HNSCC (UM-SCC) cells grown in culture were used to confirm the responses. 1.0×10^6 viable cells/ml of SCC4, SCC15, SCC25, SCC19, SCC84, SCC92, and SCC99 were incubated in culture for 24 hours. RPMI-1640 was removed and concentrations of extracellular biomarkers were determined (Milliplex immunoassays, Millipore, Billerica, MA). Adherent cells were lysed and concentrations of cell-associated biomarkers were determined (ELISA, American Research Products, Inc., Waltham, MA). An analogous two-way fixed effect ANOVA was fit to log-transformed concentrations of biomarkers (JMP10, SAS, Cary, NC) and pairwise group comparisons were conducted at the 0.05 level using the method of Tukey's Honest Significant Differences (HSD).

Results: There was an average of 85% correlation between predictive vs. experimental biomarker trends for SCC4, SCC15, and SCC25 when comparing 2 cell lines at a time. In culture, SCC cell lines produced different concentrations of immunosuppressive biomarkers including IL6, IL10, TGF β 1, VEGF, FASL, CD47, IDO, PD-L1 and other chemokines and cytokines. SCC4, SCC15, SCC25, and SCC99 cell lines produced significantly higher concentrations ($p < 0.05$) of immunosuppressive biomarkers than SCC19, SCC84, and SCC92 cell lines.

Conclusions: Expression of immunosuppressive biomarkers by HNSCC cell lines can be determined based on their profile of genomic aberrations using a computational approach. These cells likely represent different immune evasion phenotypes, a finding that will clearly impact the type of immunotherapy used to treat patients with HNSCC.

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11. Novel Biomarkers of Periodontitis Produced in Cultured Oral Cells

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Interleukin-1 receptor antagonist (IL-1ra), sCD40L, GranzymeA, GranzymeB, and alpha-fetoprotein (AFP) are novel biomarkers of periodontitis recently detected in saliva of periodontal maintenance program subjects. However, their cellular origins in the oral cavity are not well-known. The objective of this study was to determine their presence in culture media of gingival epithelial (GE) keratinocytes, dendritic cells (DCs), and activated T-cells grown in standardized culture conditions.

Human oral GE keratinocytes, DCs, and T-cells were cultivated in their respective media, transferred to high glucose RPMI-1640 containing L-glutamine with HEPES (ATCC, Manassas, VA), and adjusted to 1.0×10^6 viable cells/ml. One ml was aliquoted into wells of a 12-well culture plate. At 24 hours, tissue culture medium was removed and centrifuged to remove residual cells. Concentrations of IL-1ra, sCD40L, GranzymeA, GranzymeB, and AFP were determined in media supernatant using multiplex immunoassays. An analogous two-way fixed effect ANOVA was fit to log-transformed concentrations (JMP10, Version 10.0, SAS, Cary, NC) and pairwise group comparisons were conducted using Tukey's Honest Significant Differences (HSD), $p=0.05$.

Mean concentrations of GranzymeA (50.7 pg/ml), GranzymeB (1,595.7 pg/ml), and sCD40L (130.6 pg/ml) were produced almost exclusively by CD4+ T-cells in culture and were present in significantly higher concentrations in T-cell media supernatants than in DC and GE keratinocyte media supernatants. Mean concentrations of IL-1ra were produced by GE keratinocytes (2,6455.0 pg/ml) and DCs (10,708.7 pg/ml) in culture and were present in significantly higher concentrations in media supernatants than in T-cell (2.8 pg/ml) media supernatants. AFP was produced in all three cell types, but there were no differences among the concentrations in culture supernatants.

Levels of four novel biomarkers of periodontitis were produced under basal conditions by GE keratinocytes, DCs, and activated T-cells in cell culture. Future studies will assess their role in periodontal disease and their potential as diagnostic biomarkers.

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12. Establishing a Dental and Craniofacial Biorepository in Iowa Integrated with Medical Records

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With the recent decision by the Obama Administration to promote precision medicine in order to improve the health of Americans, it has become critical and expedient for dental scientists and clinicians to adopt this national position. Furthermore the National Institutes for Health and its constituent institutes, including the National Institute for Dental and Craniofacial Research, have also embraced precision medicine and included this in their future strategic and research focus. In response to these current realities, we (clinicians and scientists) at the College of Dentistry, University of Iowa have initiated the establishment of a Dental Biobank that will combine a DNA bank with dental and medical records of all patients visiting the dental clinic at the College. This resource will be available to researchers at the College of Dentistry and University. These researchers can study any type of dental condition or disease using this information from the DNA bank, as well as the clinical chart information from the patients. The biobank will provide an opportunity to collect biological materials such as saliva for DNA, RNA, tissues and teeth for research use in order to improve our understanding of health and disease.

13. FoxO6 Regulates Hippo Signaling to Control Face Morphology

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In this report we demonstrate that tissue-specific Hippo signaling regulates anterior growth of the face and is a crucial component in determining human facial characteristics. We have identified the transcriptional factor FoxO6 as an activator of Hippo signaling with specific expression in the brain and craniofacial tissues. FoxO6 loss-of-function mice undergo expansion of the face and skull, enlargement of the mandible and maxilla and lengthening of the incisors associated with increases in cell proliferation. FoxO6 activates Lats1 expression, thereby increasing Yap phosphorylation to control Hippo signaling. A phenotype-genotype correlation test identified significant associations ($p < 0.05$) with three FOXO6 human single nucleotide polymorphisms in Caucasian adults with dento-skeletal bite problems ranging from retrognathism to prognathism of both jaws. Together, these results identify a FoxO6-Hippo regulatory pathway that controls skull growth, odontogenesis and face morphology. These data suggest that human FOXO6 mutations explain differences in the human face form.

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14. Loss of Irx1 Function in Mice Leads to Neonatal Lethality and Tooth Defects

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Dental defects, such as tooth agenesis and enamel hypoplasia, are among the most common developmental anomalies in human. Initiation, morphogenesis, and differentiation are the three fundamental processes for tooth development, which result in sequential cellular processes such as proliferation, differentiation, migration, and secretion, leading to the formation of a functional tooth. Although the process and mechanism of dental development is well established, it remains elusive that how some transcription factors control the cell differentiation and migration. Iroquois homeobox 1 (Irx1), as a novel DNA homeobox binding transcription factor, is highly expressed during tooth development with unknown function. Our preliminary data showed that Irx1 is only expressed in outer enamel epithelium (OEE) and Stratum intermedium (SI) layer of tooth, which makes it an ideal candidate to study the function of OEE and SI during amelogenesis. Knocking out Irx1 in mice leads to neonatal lethality and pulmonary immaturity. Irx1-deficient mice show delayed lung maturation characterized by defective surfactant proteins secretion and shorter lower incisors in E18.5 embryos. CIdU and IdU incorporation assays showed that cell migration is down-regulated in Irx1^{-/-} lower incisor. Gel shift assay and chromatin immunoprecipitation assay showed that Pitx2 binds to the promoter region of Irx1 and regulates the transcriptional activity of Irx1. RNA-seq analysis on the craniofacial tissues at E14.5 from wild type and Irx1 knockout mice shows that about 300 genes are down-regulated and about 70 genes are upregulated, suggesting that Irx1 dominantly acts as a transcription activator during tooth development.

Supported by: Carver College of Medicine; College of Dentistry

15. Matrix-Metalloproteinase Response of Transwell Co-Cultures Treated with *Porphyromonas gingivalis* Hemagglutinin-B

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Introduction: Matrix metalloproteinases (MMPs) are enzymes involved in periodontal tissue destruction. Previously we found that hemagglutinin B (HagB) from the periodontal pathogen *Porphyromonas gingivalis* induces enhanced MMP responses in human dendritic cells. However, responses from individual cell types are often not representative of responses seen in clinical samples.

Objective: The objective of this study was to measure the *P. gingivalis* HagB induced MMP response in a transwell co-culture containing dendritic cells, gingival epithelial (GE) keratinocytes, and T-cells.

Methods: HagB was expressed in *E. coli* and purified. Three-cell transwell co-cultures were assembled, treated with HagB or the HagB diluent as a control, and incubated at 37°C. Tissue culture media was collected at 0, 2, 4, 8, 16, 32, and 64 hours. Results from the transwell co-culture model were verified by checking HagB-induced chemokine and cytokine responses. The responses of nine MMPs (MMP-1, MMP-2, MMP-3, MMP-7, MMP-8, MMP-9, MMP-10, MMP-12, and MMP-13) were determined after 64 hours. An analogous two-way fixed effect ANOVA was fit to log-transformed concentrations of the MMPs and pairwise group comparisons were conducted using Tukey's Honest Significant Differences test ($p < 0.05$).

Results: The dendritic cell MMP-1 response (218.8pg/ml) was attenuated in dendritic cell+keratinocyte (18.9pg/ml, $p < 0.05$), dendritic cell+T-cell (114.3pg/ml), and dendritic cell+keratinocyte+T-cell co-cultures (0pg/ml, $p < 0.05$). The MMP-9 response (2738.6pg/ml) was driven by dendritic cells and attenuated in dendritic cell+keratinocyte+T-cell co-cultures (797.4pg/ml, $p < 0.05$). MMP-7 and MMP-12 responses were enhanced, but not significant.

Conclusions: Different MMP responses are produced by cells in the presence of other cell types versus individually, which demonstrates the need for co-culture modeling to predict responses. Examining the MMP response to agonists, such as HagB, in a co-culture will help to better understand the inflammatory response. This model may help identify other inflammatory agonists and predictors of periodontal disease and assess potential treatments.

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16. Micro-Computed Tomography Evaluation of Bulk Fill Composites in Class II MOD Cavities

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Objectives: The aim of this study was to evaluate and quantify the volumetric polymerization shrinkage of one conventional and 3 low shrinkage bulk fill resin composites with bonded or unbonded conditions, through three-dimensional micro-computed tomography (mCT).

Methods: Class II preparations (2.5 mm occlusal depth x 4 mm wide x 4 mm mesial box depth and 1mm beyond the CEJ distal box depth) were performed in 48 third-molars (n=6). Four composites were tested: Vitalescence (VIT); SureFil SDR Flow (SDR); Tetric EvoCeram Bulk Fill (TET) and Filtek Bulk Fill (FILT) with and without adhesive XP Bond (B). Teeth were randomly divided in 8 groups according to the material and technique (n=6): G1:VIT; G2:VIT/B; G3:SDR; G4:SDR/B; G5:TET; G6:TET/B; G7:FILT; G8:FILT/B. Three 3D scans were performed for each tooth using mCT. First was done at the prepared tooth, second with the tooth filled with uncured composite, and the third after light-curing. Acquired mCT images were imported to Amira software for volumetric analysis for all scans.

Results: There was a statistical difference among bonded and unbonded groups in general, the last one showing more volumetric shrinkage. No difference was found between resin composites when evaluating only unbonded groups. On the other hand, in bonded groups, TET and VIT showed less volumetric shrinkage than FILT and SDR.

Conclusion: In general, unbonded groups showed more volumetric shrinkage than bonded. TET and VIT exhibited better performance compared to the other bulk fill composites in class II cavities, when adhesive was used.

17. Iowa Family Physicians and Pediatricians Oral Health Knowledge and Practices

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Background: Programs focused on training medical professionals to provide preventive dental services for children younger than 3 years of age who lack access to dental care are of crucial importance. In order to implement effective oral health training programs, it is important to first understand the characteristics of the medical providers in terms of their oral health knowledge and practices. The current literature lacks information of such characteristics for family physicians and pediatricians in Iowa.

Objectives: The purpose of this study is to investigate the oral health knowledge and practices among Iowa family physicians and pediatricians. Additional goals are to assess the most common oral health issues encountered in their patients aged 0-3 years, referral mechanisms and barriers, and provider practices regarding the application of fluoride varnish.

Methods: A 17-item survey was mailed to all licensed family physicians (n=1648) and pediatricians (n=465) 75 years of age and younger in the state of Iowa. A second mailing is currently being sent to non-respondents (85%). Univariate and bivariate analyses, as well as logistic regression models will be used to explore the differences between family physicians and pediatricians regarding their knowledge and practices (alpha=0.05). IRB approval was obtained.

Results: TBD

Conclusions: TBD

Supported by: Delta Dental of Iowa Foundation

18. Use of a Plasmid-Based microRNA Inhibitor System (PMIS) as a Platform for Adjuvant Treatment of Oral Cancers

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Background: microRNAs (miRNAs) are short pieces of genetic material around 22 nucleotides in length that have increasingly been shown in recent years to play an important role in both disease and development. Since their discovery nearly twenty years ago, this class of small biomolecules has moved closer to the forefront of gene therapy research in recognition of their subtle and modulatory effects on a wide range of cellular processes.

Introduction: The Plasmid-based microRNA Inhibitor System (PMIS) is a novel technology developed at the University of Iowa in the lab of Dr. Brad A. Amendt that allows for the knockdown of specific miRNA in living tissue. By binding to and sequestering mature miRNA sequences present in cellular plasma, the PMIS technology allows investigators to alter the levels of translation of messenger RNA targets, consequently changing the proteomic character of cells and tissues.

Problem: Oral squamous cell carcinoma is one of the more severe oral pathologies that a patient can present with in the clinic, and represents approximately 2.5% of all cancer diagnoses in the US. Several investigators have shown that miRNA expression profiles in oral squamous cell carcinomas are dysregulated when compared to normal, healthy epithelial tissues.

Solution: Here we discuss the potential for use of miRNA inhibitor systems as a possible treatment to slow the growth and metastasis of oral squamous cell carcinoma as well as other non-oral cancers. Additionally, we will discuss integrating miRNA inhibition strategies as an adjuvant that has the potential to augment traditional treatment methods, such as surgical removal and radiation therapy.

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19. Substituted Tetrahydropyran Polymers as Potential Drug Releasing Agents in the Oral Cavity

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Current mucoadhesive films offer mostly palliative treatment and little therapeutic effect for pathology in the oral cavity. The newly substituted tetrahydropyran polymers share structural similarities with naturally occurring polysaccharides, however, the current polymers are linked via carbon-carbon bonds which afford more chemical stability. The increased chemical stability of the new polymers is proposed to provide enhanced therapeutic efficiency with the capacity for localized drug delivery in the oral cavity.

Objectives: To synthesize novel polymers with varying functionality and promote mucoadhesion in the oral cavity. To test the adherence of the new polymers to epithelial tissue as well as their capacity to bond and release known therapeutic substances.

Methods: New polymers bearing the carbon-carbon linked tetrahydropyran backbone were synthesized by reacting substituted 3,4-dihydropyran monomers with a catalyst under mild conditions. New compounds were purified by either precipitation or thin layer chromatography, and characterized by known spectroscopic methods (i.e., Nuclear Magnetic Resonance (NMR), Infrared Spectroscopy (IR), etc.) The new polymers varied in the polarity of the functional group (i.e., acetate, sulfonamide, methanol, etc.) present in the 2-position of each repeating unit. Preliminary mucoadhesion studies with the newly synthesized polymers and epithelial cells are currently underway.

Results: Substituted tetrahydropyran polymers have been synthesized with varying functionality. The pendant functional group present on the pyran ring dramatically changed the polarity of the polymers. Preliminary results suggest the polymers have the capacity to release therapeutic agents in the oral cavity.

Conclusions: Changing the pendant functional group in each repeating unit dramatically affected the polymers polarity and water solubility. The carbon-carbon bound backbone present in the new polymers is stable under hydrolytic conditions and may be used to release therapeutic agents in the oral cavity.

Supported by: Iowa Dental Research Grant

20. The N-Terminal Domain of the Glucocorticoid Receptor Modulates DNA-Binding Specificity

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Objectives: Glucocorticoids (GCs) are potent anti-inflammatory and immunosuppressive agents used for the treatment of oral cavity conditions, including non-infectious inflammatory mucosal diseases, and for surgical procedures. GCs exert their functions through the glucocorticoid receptor (GR), a steroid activated transcription factor that binds DNA as a monomer or dimer via a central DNA binding domain (DBD). Once bound, GR nucleates the assembly of transcriptional cofactors and regulates gene expression. Which genes are controlled by GR is determined by where GR binds the genome. We hypothesize that cellular signals that modify domains flanking the DBD influence GR sequence specificity and dimerization, altering genomic localization and gene regulation. The goal of this study is to determine whether flanking domains alone influence GR DNA-binding specificity.

Methods: We use systematic evolution of ligands by exponential enrichment (SELEX-seq) to measure the affinity of GR for all possible sequences. Building on our work with GR-DBD, we added the N-terminal activation function-1 domain (AF1) and C-terminal ligand-binding domain (LBD), then performed SELEX-seq. The specificity of each fragment was then computed and compared to the DBD alone to determine the effect of including other domains.

Results: We expressed and purified enough AF1-DBD and full length GR to perform our experiments. We then measured the monomer and dimer DNA-binding specificities of AF1-DBD by SELEX-seq. From this data, we computed position specific affinity matrices (PSAM) that describe DNA-binding specificity. Comparing the PSAM of AF1-DBD to DBD alone revealed altered specificity.

Conclusions: The altered DNA-binding conferred by AF1 indicates that studying the DBD alone is not sufficient to determine GR specificity. Further, we showed that the monomer-binding mode is distinct from the dimer. These findings provide a platform to study how cellular signals, such as phosphorylation and cofactor binding, which alter the structure of AF1, change GR DNA-binding specificity.

Supported by: Iowa Dental Research Grant

21. Replication of Genome-Wide Association Candidate Genes in Three Sub-Saharan African Populations

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Background: Orofacial clefts (OFCs) are the most common craniofacial disorders of the head and neck with a global prevalence of 1 in 700 live births. Genome-wide association studies have identified about 18 risk loci using samples from European and Asian populations. In this study, we investigated the role of GWAS identified genetic variants in three sub-Saharan African populations (Ghana, Ethiopia and Nigeria).

Methods: We genotyped 48 GWAS significant markers in 3940 individuals (891 cases and 3049 related and unrelated controls) from Ghana, Ethiopia and Nigeria using fluidigm genotyping technology. Family Based Association Test (FBAT) was conducted on triads to investigate the over-transmission of rare alleles in case families. Single variant case-control association analysis was also done using PLINK to determine association of markers with non-syndromic clefts. Sanger Sequencing was conducted on DNA from 180 individuals with NSCL/P from Ghana.

Results: We observed significant association (unadjusted $p < 0.05$) using the FBAT for markers in ACBA4 (rs560426, $p = 0.03$), VAX1 (rs7078160, $p = 0.04$), AXIN2 (rs7224837, 0.007). In all population together, we also observed significant association ($p < 0.05$) in the case-control analyses for VAX1 (rs7078160, $p = 0.02$), PAX7 (rs742071, $p = 0.03$), MSX1 (rs115200552, $p = 0.04$), CRISPLD2 (rs1546124, $p = 0.03$). None of the markers were significant after Bonferroni correction ($p < 0.01$). IRF6 (rs642961, $p = 0.05$) and GREMI (rs1258763 $p = 0.05$) were borderline significant in the FBAT analyses. Analyses by population revealed differences in significance for some markers. We observed novel variants in VAX1 (p.Gly252Cys and p.Ala231Ala that creates new acceptor site) and ARHGAP29 (p.Asn323Asp, p.Lys426IlefsTer6 and c.1281+4A>G (donor site variant) following sequencing. These variants have never been previously reported and are not in any of the known variant databases like 1000 genomes, EVS and 61,000 exomes.

Conclusion: Our data replicated significant association with common variants in some previously reported GWAS candidates. Future genome-wide studies should be conducted to identify African specific genomic associations.

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22. Restoration Longevity among Nursing Facility Residents: A 30-Year Retrospective Study

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Purpose: To assess factors influencing restoration longevity in nursing facility residents as an important step in developing restorative treatment guidelines for geriatric patients.

Methods: Patients who received treatment on the University of Iowa, College of Dentistry's Geriatric Mobile Dental Unit (GMU) since 1985 were identified and variables that were available in electronic format were analyzed. All teeth that received at least one restorative procedure were identified, then one of these teeth per patient was selected at random. Starting with the first restorative procedure for that tooth, all subsequent procedures for that tooth and patient were recorded through the date of the last patient visit. Survival curves were generated for anterior and posterior restorations separately, where failures were defined as subsequent restorative codes on the same surface; endodontic procedures; or extraction.

Results: There were 1078 and 1146 subjects who had an anterior or posterior tooth selected, respectively. In bivariate analyses for anterior restorations, treatment payment method ($p < 0.001$), restorative material ($p < 0.001$), nursing facility ($p = 0.001$), arch ($p = 0.006$), year of the first restorative treatment ($p = 0.012$) and patient age ($p = 0.019$) were significantly associated with restoration longevity, while for posterior restorations, nursing facility ($p = 0.008$), gender ($p = 0.015$), restorative material ($p = 0.016$), year of the first restorative treatment ($p = 0.019$) and treatment payment method ($p = 0.026$) were significantly associated with restoration longevity.

Conclusion: Our results could represent an initial step in improving care for this population of under-served elderly. Knowing how long restorations (and teeth) tend to last, and what factors affect longevity, potentially could influence treatment planning and informed consent; improve communication with residents and caregivers; and help develop practice guidelines for restorative care in elderly populations.

Supported by: Delta Dental of Iowa Foundation

23. Sox2 Is Required for Periderm Formation to Inhibit Oral Adhesions and a Pitx2:Sox2:Lef-1 Network Regulates Incisor Development and Stem Cell Renewal

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Sox2 is associated with dental epithelial stem cells (DESC) in mammals and reptiles, but its transcriptional function in regulating incisor and molar stem cell maintenance, renewal and growth is not well understood. In this report we show that conditional Sox2 deletion in the oral and dental epithelium results in severe craniofacial defects, including ankyloglossia, cleft palate, arrested incisor development and abnormal molar development. Sox2 regulates the formation of the oral periderm and loss of this structure causes epithelial adhesions. The loss of Sox2 in DESCs leads to impaired stem cell self-renewal, proliferation and subsequent dissolution of the tooth germ. Tamoxifen induced inactivation of Sox2 in adult mice reduces tooth regeneration upon injury demonstrating the requirement of Sox2 for maintenance of the DESCs in adult mice. Interestingly, arrested dental development is observed in Pitx2 and Lef-1 deficient mice, similar to Sox2 conditional deletion mice in this report. Conditional overexpression of Lef-1 in mice increases DESC proliferation and creates a new labial cervical loop stem cell compartment, which produces rapidly growing long 'tusk-like' incisors. Lef-1 epithelial overexpression rescues the tooth arrest defects but not ankyloglossia or cleft palate in Sox2 conditional deleted mice. Sox2 regulates periderm development to inhibit epithelial adhesions causing ankyloglossia, cleft palate and dental anomalies, however its activation of Lef-1 is required for DESC cell proliferation and differentiation but not palatogenesis. Mechanistically, Pitx2 and Sox2 interact to regulate Lef-1, Pitx2 and Sox2 expression during development. We report a new Pitx2:Sox2:Lef-1 transcriptional mechanism for DESC self-renewal, differentiation and dental development.

Supported by: University of Iowa College of Dentistry

24. The Condition of Teeth Referred to Endodontists: A Retrospective Study

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Introduction: Endodontic literature has placed an increasing emphasis on the importance of preserving tooth structure during access in order to increase survivability. Different outlines of minimally invasive access openings (MIA) have been recommended. However teeth referred to endodontists often contain so little sound tooth structure that performing MIA is rarely an option. The purpose of this retrospective study was to determine the condition of teeth being referred to endodontists.

Methods: 350 pre-operative periapical images from patients presenting to a graduate endodontic clinic were reviewed. Each image was imported into a software program capable of measuring the relative area within a geometric shape. Any portion of tooth coronal to the CEJ affected by caries or containing restorative material was traced. A ratio was calculated showing the radiographic percentage of healthy, natural tooth structure present. Each case was also judged on whether MIA could have been performed. PARL size and demographic data were also gathered.

Results: The teeth were grouped into five categories based on the amount of healthy tooth structure observed (HTSO) and are as follows: 0% HTSO — n=3(0.9%); 1%-33% — n=60(17.7%); 34%-66% — n=160(47.2%); 67%-100% — n=45(13.3%). The mean HTSO was 47.5%. Percent of teeth in which MIA could have been performed was n=7(2%).

Conclusions: The average amount of HTSO remaining on teeth referred for root canal therapy was 47.5%. Only 2% of these teeth would be suitable for MIA. Its clinical applicability is very low; therefore restorative procedures continue to be a critical factor for teeth survivability.

25. **microRNA-200c Directly Targets and Represses IL-6, IL-8, and CCL-5 Expression and Enhances Osteogenic Differentiation**

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Periodontitis is a chronic, destructive inflammatory disease of the tooth-supporting tissues, which may result in the removal of the tooth and aggravate microvascular complications. Conventional treatments for bacterial infection arrest the disease but do not recover the damaged bone or connective tissue. MicroRNAs are short RNA molecules involved in post-transcriptional regulation of gene expression. miRNAs expression has been demonstrated to modulate various biological processes, such as cellular proliferation, inflammatory pathways, tissue regeneration and embryonic development. The advantage of using miRNA as effective therapeutic avenue is the ability to target one or multiple biological pathways with a single miRNA; which may improve the treatment response in patient with degenerative, inflammatory and infectious disorders.

Objectives: The goal of this study was to evaluate the effect of miR-200c on the inflammatory response and the osteogenic differentiation of periodontal ligament fibroblasts and bone marrow MSCs.

Methods: miR-200c was incorporated into polyethylenimine (PEI) to form nanoplexes at an N/P ratio of 10:1. Periodontal ligament fibroblasts were treated with PEI-miR-200c nanoplexes, and PEI-empty vector as control. After 4 hours of transfection, cells were cultured in DMEM completed medium supplemented with or without LPS (1µg/ml). IL-6, IL-8, and CCL5 concentrations were measured in supernatants using a Luminex 100 (Austin, TX).

Bone marrow MSCs were treated with PEI-miR-200c nanoplexes and cultured in osteogenic medium for up to two weeks. ALP activity and calcium deposition were analyzed and transcripts of ALP and Runx2 were quantified using real-time PCR.

Results: The overexpression of miR-200c effectively represses multiple proinflammatory mediators, including IL-6, IL-8 and CCL-5, in periodontal ligament fibroblasts and improve osteogenic differentiation in bone marrow MSCs.

Conclusion: These results substantiate the potential use of miR-200c for the treatment of periodontitis-associated bone resorption and restore the periodontal bone defects by modulating imbalance and dysregulation of proinflammatory mediators and improving bone formation.

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26. Post-Extraction Alveolar Ridge Bone and Mucosa Volumetric Changes Show Non-Correspondence

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Objective: This study aimed at assessing whether soft tissue profiles were predictive of changes to the underlying bone following tooth extraction alone or tooth extraction in conjunction with an alveolar ridge preservation technique.

Methods: Healthy patients requiring the extraction of a single-rooted tooth were recruited (n=53). Patients were randomly assigned to either the control group (extraction alone), or the experimental group (tooth extraction and socket grafting using an allograft and a membrane). Full-arch impressions and CBCT scans were taken pre- and post-treatment. Volumetric measurements were assessed for the area of interest using stone casts and cleaned up DICOM data. A Kruskal-Wallis rank sums test and a Spearman's rank correlation test were run to assess patterns of volumetric change.

Results: When a Kruskal-Wallis test was run on the data using Grafting/Non-Grafting as the grouping variable, there was no statistical association between treatment type and soft tissue volume loss ($p=0.7442$). A Spearman's rank correlation test was used to regress hard tissue volumetric change on soft tissue profile volumetric change, and no correlation was found ($p=0.4435$). Both treatment groups (Grafting, Non-Grafting) were then examined independently and a correlation between hard and soft tissue volumetric changes was tested for. In neither the Grafting group ($p=0.956$) nor the Non-Grafting group ($p=0.379$) was there a statistical correlation between the changes to the hard tissue volumes and the changes to the soft tissue volumes.

Conclusions: We posit that the non-congruence between hard and soft tissue profiles is likely caused by the faster healing rate of the soft tissue as compared to the alveolar bone response, which may mislead clinicians that make their assessments of underlying bone availability based on mere visual inspections of the site of interest. Thus we urge caution in using external assessments to judge hard tissue availability in both clinical or research settings.

27. An Assessment of Trends in Periodontal Randomized Clinical Trials

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Background: In evidence-based dentistry (EBD), combined results from well-designed and implemented randomized control trials in the form of well-conducted and reported systematic reviews/meta-analyses provide unbiased guidance to clinicians. The objectives are twofold: to determine the total number and trends of randomized clinical trials (RCTs) published in periodontics over time (select years) and to identify the area of periodontics that have a dearth of RCTs.

Methods: PubMed and Web of Science (WOS) were searched for RCTs in periodontics published up to 12/31/2014 by two investigators using ‘periodontics’ and ‘periodontology’ search terms in both databases with an English language filter. This study went through two rounds of filtering to identify trials. In the first filtering process, articles were identified as RCTs solely based on title and abstract. The second filtering comprised of reading the full text of the selected articles published in 2014, 2009, 2004, 1999, 1994, 1989, 1984, 1979 and 1970-74. Articles were eliminated due to not being RCTs, in-vitro or non-human studies, or topics unrelated to periodontics. From the selected trials, we are currently extracting descriptive data such as publication year, country of origin, number of authors, sample size, single/multi-center, funding source and categorization into a particular periodontics topic.

Results: After the first filtering in the PubMed database, we identified 2,452 articles for “Periodontics” and 2,973 articles for “Periodontology.” WOS yielded 610 and 452 articles, respectively. The second filtering resulted in a total of 460 articles (PubMed and WOS combined) for the selected years. The number of RCTs significantly increased over time with a slight drop in 2014. The percentage of trials reporting randomization process and sample size calculation has increased substantially during the last two decades.

Conclusions: The annual number of periodontal RCTs from selected years grew substantially over 1970-2014. Periodontology RCTs reporting power-analysis and randomization process have increased substantially during the last two decades. The current process of data extraction identifies trends and dearth in periodontal RCTs to direct where future high-quality clinical research is needed.

Supported by: Iowa Dental Research Grant

28. An Examination of Integration Across the Units of the Nasal Septum

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Nasal septal deviation often results from discordant growth between the nasal septum and surrounding nasofacial skeleton. While in some cases deviation results from skeletal constraints on septal growth, there is evidence that population variation in septal deviation is influenced to a greater degree by absolute differences in nasal septal size. Studies investigating septal deviation have traditionally treated both the osseous and cartilaginous portions of the nasal septum as one unit. The adult nasal septum is, however, comprised of three units: the vomer, the perpendicular plate of the ethmoid, and the cartilaginous septum; the latter two of these are developmentally the same structure. Differential growth between the three units of the septum, arising through differing levels of integration, may impact septal size and deviation. In this study, we examined patterns of integration across the three units of the nasal septum (vomer, ethmoid, cartilage) in a sample of adults (n=101) of European and African descent. We examined whether certain pairings of the structures (e.g., the perpendicular plate of the ethmoid and the cartilaginous septum) were more strongly integrated than others using 2-block partial least squares analysis. In addition, we tested for patterns of variation between the population groups. We found that the ethmoid/cartilage units were more strongly integrated (RV=0.526, p<0.001) than the ethmoid/vomer (RV=0.275, p<0.001) or the vomer/cartilage (RV=0.33, p<0.001). The European sample, predictably, showed taller, longer nasal septa (p=0.016); however, we were able to identify that the differences are driven in part by a supero-inferiorly shorter vomer and a relatively smaller nasal septal cartilage in the African sample. Our results indicate that adult nasal septal shape is influenced by the differential growth patterns of the vomer and the ethmoid/cartilage complex. These differences contribute to population variation in nasal septal size and may also contribute to the development of nasal septal deviation.

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29. Antero-Posterior Measures in Normal & Class II Occlusions: Mixed-Permanent Dentitions

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Objectives: Compare antero-posterior (AP) relations of permanent first and primary second molars in the mixed (MD) and permanent dentitions (PD) of subjects with Class I normal occlusion (CIN) and Class II malocclusions (CII), and validate Roemmich 2014.

Methods: Twenty-nine subjects with CIN (16 males (♂), 13 females (♀)), and twenty-one CII (11 ♂, 10 ♀) participated in the University of Iowa Growth Study. Longitudinal data were collected at average ages (CIN) 9.1 years and 15.8 years and (CII) 8.3 years and 14.1 years in MD and PD respectively. AP distance from mesio-buccal cusp tip of upper permanent 1st molar to buccal groove of the lower permanent 1st molar (1PeM) was measured in MD and PD with digital calipers [mm]. AP distances between the terminal planes (TP) of the primary 2nd molars (2PrM) were measured in MD. Measurements were recorded as negative when the maxillary point was distal to the mandibular point, positive when mesial, and +0.1 mm when zero. Occlusion groups were compared by the two-sample t-test; MD-PD transition was detected by the paired-sample t-test (alpha =0.05).

Results: Intra-class correlation coefficients for intra- and inter-observer agreement ranged from 0.93-0.99. MD measures differed significantly between two groups (p<0.0001); 1PeM: CIN [1.1±0.8], CII [2.3 ±0.9]; 2PrM-TP: CIN [-1.2±0.7], CII [0.1±0.8]. PD measures differed significantly (p<0.0001) between groups (p<0.0001); CIN [-0.3 ±0.6]; CII [2.7 ±2.0]. In MD, ♀ 1PeM left measures were similar in CIN & CII. In the MD to PD transition, CIN, 1PeM measures became significantly (p<0.0001) less positive from MD to PD; in CII no significant change was found.

Conclusion: CIN molar measures were significantly less positive than CII measures. In MD-PD transition, CIN measures became less positive; CII measures did not change. Gender differences were minimal. Roemmich was validated. Further analysis is ongoing; results will be reported.

Supported by: Iowa Dental Research Grant

30. Antero-Posterior Measures in Normal and Class II Occlusions: Primary-Mixed Dentitions

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Objective: Evaluate antero-posterior (AP) relations of primary second molars (P2M) in the primary (P) and mixed dentitions (MD) of subjects with Class I normal occlusion (CIN) and Class II malocclusions (CII).

Methods: Thirty two subjects with CIN, 17 males (♂), 15 females (♀) and twenty five CII (N = 12 ♂ and 13 ♀) participated in the University of Iowa Facial Growth Study. Longitudinal data were collected at average age (CIN) 4.9 years and 8.4 years and (CII) 4.9 years and 8.1 years in P and MD respectively. AP distance from the mesio-buccal cusp tip of upper 2nd primary molar to the buccal groove of the lower 2nd primary molar (MBC-BG), and terminal planes [TP] of the upper and lower P2M were measured in P & MD with digital calipers [mm]. Measures from both sides were recorded as negative when the maxillary point was distal to the mandibular point, positive when mesial, and +0.1 mm when zero. Groups were compared by the two-sample t-test, P-MD transition was tested by the paired sample t-test. ($\alpha=0.05$).

Results: Right side measures reported. Intra-class correlation coefficients for intra- and inter-observer agreement were 0.88 and 0.82. Mean MBC-BG measures in P and MD were significantly different between two occlusion groups, CIN [-0.2 ±0.8]; CII [0.3 ±0.6]; $p<0.0075$]; and CIN [-0.4 ±0.89]; CII [0.4 ±0.7]; ($p=0.0003$), respectively. Mean TP measures were not significantly different between groups in P, but differed significantly in MD; CIN [-0.6 ±0.8] CII [-3.5 ±0.7]; ($p=0.1625$) and CIN [-0.96 ±0.8]; CII [-0.01±0.8]; ($p<0.0001$); respectively. In MBC-BG measures, CIN became more negative and CII measures became more positive in transition from P to MD; groups differed significantly ($p=0.0012$) in TP measures.

Conclusion: In P and MD, MBC-BG measures in CIN were more negative than CII. MBC-BG measures may be useful in prediction.

Supported by: Iowa Dental Research Grant

31. Assessment of the Current Status and Trends of United States CODA-Accredited Post-Doctoral Periodontics Graduate Programs' Integration of Implant Provisionalization into Core Curricula

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Aim: Our primary goal was to investigate the current status of implementation of 2013 CODA Accreditation Standard 4-10.2.d (Implant Provisionalization) in postdoctoral periodontal programs across the US. We invited all CODA-accredited, US Graduate Periodontics Program Directors to complete a survey regarding didactic and clinical approaches, future plans, current predominant methods, and demographic data specific to the director and the educational program.

Materials and Methods: We identified 56 accredited Periodontics Graduate Programs to contact, per the American Academy of Periodontology website (www.perio.org). The electronic survey was disseminated via e-mail to the respective Graduate Periodontal Program Directors, their participation in a survey requested, and a link to the survey provided. The survey was designed with Qualtrics (Provo, UT, USA). IRB approval #201503707.

Results: Data from a total of 29 out of 56 programs was available for analysis upon closure of the survey. At the time of abstract submission, data is being analyzed on a regional and national basis.

Discussion: Our study addresses the scarcity of information available regarding how Graduate Periodontal Programs are implementing the recent revisions to the CODA Accreditation Standards. We hypothesized that there will be considerable variation in how programs address incorporating implant provisionalization into their curricula, and that this information would be of particular interest to the Periodontics specialty.

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32. Associations Between Beverage Characteristics and Cariogenic Bacteria in American-Indian Children

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Objective: Sugar-sweetened beverages are known to increase caries risk. However, whether interactions between sugar content, pH, and titratable acidity of beverages influence growth of bacteria associated with caries is unknown. Our aim was to identify the physiochemical properties of commonly consumed beverages, and their associations with oral bacterial profiles of American-Indian (AI) children.

Methods: Data were collected as part of a longitudinal investigation of risk factors for caries in AI children. Children (n=39) with complete bacterial profiles (8 visits) from 1-36 months were the focus of analyses; colonization was defined as having the bacteria present at 2 visits. There were 4 possible bacterial profile groups: *Streptococcus sobrinus* (SS) only, *Streptococcus mutans* (SM) only, both SM and SS and neither SM nor SS. Brand and/or type of consumed beverages were identified from 24 hour recalls; pHs and titratable acidities (TA) of purchased beverages were measured. Percent of total beverage intakes from 36 month questionnaires were grouped according to pH (low, medium, high), TA (low, medium, high), and manufacturers' sugar content (sugar-free, low, medium, high). The exact Wilcoxon rank sum test was used to compare the distribution of specified percent of beverage consumption between bacterial profiles.

Results: Bacterial profiles (SS=6; SM=16; SS/SM=15; noSS/noSM=2) did not differ by gender. SS positive children had a higher median percent sugar-free beverage consumption (34.3%) than SS negative children (19.6%; p=0.014). SS/SM positive children also had a higher median percent sugar-free beverage consumption (39.2%) than SM only children (19.6%; p=0.008). Bacterial profiles did not differ by relative pH or titratable acidity intakes.

Conclusion: These data suggest a high degree of cariogenic bacterial colonization in this population, and that beverage consumption relationships with cariogenic bacteria in this population might differ from other groups. Further analyses with additional samples are needed to clarify this relationship.

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33. Comparison of Visual and Digital Assessment: Evaluating Common Wax-up Errors

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Objectives: To evaluate the correlation of visual and digital assessment in evaluating common wax-up errors.

Methods: A ½ fractional factorial design with replication was used for six treatment conditions (present, absent) upon 64 preparations. These treatment conditions corresponded to wax-up errors involving: Embrasure, Line Angle, Buccal Contour, Buccal cusp, Mesial Marginal Ridge, and Triangular Ridge. The prepared teeth were scanned and compared to a master model using Compare software at a tolerance of 0.25mm (Digital Score). These same preparations were assessed by expert faculty, who graded all 64 pieces on two separate occasions. Expert grading was done using a rubric with 23 criteria and three subscales. Each subscale was handled by a dedicated faculty member for both instances of grading. When errors were found, faculty also rated the severity of the error as mild (1), moderate (2), or severe (3). A traditional expert grade was assigned using the total number of error free criteria divided by 23 (Visual Score). A modified grade was assigned using the severity of the error to weight the point deduction (Weighted Visual Score). The hypothesis was that there would be no agreement among the three scoring methods. Inter/intra-rater agreement was examined using the intraclass correlation coefficient, spearman rank correlation coefficient, and difference analysis.

Results: Inter-rater reliability between weighted visual and digital scoring (ICC=0.58 & 0.54) was comparable to the agreement between weighted visual and visual scoring (ICC=0.59 & 0.63). The lowest agreement was between visual and digital scoring (ICC=0.11). Intra-rater reliability was excellent for visual and weighted visual scoring (ICC > 0.8).

Spearman correlation provided evidence of a strong, positive correlation for both visual (Rs=0.75, P<0.0001) and weighted visual scoring (Rs=0.76, P<0.0001) with digital assessment.

Conclusions: Visual and digital assessments were valid evaluation methods. Weighted evaluation showed comparable correlation and increased agreement with digital assessment.

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34. Effect of Nanoparticles on Conversion and Mechanical Properties of Dental Adhesives

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Objectives: The durability of resin-dentin bond is of great importance to the longevity of composite restorations but is compromised by hydrolysis of sub optimally infiltrated and/or polymerized resin and host-derived protease degradation of water-rich, resin-sparse collagen matrices. The long-range goal is to develop a therapeutic nanoparticle filled adhesive to reduce the effects of these bond-degrading actions. The degree of conversion (DC) and mechanical properties of adhesives containing silanated and non-silanated nanoparticles were analyzed as a model for future materials development.

Methods: Adhesives (60%BisGMA/39%TEGDMA/0.75%EDMB/0.25%CQ) containing 15 nm SiO₂-amorphous nanoparticles with or without silane treatment in various weight amounts (0%, 2%, 4%, 6%, 8%, and 10%) were individually formulated (n=3/per group). Real time Raman spectroscopy was used to measure DC and peak rate of reaction while curing with an incident irradiance of 320 mW/cm² at 320-500 nm wavelength. Dynamic Mechanical Analyzer (DMA) was used to characterize samples cured after a radiant exposure of 17.1 J/cm² using an Optilux 500 curing unit. Two-way ANOVA was performed to evaluate interactions between adhesive type and filler concentrations on DC and rate of polymerization ($\alpha=0.05$).

Results: Significant interactions were found between adhesive type and filler levels on both DC ($p=0.0161$) and rate of polymerization ($p=0.0008$). Therefore, simple effects were tested. The silane treated filler concentration had no significant effect on the rate of polymerization but significantly increased DC ($p=0.0357$) in 4% ($58.1\pm 0.5\%$) and 10% ($57.7\pm 1.2\%$) as compared to unfilled adhesive ($56.0\pm 0.7\%$). Unsilanated filler groups at 4% and above demonstrated faster rates of reaction ($p<0.0001$) and higher DC ($p=0.0003$) as compared to the unfilled adhesive. The DMA results of the formulations were not different from one another.

Conclusions: DC was affected by both filler types whereas only filler without silane treatment affected the rate of polymerization. The characterization methods used show promise for future adhesive materials development.

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35. Effect of Polydopamine Root Dentin Coating on the Bonding of Glass-Ionomer

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Background: Glass-ionomer materials are commonly used as coronal dentin liners and root dentin restoratives. A novel polydopamine dentin coating inspired by mussel bioadhesion, mainly consisting of 3,4-dihydroxy-L-phenylalanine (LDOPA), might show benefits for these type of lesions. However, the effect of polydopamine on dentin bond strength (SBS) of glass-ionomer is unknown.

Objective: To determine the shear bond strength of GC Fuji IX (FJ) and Fuji IILC (FJII) to root dentin and to evaluate the effect of a polydopamine coating on the bond strength of those materials.

Methods: Root dentin fragments were sectioned from 30 third molars and polished using 600 grit SiC paper. Half of the samples were placed into dopamine hydrochloride (Sigma-Aldrich) solution (2mg/ml in 10mM Tris buffer, pH 8.5, 37°C) and mechanically stirred for 24 hours to form a polydopamine layer. The specimens were then rinsed with distilled water and placed in an ultrasonic device for 10 minutes and dried. A remineralization solution was used at a pH of 7.0 to maintain the sample for one day. Restorative materials were applied according to manufacturer's instructions to both coated and control groups. Specimens were stored for 24 hrs (100% humidity) before SBS testing (n=10/per group). SBS was done in a universal testing machine at 1mm/min crosshead speed.

Results: Two-way ANOVA was performed. A statistical difference was observed among the materials ($p<0.001$). Mean SBS and standard deviation in MPa were: FJ: 10.7 (3.2), FJ coated: 7.0 (4.9), FJII: 30.5 (4.4) and FJII coated: 18.6(7.5). Cohesive failures were mostly noted in the FJII group. For FJII group, a statistical significant difference was observed between the coated and control group.

Conclusions: In this study, modifying the dentin substrate with a polydopamine coating had no effect on the SBS of the conventional glass-ionomer, but it negatively affected the SBS of the resin-modified glass-ionomer restorative.

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36. Enhancing Patient and Caregiver Education via Print and Multimedia Devices

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Purpose: To assess whether patient education devices improve understanding of commonly misunderstood dental procedures.

Methods: Ten small-group sessions (N=91) were conducted. Subjects completed a pre-test to assess baseline knowledge of bridges, root canal treatment (RCT) and scaling and root planing (SRP). Next, each dental procedure was presented using a different method (i.e. bridge via verbal presentation, RCT via a flip chart and SRP via an iPad app). The pairing of the educational methods with the dental procedures rotated each session. Lastly, participants completed a post-test to evaluate increased knowledge. Statistical analyses included the paired-samples t-test and one-way repeated measures ANOVA with the post-hoc contrasts test ($\alpha=0.05$). IRB approval was obtained.

Results: Participants had limited knowledge at pretest (SRP=11%, Bridge=22%, RCT=37% correct), with improved knowledge at post-test (SRP=61%, Bridge=84%, RCT=72% correct). The mean percent-correct score at post-test was significantly greater than the mean percent-correct score at pre-test for each education method and dental procedure combination ($P<.0001$ in each instance). Although no significant difference was found at pre-test when grouping procedures together by educational method, the mean percent-correct change in pre-test to post-test scores for the verbal presentation (mean=41%) was significantly lower than the iPad (mean=52%) or the flip chart (mean=53%).

Conclusions: The use of patient education devices improved understanding of dental procedures more than verbal explanations alone. Pediatric dentists should consider using education devices when explaining dental procedures to children and their guardians.

Supported by: Iowa Dental Research Grant

37. Evaluation of a Novel Fixation Method for Microtensile Testing of the Resin-Dentin Bond

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Objectives: Develop and validate a readily adoptable specimen gripping system (Geraldeli V2) for resin-dentin microtensile (uTBS) testing. Improvement in specimen fixation is needed due to frequent pre-test failures and failure pathways involving glue or substrates. Hypotheses tested were that Geraldeli V1 and V2 gripping devices would produce equivalent uTBS, debond pathways and successful tensile tests.

Methods: Fifteen non-carious human molars (n=5/per group) were prepared to expose occlusal dentin for composite bonding (Z100-3M) with one of three adhesives (OptiBond FL-OPFL, Clearfil SE-CSE, Scotchbond Universal-SBU). Dentin-composite build-ups were sectioned into 16 specimens per tooth (n=240) and randomly distributed for tensile testing (Zwick Z2.5; Zwick GmbH) to failure at 1 mm/min using cyanoacrylate (Zapit) for fixation to V1 and V2 gripping devices. Failure mode was verified with stereomicroscopy at 40X (Stemi2000, Carl-Zeiss). Statistical analyses included nonparametric Wilcoxon rank-sum test, a simple random effect in Mixed Model ANOVA, parametric Weibull regression model, and Fisher's exact test ($\alpha=0.05$).

Results: There was a significant difference between V1 and V2 gripping devices in median/mean TBS for each adhesive system ($p<0.0001$). Differences in failure mode between devices was adhesive dependent with OPFL ($p=0.0022$) and SBU ($p=0.0362$) demonstrating more interfacial failures with the V2 device, while no difference was observed with CSE ($p=0.8336$). Specimens pulled out of the fixation device prior to successful tensile testing during 19% of tests with V1 and 7% with V2. The fracture pathway was associated with the glue fixation 17% and 10% of tests with V1 and V2, respectively.

Conclusion: Geraldeli V2 produces lower median/mean uTBS with greater variability and produces a greater frequency of interfacial failures and successful tensile tests. Although promising, the V2 device requires additional validation.

Supported by: Iowa Dental Research Grant

38. Evaluation of Various In-Office Tooth-Whitening Systems on Overall Color Change

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Objectives: To evaluate whitening efficacy of different in-office whitening systems.

Methods: Extracted human molars (n=60, 15 per group) were randomly assigned to Group NC: Glycerol gel; Group QPRO: 20% HP varnish (Zoom Quick Pro, Philips Oral Healthcare); Group ZOOM_NL: 25% HP gel (Zoom Chairside Whitening); and Group ZOOM_WL: 25% HP gel (Zoom Chairside Whitening) with LED light activation. All teeth were subjected to three sessions with an interval of 3-5 days for a total of 30 minutes. Instrumental color measurements were performed at baseline (T0), 1-day post 1st whitening (T1), 1-day post 2nd whitening (T2), 1-day post 3rd whitening (T3), and 1-month post whitening (T4). Color difference was calculated as ΔE^* . One-way ANOVA followed by the post-hoc Tukey's HSD test was performed to detect the difference among the four groups in baseline color parameters and ΔE^* at each time point. One-way ANOVA with repeated measures followed by the post-hoc contrast test was used to determine difference in ΔE^* among the four time points within each group.

Results: There was no difference in all baseline color parameters among the groups ($p > 0.05$). At 1-day post 1st whitening ΔE^* of NC was lower than other groups, while no difference was found among QPRO, ZOOM_NL, and ZOOM_WL. At 1-day post 2nd whitening, 1-day post 3rd whitening, and 1-month post whitening, ΔE^* of NC was lower than other groups, while ΔE^* of ZOOM_WL was greater than other three groups. No difference was found between QPRO and ZOOM_NL. Except for NC, there was a significant difference in ΔE^* among the four time points within QPRO, ZOOM_NL and ZOOM_WL with each with least to highest ΔE^* values in one-day 1st post whitening, 1-day 2nd post whitening, 1-day 3rd post whitening and 1-month post whitening, respectively.

Conclusion: Tooth whitening efficacy is influenced by type of whitening system used.

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39. Expectation and Satisfaction among Different Prosthetic Therapies and Relationships with Other Patient-Related Variables

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Patient satisfaction is the ultimate goal of prosthetic therapies and is reportedly linked to patient quality of life. The main objective of this presentation is to show how expectations and satisfaction of patients compare among four prosthetic treatment options. Secondary objectives include determining the impact of secondary variables (such as age and gender) on the expectations and satisfaction of patients. Data from four published studies using similar methodology in the same area composed a final sample of 223 patients receiving four different treatments: conventional complete dentures, conventional removable partial dentures, implant-supported complete dentures, and implant-supported fixed bridges or crowns. In all studies pre- and post-treatment scores were given to four treatment outcomes (chewing, esthetics, phonetics, and comfort), using a visual analogue scale from 0 (worst possible result) to 10 (best possible result). The data were submitted to descriptive, bi-variate, and multi-variable regression analysis. Implant-based procedures presented the highest expectations scores, but these procedures also had high satisfaction scores. Alternatively, removable partial denture therapy was the treatment that received the lowest satisfaction scores. Age and sex had no effect on expectation or satisfaction scores.

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40. Exploratory Descriptive Study of Digital Searches Concerning Fluoridation Terms

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Objectives: Seventy years of research has documented the safety and effectiveness of community water fluoridation. Despite virtually unanimous support of fluoridation by the dental community, public understanding of fluoridation is increasingly influenced by anti-fluoridation lay websites accessible through search engines. This study begins to explore and describe patterns of search engine use for fluoridation and fluoride terms in the United States.

Methods: Google search engine traffic was collected using Google Trends for 5 fluoridation terms in the US by state (including D.C.), metro area and city. Numbers collected represent the highest point of activity for the term over time with a score of 100 being the highest. Exploratory data was collected from May - November 2015 with final data collected on December 23, 2015.

Results: The term fluoride water yielded the greatest number of active states (34/51) followed by fluoride in water (25/31), fluoridation (7/51), water fluoridation (4/51) and community water fluoridation (0/51). Oregon was the top state of interest for 3 terms (fluoride water, fluoridation, and water fluoridation), however, Utah was the top state for fluoride in water. States with 3 or more search terms that registered included Oregon, Washington, Massachusetts, California, Florida, New York and Texas. Only 2 terms (fluoride water and fluoride in water) registered metro area activity. The top metros of interest for fluoride water and fluoride in water were Los Angeles, CA and Denver, CO respectively. 3 terms yielded data for US cities, fluoridation (2 cities), fluoride in water (13 cities) and fluoride water (15 cities). Portland and New York City were the only cities to appear for all three search terms that registered interest.

Conclusions: Areas showing results tend to be large population areas. Many of these high interest states have had documented anti-fluoridation movements recently.

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41. Food Programs, Dietary Habits and Caries in Children Aged 2-5

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Purpose: Food assistance programs (FAPs) are designed to equalize diet quality across socioeconomic status (SES) groups. Dental caries is a diet related disease and there may be differences in disease burden between children who do or do not partake in FAPs. Dietary risks include total sugar intake as well as its frequency and timing. Food insecurity is often associated with inexpensive, readily accessible foods which are highly processed and high in added sugars. Eating these foods greatly increases caries risk. FAPs are, in theory, available to increase families with low SES access to healthier diets. The objective of our ongoing study is to explore associations between participation in FAPs, dietary habits and caries burden.

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. Subjects' 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 dietary habits. Dental charts were reviewed to identify caries experience and weight and height measures.

Results: Subjects (n=59) were 73% white, 51% male and 4.3+/- 1.2 years of age. Forty % of subjects received food assistance (i.e., SNAP), 34% reduced school lunch meals and 34% other FAPs; 29% of families participated in WIC. Fifty-six % of subjects had caries; of subjects with caries the mean was 6.3+/- 5.4 caries with a range from 1-20.

Conclusion: More research is needed to determine the associations between FAP participation, dietary habits, and caries burden.

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42. Magnolia Plant Extracts with Selective Toxicity against Oral Streptococci

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

Methods: Extracts were tested via optical density analysis in overnight planktonic cultures of *S. sobrinus*, *S. mutans*, or *S. sanguinis* at concentrations of 0.356, 0.178, 0.089, or 0.0178 mg/ml. Extracts were further tested by measuring reductions in viability of biofilm organisms following an exposure of two hours.

Results: In previous work, extract 10-F7-2 from *Michelia figo* reduced overnight *S. mutans* growth to 25% of the control compared to 80% for *S. sanguinis*. Similarly the extract mzw-3 from *Michelia x alba* reduced overnight *S. sobrinus* growth to ~25% of the control compared to growth of 90% for *S. sanguinis*. Reductions in biofilm viability following two-hour exposures were more modest but increased when the agents were combined. In order to build upon these observations, further testing was done for selective inhibitory toxicity using a new set of magnolia fractions. Fraction 562 reduced overnight planktonic *S. mutans* growth to less than 1% of the control whereas *S. sanguinis* exhibited 27% growth relative to the control. However, there were no selective reductions found in the biofilm growth analysis.

Conclusion: A new fraction with selective toxicity was identified — one with activity against *S. mutans*. This fraction demonstrated a selective inhibitory effect in the planktonic suspension but not in a biofilm. This experiment highlights the importance of testing potential antimicrobial compounds under conditions that mimic the oral environment. Through the analysis of multiple magnolia extracts it has been consistently observed that fractions displaying selective toxicity against key oral streptococci can be demonstrated. Further purification and development of these substances may lead to clinically useful regimens that are effective against organisms in a biofilm state.

Supported by: Iowa Dental Research Grant

43. Marginal Ridge Discrepancy Post-Orthodontic Treatment and Changes in Crestal Bone Level - A Cross-Sectional Study

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Objectives: The American Board of Orthodontics utilizes the objective grading system containing eight criteria, one being marginal ridge alignment with an acceptable height discrepancy of 0.5mm or less. The purpose of this retrospective study was to determine the implications of marginal ridge discrepancy measured in the study cast models as it relates to periodontal health assessed by radiographic bone level measurements in relation to cemento-enamel junction.

Methods: Bitewings of 53 subjects who had completed treatment in the Department of Orthodontics were identified using the electronic health record. Radiographic distance from CEJ to alveolar crest were measured from the mesial of the first molar, mesial and distal of the second premolar, and distal of the first premolar for a total of 4 points per sextant with a maximum of 16 measurements per subject. A 10 subject calibration was used prior to radiographic examination to confirm intra- and inter-examiner reliability. Marginal ridge discrepancy will be graded using the ABO grading tool on casts taken at 2-year recall visit. Either Pearson correlations or Spearman rank correlations (depending on distribution of data) will be used to examine the correlation between the marginal ridge discrepancy and radiographic bone level changes. Subject radiographic measurements will be separated into three time periods following de-banding: 0-6 months, 6 months to 2 years, and 2-5 years. Each individual site will be the unit of analysis. A p-value of <0.05 will be deemed to be statistically significant.

Results: Calibration exercise revealed good inter- and intra-rater agreement. Radiographic measurements in the identified 53 patients were completed. We are in the process of identifying and measuring marginal ridge discrepancy. The statistical analysis will follow.

Conclusion: Through this study, the current ABO standards of marginal ridge alignment as it relates to periodontal health will either be supported or disputed, both resulting in improved patient care.

Supported by: Iowa Dental Research Grant

44. Nutrient Intakes Associated with Caries in American Indian (AI) Children

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Inadequate nutrient intakes are thought to contribute to problems during tooth development and increase risk of dental caries.

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

Methods: This is part of an ongoing longitudinal study of risk factors for caries in young AI children (n=239; 107 male, 132 female). Dietary data at 28 and 36 months and caries data at 36 months were used in these analyses. Twenty-four hour dietary recalls administered by trained staff to the child's caregiver were analyzed using Nutritionist Pro® to obtain nutrient intakes. Standardized dental examinations were completed by trained dental hygienists and were surface-specific for frank decay, and caries were quantified as dmfs. Associations between nutrient intakes and dmfs were examined using Spearman rank correlations (SAS, version 9.3).

Results: Eighty percent of AI children had caries at 36 months; mean dmfs was 14.6±16.5. Correlations were observed between nutrient intakes at 28 months and dmfs at 36 months for energy (r=0.162; p=0.015), protein (r=0.174; p=0.009), fat (r=0.165; p=0.013), vitamin A (0.158; p=0.018), vitamin D (0.131; p=0.049), riboflavin (r=0.168; p=0.012), niacin (r=0.171; p=0.010), and vitamin B12 (r=0.152; p=0.023). No correlations were seen between nutrient intakes at 36 months and dmfs at 36 months. At 28 months, 99% of children consumed the Estimated Average Requirement (i.e., EAR) for protein, 90% for fat, 88% for vitamin A, 21% for vitamin D, 98% for riboflavin, 96% for niacin and 97% for vitamin B12.

Conclusion: In this high risk population, higher intakes of select nutrients were associated with caries risk. Most children had adequate nutrient intakes suggesting that overnutrition might be contributing to increased caries risk.

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45. Patients' Esthetic Expectations and Satisfaction of Complete Denture Therapy

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Objectives: This study aimed to test for possible relationships between esthetic satisfaction of complete denture therapy and factors including age, gender and esthetic expectations.

Methods: Data were pooled from four complete denture therapy studies carried out at the dental clinic at University of Taubate from 2009 to 2015: Bellini et al. (n=64), Marachlioglou et al. (n=20), Gaspar et al. (n=100) and Santos et al. (n=99), and a secondary data analysis was performed. All studies were similar methodologically and recorded patients' esthetic expectation and satisfaction scores using a 0 to 10 visual analogue scale. Wilcoxon signed-rank test was used to test the difference between satisfaction and expectations. Fisher exact, Spearman rank correlation, Wilcoxon Rank Sum and Kruskal-Wallis tests and Cochran-Mantel-Haenszel test using ridit scores procedure were used to assess the relationships regarding the heterogeneity among studies, satisfaction and factors of interest.

Results: Of the 283 subjects studied, 52% were female, and median age was 58 years. The satisfaction scores exceeded expectation scores significantly (p<0.0001), though they were both high. Age, gender and expectations were different among studies (p<0.0075); age also differed between genders (p=0.0036). After adjusting for study, men had higher expectations than women (p=0.0049) and there was no gender difference in level of satisfaction. Only in males, was satisfaction positively correlated with expectations (r=0.30; p=0.0004). In the Santos *et al.* study, increasing age was associated with lower expectation (r=-0.23; p=0.0242) and increased difference between esthetic expectation and satisfaction (r=0.26; p=0.0081).

Conclusions: Overall, patients were more satisfied than they expected esthetically after complete denture therapy; esthetic satisfaction was not different between genders or with age. Men's expectations were higher than women's and positively correlated to their level of satisfaction.

Key Words: Patient expectations; complete dentures; patient satisfaction; esthetics; prosthodontics

Supported by: Iowa Dental Research Grant

46. Premature Birth and Early Childhood Caries among Children 0-3 Years

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Objectives: Investigate the relationship between premature birth and Early Childhood Caries (ECC) risk factors among children aged 0-3 years.

Methods: Data were collected from children's records at the University of Iowa's Infant Oral Health Program (IOHP). Mothers completed questionnaire regarding their prenatal history, their child's demographics, neonatal history, oral hygiene and dietary habits. Clinical evidence of plaque, enamel defects, and caries were obtained. Odds ratios (ORs) were calculated for significant associations detected by Chi-square tests ($p < 0.05$).

Results: 885 children were included, 15.4% of children were premature (<37 weeks gestational age, $n = 136/885$), 50.5% were male ($n=433/885$); median age was 18.1 months. Bivariate analysis revealed that children born prematurely were positively associated with: caregiver's low dental health literacy (OR: 1.95, 95% CI: 1.06, 3.60), maternal health problems during pregnancy (OR: 5.00, 95% CI: 33.3, 7.52), medication use during pregnancy (OR: 1.95, 95% CI: 1.32, 2.89). Prematurity was associated with child's medical history: low birth weight (OR: 139.54, 95% CI: 33.09, 588.38), jaundice (OR: 1.88, 95% CI: 1.18, 2.99), intubation (OR: 5.52, 95% CI: 1.11, 5.74), breathing difficulties (OR: 2.62, 95% CI: 1.56, 4.39), serious illness (OR: 3.51, 95% CI: 3.51, 10.09), hospitalization (OR: 3.13, 95% CI: 2.08, 4.73). Dietary factors of significant association were: breastfeeding (OR: 0.68, 95% CI: 0.46, 1.00), bottle-feeding throughout the night (OR: 1.96, 95% CI: 1.03, 3.76), nighttime consumption of cariogenic drinks/foods (OR: 2.35, 95% CI: 1.47, 3.77), consumption of cariogenic beverages (OR: 2.05, 95% CI: 1.10, 3.85). Irregular dental care among children aged 12-36 months (OR: 2.93, 95% CI: 1.26, 6.82) was reported.

Conclusions: This study showed a positive association between prematurity and important ECC risk factors. Premature children had a significantly higher percentage of dietary factors that increase ECC risk. Premature children and their parents should be targeted for early preventive dental care in life.

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47. Risk Factors Associated with ECC-Surface Location among Low-Income Young Children

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Objectives: Early childhood caries (ECC) continue to be a major public health concern, while our knowledge of risk factors associated with ECC by surface type is limited. The purpose of this study was to assess risk factors for smooth-surface caries in primary anterior teeth and smooth-or-pit-fissure-surface caries in posterior teeth in children enrolled at the University of Iowa's Infant Oral Health Program (IOHP). An additional goal was to identify the strongest future caries-risk indicators collected at IOHP.

Methods: Data were obtained from a chart review of 104 subjects aged 6-48 months at the initial IOHP visit who then became patients at the University of Iowa College of Dentistry (aged =72 months at the most recent visit). Statistical analysis consisted of descriptive statistics and bivariate analysis.

Results: Children (51% male, 79.8% non-White) had an average age of 24.5 ± 9.3 months and averaged 15.4 ± 4.5 teeth. About 31% exhibited ECC and 54.5% were classified as high caries-risk at their first IOHP visit. Bivariate analysis revealed that children with cavitated ($p=0.0004$) and non-cavitated ($p=0.0051$) lesions, and high caries-risk ($p=0.0715$) at the initial IOHP visit were more likely to have greater numbers of decayed-and-filled-cavitated-lesions on smooth-surfaces in primary maxillary anterior teeth at follow-up, while children with cavitated lesions ($p=0.0099$) were more likely to have greater numbers of decayed-and-filled-cavitated-lesions on smooth-or-pit-fissure-surfaces in posterior teeth. Additionally, results showed the strongest caries-risk indicators for future caries ($p < 0.05$) were consumption of cariogenic beverages >2x daily, older age, greater number of teeth, inconsistent daily brushing, and presence of cavitated/non-cavitated lesions, enamel defects, and visible plaque on maxillary incisors.

Conclusion: Previous caries experience was strongly associated with ECC-surface location. Age, number of teeth, dietary/oral hygiene habits, and presence of cavitated/non-cavitated lesions, enamel defects, and visible plaque on maxillary incisors were predictors of future ECC. Further analysis is ongoing.

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48. State-Level Relationship between Dentists' CHIP Participation and Reimbursement Rates

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Background: Numerous studies have documented that low reimbursement rates are related to dentist satisfaction with their participation in Medicaid.

Objective: To describe the state-level relationship between reimbursement rates and patient-to-dentist participation rates in the Children's Health Insurance Program (CHIP). We hypothesize that states with higher reimbursement rates will have lower patient-to-dentist ratios.

Methods: CHIP enrollment data for 2012 was obtained from the Center for Medicare and Medicaid Services. Practitioner participation data was obtained from the Medicaid-CHIP State Dental Association's National Profile Survey. Patient-to-dentist ratios were calculated by state. A reimbursement rate index for pediatric dental care was obtained from the ADA's Health Policy Institute using reimbursement data for the 14 most common procedures in 2013. Patient-to-dentist ratios were plotted against reimbursement rates to generate an R^2 value to describe the state-level reimbursement-participation relationship.

Results: In 2012, the average patient-to-dentist ratio across all states was 77:1; median 69:1. Lowest ratio was in New Mexico 11:1; highest in Tennessee 176:1. Pediatric dental Medicaid reimbursement rate index as percentage of usual, customary, and reasonable charges ranged from 26.7% (MN) to 81.1% (DE). There was no statistically significant relationship between indexed reimbursement rates and patient-to-dentist ratio with an R^2 value of 0.0319.

Conclusions: While low reimbursement rates are often reported as a primary determining factor on whether or not to participate in dental Medicaid, at the state level, there seem to be other factors affecting participation rates as well as potential differences in how states report these data that might affect these results.

Supported by: Iowa Dental Research Grant

Data provided by Mary Foley and the Medicaid-CHIP State Dental Association. Data also obtained from the ADA Health Policy Institute.

49. *Streptococcus sobrinus* Genotyping in American Indian Mother-Child Pairs

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Objectives: American Indian children suffer from devastatingly high rates of severe early childhood caries (S-ECC). The primary etiological agents of S-ECC are *Streptococcus mutans* (SM) and *Streptococcus sobrinus* (SS). Although SM is more commonly associated with caries, SS is often associated with more severe caries. The objective of this project was to create a genotype library of SS isolates from 21 mother-child dyads in a population of Northern Plains American Indians in order to reveal the transmission and colonization patterns of SS within this high-risk population.

Methods: Plaque samples were collected from children and their mothers from the time of the child's birth to 36 months of age. Samples were cultured on MSKB selective agar. SS isolates (identified by PCR) were genotyped by AP-PCR. Gel images were analyzed and compared with GelCompar/Eliv6.5 software. Exact Wilcoxon tests were used to compare the distribution of dmfs/DMFS scores between subgroups based upon genotyping results and SM/SS status (presence/absence of SM and SS).

Results: Ninety percent of children shared at least one SS genotype with their mother. SS positive individuals hosted a range of 1-3 SS genotypes with families exhibiting a spectrum of 1-5 genotypes. The most common genotype was found in 57% of the sample population. There were no statistically significant differences in the distribution of dmfs/DMFS scores between groups with different genotype counts, or subgroups based upon SM/SS status.

Conclusions: Our data show SS genotype commonalities exist both within and across families in our sample population. This suggests that SS exhibits some vertical transmission from mother to child. These data also suggest increased genotypic diversity and SM/SS status do not impact caries experience, however, further analysis with a larger sample size is needed.

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50. Substituted Tetrahydropyran Polymers as Polysaccharide Mimics and Scaffolds for Design of Novel Antimicrobial Polymers

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Antimicrobial Peptides (AMPs) are a feature of host defense against pathogenic microorganisms present in the oral cavity. Naturally produced AMPs are amphiphilic-containing hydrophobic and hydrophilic functionality with the capacity to disrupt pathogenic microbial membranes. In the oral cavity, therapeutic effects of AMPs are significantly limited due to the chemical and enzymatic hydrolysis of the amide bond present in the core structure. Carbohydrates present in the oral cavity have also been reported to employ antimicrobial activity. Similarly, therapeutic effectiveness of carbohydrates is limited due to hydrolysis of glycosidic bonds present in the repeating units. The current polymers have a core structure employing features of AMPs *and* naturally occurring polysaccharides with increased stability to hydrolysis.

Objectives: To produce novel substituted tetrahydropyran polymers with different ranges of polarity and amphiphilicity. To study the activity of the compounds utilizing structure activity studies (i.e. MIC values). Studies will guide future polymer design to optimize their antimicrobial properties.

Methods: Monomers utilized in initial syntheses contained a core 3,4-dihydropyran structure that affords novel monosubstituted tetrahydropyran polymers under mild chemical conditions in the presence of a catalyst. The current polymers are linked via a carbon-carbon bond framework that is more resistant to degradation under hydrolytic conditions. Purification of all new compounds included precipitation and/or column chromatography. Characterization was carried out by Nuclear Magnetic Resonance (NMR), Infrared Spectroscopy (IR), and Mass Spectrometry (MS).

Results: Several mono-substituted polymers with varying polarity were synthesized and characterized. Preliminary biological activity studies (i.e. MIC studies) of the first generation of substituted polymers were carried out.

Conclusion: Synthetic methods for the production of the substituted tetrahydropyran polymers was developed and refined. Initial activity studies suggest, hydrophobic polymers with mono substitution of the core 3,4-dihydropyran structure were not active against *E. coli* and *S. aureus*. Highly substituted tetrahydropyran polymers are currently being pursued.

Supported by: NIH; Dows Research Award

51. Success Rates of Hall Technique Crowns in Primary Molars: A Retrospective Pilot Study

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Objectives: The purpose of this retrospective observational study was to assess success rates, both clinical and radiographic, of stainless steel crowns placed on primary molars using the Hall technique at the University of Iowa College of Dentistry. The results of this study will help to determine future research avenues for the study of “Hall crowns.”

Methods: A retrospective analysis was performed using recorded data of patients with any primary molar treated with a stainless steel crown (SSC) placed by the Hall technique between 2008-2015 at the University of Iowa College of Dentistry. The primary outcome of failed treatment was categorized in two different ways: clinical and radiographic failure. Clinical failure was defined as the need for pulp therapy or extraction following initial crown placement. Radiographic failure was defined by the presence of any pathologic condition including: external/internal resorption, bifurcation radiolucency or widened PDL resulting from treatment.

Results: Of the 293 crowns (mean age of child=5.1±2.4 years, 61.1% male) that fulfilled the inclusion criteria, 180 crowns returned for at least one follow up (mean time=9.9 months). At the first follow up, 178 (98.9%) of 180 SSCs placed using the Hall technique were clinically successful and of those with radiographs available 86 (98.9%) of 87 were radiographically successful. After the second follow up visit (mean time=20.1 months) 74 (97.4%) of 76 were clinically successful and 37 (94.9%) of 39 were radiographically successful.

Conclusion: These preliminary results provide significant information regarding the outcomes of primary molars treated with Hall technique crowns and validate prospective investigation with greater specificity and extended follow-up in the future. Further analysis is ongoing and results will be reported.

Supported by: Iowa Dental Research Grant

52. Teaching of Geriatric Dentistry in the United States- Preliminary Results

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Objectives: The aim of this study was to re-examine the teaching of geriatric dentistry in the U S dental schools. This is a follow up study from similar studies conducted over the last 30 years.

Materials and Methods: All dental schools in the United States were contacted via email with a questionnaire developed by Ettinger et al to assess the teaching of geriatric dentistry. Non-responding schools were sent a minimum of three reminder emails to complete the survey. A statistical analysis was performed. Descriptive statistics were conducted to profile the variables of interest. Bivariate analysis was performed to explore if any of the variables in the study were related to dental school region or type (private vs. public) using Fisher’s exact test, nonparametric Wilcoxon rank-sum test, and the Kruskal-Wallis test.

Results: Fifty-six of the 67 dental schools completed the questionnaire. Geriatric dentistry was taught in all dental schools, for 95% the course was compulsory. We found that 56% were teaching it as an independent course, 25% as an organized series of lectures, and 7% as part of other courses. With regard to clinical experiences, 87% have some form of compulsory clinical education in geriatric dentistry. A marginally significant association was found between the type of school and how many lectures were given in an independent geriatric dentistry course (p=0.0891). Additionally, public schools were marginally associated with an increased interest in expanding the geriatric dentistry curriculum (p=0.078). No differences were found between the variables and school location.

Conclusions: Geriatric dentistry curriculum in dental schools throughout the United States is varied and differs in many ways. The teaching of geriatric dentistry has increased among all schools and has been increasing for over 30 years. Future research is needed to determine the impact of this teaching on services to the geriatric community.

Supported by: Iowa Dental Research Grant

53. The Effect of Dentin Location on Erosion Depth on Acid-Challenge

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Objectives: To evaluate the effect of dentin location on the erosion depth as measured with polarized light microscopy.

Methods: A total of twenty-four extracted sound human molars were obtained and randomly divided into four groups (n=6/per group), including Group A: Occlusal Superficial Dentin; Group B: Occlusal Deep Dentin; Group C: Longitudinal Dentin section; and Group D: mixture of superficial, deep occlusal and longitudinal dentin sections. All dentin blocks were painted with nail varnish to expose a 1x4mm unexposed surface. Groups A-C were then exposed to 1.0 citric acid (pH 3.9) for 1hr at 35°C. Group D served as the negative control and was treated with Grade 3 water for 1 hr. Samples were then sectioned and erosion depth measured with polarized light microscopy. One-way ANOVA, followed by the post-hoc Tukey's HSD test, was conducted to detect the difference in the mean drop values of surface from the unexposed surface (μm) among the four depth levels of dentin groups ($\alpha=0.05$).

Results: . One-way ANOVA revealed that there was a significant effect of depth of dentin on the drop values of surface from the unexposed surface ($F(3, 20)=83.28$; $p<0.0001$). The post-hoc Tukey's HSD test indicated that the mean drop value observed in Occlusal Deep Dentin group (mean=34.5 μm ; SD=5.29 μm) was significant greater than those observed in Occlusal Superficial Dentin (mean=26.34 μm ; SD=4.89 μm) and Longitudinal Dentin (mean=24.7 μm ; SD=3.47 μm) groups, while no significant difference was found between Occlusal Superficial Dentin and Longitudinal Dentin groups. Moreover, all those three experimental treatment groups were significantly different from the Negative Control Group, which showed a zero drop value of surface.

Conclusion: Erosion depth upon erosive challenge was influenced by the location of dentin.

Supported by: Iowa Dental Research Grant

54. Third Molar Agenesis and Dental Arch Form: A Three-Dimensional Geometric Morphometric Analysis

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Objectives: Developmental absence of the third molars is the most common form of dental agenesis. While researchers have documented a significant relationship between third molar agenesis and craniomandibular form, there is little information on the relationship between this phenotypic variant and the morphology of the dental arches. In the present study we conducted a geometric morphometric analysis of dental arch shape comparing subjects with agenesis to a control sample. Specifically, we examined whether third molar agenesis is predictably associated with altered patterns of dental arch shape.

Materials and Methods: We compared n=29 non-syndromic subjects missing at least one third molar to n=44 control subjects. We collected three-dimensional coordinate landmark data from dental arch casts and used Procrustes analysis to distill size and shape variables. We tested for significant differences in dental arch size using independent samples t-tests. We then examined shape variation using discriminant function analysis. Finally, we tested for significant differences in shape using Mahalanobis distance values.

Results: Our results indicate that there was no significant difference in dental arch size between the agenesis and control samples. We did, however, find that there was a significant difference in shape variation ($P<0.001$) with the agenesis sample characterized by a greater anterior-posterior discrepancy between the arches. Additionally, the agenesis sample exhibited a less rounded upper arch.

Conclusions: Third molar agenesis is associated with altered dental arch shape, and variation in the relationship between the upper and lower arches. Thus, factors that influence the presence/absence of the third molars appear to have an effect on aspects of dental arch form.

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55. Time-Course Reaction of Blue Dye after Treatment with Hydrogen Peroxide

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Objectives: To evaluate the time-course reaction of a blue food dye on exposure to hydrogen peroxide with the use of thin layer chromatography (TLC) and spectrophotometer and determine the relationship between the two types of measurements.

Methods: Time course reaction of 0.1ml of dye (Brilliant Blue FCF) and hydrogen peroxide (HP) with 0.5ml of pH 9 buffer was evaluated. Aliquots of reaction mixture at different interval times (0,5,10,15,20,30,45,60min) were transferred onto a TLC plate and intensity of dye was analyzed with computer program TNIMAGE. This procedure was repeated using a spectrophotometer (Power Wave X-I) on seven samples at peak wavelength of 630nm at respective time-intervals. Pearson correlation test was used to evaluate the relationship between the average absorbance level and the area under the curve for blue dye. Friedman test, followed by the post-hoc Bonferroni test, was used to detect the difference in absorbance levels among the eight different time points ($\alpha=0.05$).

Results: Within one hour, the median reaction color absorbance dropped from 3.56(0min) to 0.24 (60min) and the area on the TLC plate decreased from 211 (0min) to 3 (60min). Significant differences in median absorbance levels were found among all eight time points ($p<0.05$ for all instances). The data showed that the absorbance levels significantly decreased as time increased (mean (SD): 3.57(0.05) for 0-min; 2.74(0.13) for 5-min; 2.14(0.10) for 10-min; 1.65(0.08) for 15-min; 1.28(0.07) for 20-min; 0.79 (0.07) for 30-min; 0.41(0.05) for 45-min; 0.23(0.03) for 60-min). A strong correlation between the absorbance level and the area under the curve was found ($r=0.99$, $p<0.0001$).

Conclusion: Time-course reaction of a blue dye on exposure to HP can be evaluated with TLC and spectrophotometer, which showed a strong correlation in this study.

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56. Traumatic Dental Injuries in Children: Experience of the College of Dentistry at the University of Iowa Pediatric Dentistry Clinics

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Objectives: To evaluate etiology, types of traumatic dental injuries (TDIs), management and outcomes of dental traumatic injuries within the College of Dentistry Pediatric Dental Clinics at the University of Iowa in the period of 2008-2015.

Methods: The records of 193 children (327 teeth) presenting to the Pediatric Dentistry Department for TDI management were reviewed (2008-2015). Each subject contributed at least one tooth to the sample. The descriptive analyses focused on demographics, cause, type of injury, duration of time elapsed between the injury and dental care, presence of extra-oral/soft tissue injuries, treatment, follow-up visit, medical history, and complication status. A specific analysis data set composed of independent observations was established by randomly selecting one tooth/subject. Bivariate analyses used the Chi-square and Fisher's exact tests for nominal variables ($\alpha=0.05$).

Results: Average age was 10.8 ± 2.8 years and 120 (62.2%) were boys. The most common age for dental trauma was between 9-11 years. Most injuries involved maxillary central incisor teeth. Enamel-dentin fracture was the most common injury encountered to the hard tissues (46.6%) and lacerations were the most common extra oral soft tissue injury (33.3%).

Simple fall was the most common cause of injury. Only 39.6% of children came for dental treatment the same day of injury. 155 (80.3%) presented for follow up visits; the most reason for not returning for follow-up visit was going back to their own dentists. There was a significant difference in the distribution of types of fracture and supporting structure injuries between genders ($p=0.0128$, $p=0.0022$ respectively). No significant relationship was found between medical history and follow-up visit status ($p=1$).

Conclusions:

- The most common age for TDI was between 9-11 years.
- Overall boys significantly outnumbered girls in TDI (62.2% vs. 37.8%).
- Further analyses with larger sample size would permit more definite evaluation of important relationships.

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57. Dentist Practice Location Demand Threshold at the Community Level

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Objective: Although practice location is one of the most critical decisions made by dentists, very little research is available about community characteristics that influence this choice. Demand threshold analysis was performed to understand variables associated with practice location.

Methods: The 2010 National Establishment Time Series, a longitudinal database, was used to geo-code practice locations of Iowa dentists. A Poisson regression was used to estimate the demand threshold; the dependent variable was whether or not a community had one or more dental practices. Explanatory variables from the U.S. Census Bureau included population size, population density, median income, median age, percentage of adult population who were high school graduates or higher, and percentage of adult population with a bachelor degree or higher. Similar analysis was performed using year 2000 to determine whether or not there were changes during the decade.

Results: Of 1506 active Iowa dentists in Iowa, 1367 were in private practice. There are 947 incorporated communities in Iowa, with 23% (n=215) having at least one dentist and 79 of these latter communities (36.7%) with only one dentist. Controlling for community size, increasing either median household income or the percentage of individuals with at least a bachelor's degree decreased the demand threshold for a community. The threshold for a community having at least one dentist increased, however, as the community's median age was greater than 40 years. Similar findings were found for year 2000 data.

Conclusion: Although population is related to whether or not a community has at least one dentist, other factors such as household income and educational level are significantly associated with demand threshold. Further analysis is warranted that considers the effects of proximity to other communities.

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58. Medical Management of Caries in Primary Dentition Using Silver Nitrate

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Objectives: Medical management of caries utilizing silver compounds has recently gained national attention. This study compares medical management of caries in primary teeth utilizing silver nitrate and fluoride varnish to conventional restorative treatment.

Methods: The study population consisted of Amish children ages 2-11 years living near Kalona, Iowa. This population was selected due to known high caries rate, low fluoride exposure, lack of dental insurance, and episodic dental care. Children with at least one primary tooth with caries extending into dentin were invited to enroll in a two-arm, parallel group, patient-randomized controlled pilot trial. Enrollees were assigned to either: 1) conventional restorative caries management (CON); or 2) medical management of caries using silver nitrate and fluoride varnish (SN). Sample allocation ratio was 2SN:1CON.

Baseline measures and outcome data were assessed through direct reporting, clinical examination including blinded radiograph assessment, and child/parent questionnaires. Outcome measures included incidence of caries, pain or infection, patient quality of life, cost-effectiveness, and acceptability of treatment strategies.

Results: Results reported are from an ongoing two-year clinical trial still in enrollment. To date, 84 children have been screened for eligibility; 66 were eligible and enrolled. 19 were assigned to CON and 47 assigned to SN. 39 children (59.1%) were males. Mean age was 7.43±2.16 years. Total number of teeth with caries into dentin eligible for the study was 274. Sixty three (23%) for CON and 211 (77%) for SN. 51 children (19 CON, 32 SN) completed treatment and six month recall. No complaints were reported by parents or patients, including black discoloration associated with silver nitrate.

Conclusions: Preliminary findings suggest high levels of acceptability for silver nitrate treatment. To date, effectiveness of silver nitrate on dental caries has not been reported. Future results will provide information regarding clinical and cost effectiveness of medically managing caries in children.

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59. Analysis of RNA Expression Profile to Induce Cementum Producing Cells

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Background: Cementum is one of the four tissues that compound the periodontal ligament. It is a mineralized tissue that covers the surface of the roots of teeth. In the periodontal ligament, fibers are inserted in the cementum and bone attaching the teeth to the alveolar bone. At the level of the gingiva, they seal the tissue around the teeth preventing the invasion of bacteria to deeper tissues.

Cementogenesis is the process of cementum formation. Today it is not well understood what are the factors that induce and modulate this process.

Purpose: The goal of this project is to identify the regulators at the RNA level that induce or modify cell differentiation. Promoting cells differentiation from gingival cells can solve clinical problems such as recessions, periodontal defects and reestablishing a biological seal around dental implants.

Methods: This study in progress involves the comparison of 5 cell lines (periodontal ligament, dental pulp from deciduous teeth, dental pulp from permanent teeth, gingival cells and cementoblast) to find the most favorable cell line and identify the markers and factors to the genomic level that take part in the cementogenesis process.

The RNA of the different cell lines will be isolated and RNA assay will be performed to identify and evaluate the levels of specific markers of the cementum. These findings will be used to induce other mesenchymal cell lines to cementoblast like cells promoting the apposition of cementum.

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60. Assessment of Solubility of Carrier Based Obturation Systems: Guttacore and EdgeCore

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Introduction: Edgecore and Guttacore are carrier-based obturation systems constructed with a gutta percha core. This study assessed the solubility of carrier-based obturation systems when placed in chloroform or water for differing time periods.

Materials and Methods: Forty gutta percha cones from each obturation system were randomly divided into 4 groups; 10 cones for each solvent at time periods of 2- and 5-minutes. Sequence gutta percha cones were used as a comparison to the carrier based systems. Cones were weighed pre- and post-placement in solvent to the nearest hundredth milligram. One-way ANOVA followed by the post-hoc Tukey's HSD test was used to compare differences in weight change observed between the three groups ($\alpha=0.05$).

Results: Guttacore had significantly greater mean dissolution at 2-minutes ($-9.15 \pm 3.16\text{mg}$) and 5-minutes ($-21.64 \pm 6.16\text{mg}$) compared to Edgecore ($-6.39 \pm 1.22\text{mg}$; $-11.82 \pm 3.34\text{mg}$) and Sequence ($-2.86 \pm 1.30\text{mg}$; $-9.13 \pm 7.31\text{mg}$). Edgecore showed significantly greater mean dissolution than Sequence at 2-minutes but no statistical difference at 5-minutes. Within distilled water, Edgecore showed a significant decrease in weight while Sequence showed an increase in weight at 5-minutes. No significant difference was found between any of the obturation systems at 2 minutes within distilled water.

Conclusion: Within the limitations of this study, Guttacore showed the greatest dissolution compared to Edgecore and Sequence gutta percha cones when placed in chloroform solvent for both 2- and 5-minutes. Further testing is needed to assess the solubility of the gutta percha carrier itself of Guttacore and Edgecore.

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61. Characteristics Associated with Dentists' Attrition in Iowa: 1997-2014

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Objectives: It is important to observe and understand dentists' patterns of entry into and departure from the profession to inform policymakers so that they can address anticipated oral health workforce needs. This study assessed dentist attrition and factors associated with relocation and retirement in Iowa from 1997-2014.

Methods: Data were obtained from Iowa Dentist Tracking System (IDTS) for dentists who departed from the workforce between 1997-2014 in Iowa. Selected characteristics of exited dentists were examined among those who either relocated out-of-state or voluntarily retired. Pearson's Chi-square and Fisher's exact tests were used to assess associations between different variables among relocated and retired dentists.

Results: Of 1,021 dentists leaving the system, 330 (32.3%) relocated to another state and 531 (52.0%) retired. Other dentists exited the profession due to illness, death, loss of license, inactive status, joining the Armed Forces or pursuing advanced education. Among dentists who had relocated, a majority of them were males (63.9%), <40 years of age (63.0%, mean age-38[*sd*-10.4]), and in private practice (78.2%). Only 26.7% were in a solo practice arrangement and 40.6% had relocated within 5 years of practice. The majority of retirees were male (96.4%), ≥60 years (85.5%; mean age-66[*sd*-7.4]), and in private practice (89.6%); 55.6% were in a solo practice arrangement. Among those who relocated, general practitioners were significantly more likely to be ≤40 years of age and work in a private practice setting than specialists (*p* <0.01). Among retirees, general practitioners were more likely to work in a solo practice arrangement than specialists (*p* <0.01).

Conclusions: The most common reasons for attrition were relocation and retirement. The majority of dentists who relocated to another state were young general practitioners who had worked primarily in non-solo, private practice settings. Retiring dentists were primarily leaving the profession as general dentists in solo practice.

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62. Comparison of Light Propagation in Dental Tissues and Resin Composites

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Objectives: This study used three LASERs (red, green and blue) with a spectrophotometer to compare the light propagation (absorption, transmittance and attenuation) in dental tissues and nanofilled resin based composite using three incremental build-up techniques: one shade (Body), two shades (Enamel and Dentin), and three shades (Enamel, Transparent and Dentin).

Methods: Twenty un-erupted recently extracted human third molars (shade: B1) were used to obtain forty tooth slabs (1.5mm thickness x 4 mm length). The samples were randomized and equally distributed into four experiment groups: Positive Control (Dental tissues — enamel, dentino-enamel-junction and dentin), Technique 1 (T1 = one shade, B1B), Technique 2 (T2 = Two shades, A2Dentin/B1Enamel), and Technique 3 (T3 = 3 shades, A2Dentin/Transparent/B1Enamel). One calibrated operator performed all procedures and tests. Cavity preparation was standardized using a #58 carbide bur. Using the spectrophotometer, each specimen was irradiated at 0° degree from occlusal to cervical by the three LASERs. A Voltmeter recorded the light output signal and from this raw data the following optical constants were calculated: absorption (A), transmittance (T) and attenuation coefficient (K). The data was analyzed using One-way ANOVA, followed by the post-hoc Tukey's test. All tests utilized a significance level of 0.05.

Results: Regarding absorption and transmittance, dental tissues were significantly different compared to the three build-up techniques for all LASERs. Regarding the attenuation coefficient, dental tissues were no significantly different for T2 and T3 for the blue and red LASERs, however they were significantly different for the green LASER. There was no significant difference among the three lasers for T2 and T3.

Conclusion: Within the limitations of this study, none of the build-up techniques used were able to reproduce the dental tissues optical properties and techniques 2 (two shades) and 3 (three shades) resulted in a similar pattern of light propagation.

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63. Evaluation of Biodegradable PLGA Implants for Local Delivery of Antioxidants

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Inflammation induces an elevated level of reactive oxygen species (ROS) which is detrimental to cells if produced in high enough concentrations. Antioxidants such as n-acetylcysteine (NAC) or ellagic acid can counteract the effects of ROS and help balance the redox cycle of cells. The aim of this study was to develop a novel antioxidant delivery system for the treatment of periodontal wounds and diseases. Biodegradable polymers are excellent materials for the development of drug delivery systems in order to provide sustained release of drugs over long periods of time. Specifically, poly (lactic-co-glycolic acid) (PLGA) is a commercially available polymer that is ideal for use in biomedical applications as it is approved by the Food and Drug Administration and degrades under physiological environments into naturally occurring byproducts. Using a hot-melt extruder, mixtures of PLGA with NAC or ellagic acid were extruded into long strands and cut into pellet-shaped implants. The drug loading and release profile of the implants were determined using spectrophotometry. Due to the slow degradation of PLGA, long-term release of antioxidants was achieved *in vitro*. This method is also advantageous due to the high drug loading of both antioxidants in the polymer matrix along with spontaneous degradation of the implant in physiological conditions. The therapeutic potential of these implants will be evaluated using *in vitro* and *in vivo* inflammation models.

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64. Longitudinal Analysis in Infant Dental Arch Shape

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Objectives: Previous work (Varner *et al.*, 2015) has shown that changes in dental arch shape as a function of growth manifests as early as age 5 and significantly differentiate between distal step and mesial step/flush terminal plane. The goal of this project is to test whether difference in dental arch growth found in distal/mesial/flush occlusal patterns can be found prior to the full eruption of the full primary dentition.

Methods: A longitudinal dental cast sample (Iowa Infant Growth Study) of 30 children (10 distal, 10 mesial, and 10 flush) over 5 different time points (from 2 months post-natal to 2 years of age) was landmarked using 3 established landmarks for edentulous casts and 10 sliding semi-landmarks along the occlusal aspect of the maxillary and mandibular dental arches. The slid landmarks were then subjected to relative warps analysis to quantify shape and then regressed against age to calculate y-intercept and slope difference based on distal/mesial/flush occlusal patterns.

Results: Significant differences in the growth of distal and mesial step arch shapes were found along RW2 (11.3% variance explained) in the mandibular dataset ($p=0.048$) as well as distal and mesial step ($p=0.041$) and distal step and flush (0.006) maxillary arch morphologies along RW5 (1.8% variance explained). Individuals who were classified as distal step demonstrated a tendency to develop a right-skewed mandibular arch shape while individuals who were classified as mesial step developed a more left-skewed mandibular arch shape. Likewise, individuals who were classified as distal step developed a more squared anterior maxillary arch shape when compared to both the mesial step and flush groups, who demonstrated a more tapered anterior maxillary arch shape in comparison.

Conclusions: These results indicate that differences in growth patterns leading to a mesial/distal/flush occlusal form can be noted prior to age 5 and as early as age 2.

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65. Micro-CT Validation of a Chemically Induced Method to Simulate External Root Resorption - Pilot Study

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Background: An accurate diagnosis of the extent and location of external root resorption (ERR) is crucial to the prognosis of the tooth. Most experimental *in vitro* radiographic studies try to mimic ERR by using round burs, which produce sharp, regular cavities that do not accurately represent ERR, and are easier to identify radiographically.

Objective: To develop a study design that more closely simulates the actual clinical conditions of ERR lesions for use in *in vitro* radiology studies.

Materials and Methods: Ten teeth were selected for this pilot study. They were coated with a fast-drying acid-resistant varnish, leaving only a 7mm² circular window of exposed root on the lingual surface. Prior to the demineralizing induction, teeth were scanned on a micro-CT unit with 15µm voxel size. This first scan was used to evaluate the surface of the roots and as gold-standard. The teeth were kept individually in small plastic containers, immersed in 14mL of the demineralizing solution (0.05M acetate buffer, pH 4.8, 1.12mM calcium, 0.77mM phosphate, 0.03p.p.m. fluoride) and incubated at 37°C for 3 cycles of 7 days. After each cycle, new micro-CTs were acquired with the same parameters for comparison. The concentrations of minerals (i.e. phosphorus and calcium) in the demineralizing solutions of each individual container were obtained prior and after the demineralizing cycles, and were used as gold-standard.

Preliminary Results: The demineralizing solution, already established for caries lesions simulations, appears to be reliable in simulation of small and irregular lesions that more closely resemble *in vivo* ERR lesions.

Future Directions: The demineralizing method has been applied in a major research with a larger sample. This research aims to evaluate the influence of the CBCT scan mode in the diagnosis of chemically induced external root resorption in the apical third of anterior teeth.

66. Retrospective Histopathologic Evaluation of Fibroblastic versus Myofibroblastic Entities of the Oral Mucosa

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Objective: To use immunohistochemistry to determine whether myofibroma is a distinct entity or a variation of other fibroblastic entities. Staining patterns of vimentin, SMA and CD34 are evaluated in irritation fibromas, giant cell fibromas, ulcerated fibromas, inflammatory fibrous hyperplasias, focal keratosis and chronic mucositis and myofibromas. This study assesses whether myofibromas demonstrate similar staining patterns of vimentin, SMA and CD34 to the aforementioned lesions and if these stains are adequate in differentiating the entities.

Methods: Upon IRB approval, 46 cases of fibroma, 47 cases of focal keratosis and chronic mucositis, 44 cases of giant cell fibroma, 44 cases of inflammatory fibrous hyperplasia, 23 cases of myofibroma and 45 cases of ulcerated fibroma were collected. Hematoxylin and eosin-stained slides were reviewed and immunohistochemistry of vimentin, SMA and CD34 was performed. Staining patterns were graded as 0, 1 and 2 (<25%; 25-50%; and >50% respectively). Differences were analyzed by the Kruskal-Wallis test and Dunn's test for pairwise comparisons.

Results: Vimentin was positive in all groups (grade 2). SMA was negative for all groups except myofibroma (78.3%, grade 2, p < 0.05). CD34 was positive for all groups except giant cell fibroma (55.8% positive) and myofibroma (73.9% negative). The Dunn's test for pairwise comparisons revealed statistically significant differences for CD34 staining between myofibroma and fibroma; focal keratosis and chronic mucositis; inflammatory fibrous hyperplasia; and ulcerated fibroma.

Conclusions: The results indicate that SMA immunohistochemistry is helpful but not definitive in delineating myofibroma as a separate entity. The results also indicate that CD34 is not reliable in distinguishing any of the entities from one another.

67. The Susceptibility of Oral Streptococci to Anti-Microbial Agents

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Early childhood caries is one of the most abundant chronic microbial diseases. One of the major etiologic hypotheses for dental caries is the ecological plaque hypothesis which suggests that caries is a result of a shift in the balance of the resident microflora driven by changes in the local environmental conditions. This may be exemplified by increases in the cariogenic species *S. mutans* at the expense of other common plaque streptococci such as *S. sanguinis*.

Objective: The aim of this research was to measure the differential susceptibility of oral streptococcal species to currently available anti-microbial agents in order to predict which might be most promising in changing the plaque ecology.

Methods: Chlorhexidine gluconate, silver nitrate, and povidone iodine were tested for antimicrobial activity in *in vitro* killing assays in which each oral streptococcal species was exposed to each agent for 5 minutes, washed, and tested for remaining viability.

Results: The results showed that silver nitrate and povidone iodine were more effective at reducing bacterial counts than chlorhexidine. Relative susceptibility to each agent varied between species but iodine was the most effective in having a greater effect on the mutans streptococci than on *S. sanguinis*, by a magnitude of 1-3 logs.

Conclusion: These data could aid in our understanding of how to better manipulate the dental plaque ecology to develop a healthy oral flora.

68. Novel Multi-Species Root Canal Infection Model in Extracted Human Teeth

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Objectives: Bacterial disinfection of the root-canal (RC) system is critical for successful RC treatment. The aim of this study was to develop a stable reproducible polymicrobial biofilm in human teeth using four bacterial species previously isolated from failed RCs (*Enterococcus faecalis* (EF), *Actinomyces viscosus* (AV), *Porphyromonas gingivalis* (PG), and *Fusobacterium nucleatum* (FN)) that can be used to compare new methods with established root canal disinfection techniques.

Methods: The four bacterial species were cultured individually according to species requirements. A polymicrobial bacterial suspension containing all 4 species was prepared when cultures reached the desired optical density. The polymicrobial suspension was first tested on enriched blood agar to confirm that all species would grow well together. Optimal concentrations of each bacteria for the tooth model system were determined through a series of experiments growing polymicrobial biofilms in 12-well plates. Following successful growth in plates, the multi-species biofilm was grown in human premolar teeth under anaerobic conditions. Biofilms were assessed by physical removal of the biofilms and spiral-plating resulting multi-species suspensions onto selective and differential agars for incubation.

Results: All bacteria have been consistently recovered from multi-species biofilms colonizing root canals of human teeth in our model system. Our studies to date have shown that we can achieve stable and reproducible microbial communities established in the root canals of human teeth.

Conclusions: We have developed a stable reproducible human tooth multi-species biofilm model. Our immediate future studies will focus on development of a prolonged, multi-species biofilms maintained over a period of several weeks. We believe this novel biofilm model will allow for more accurate determination of the efficacy of new and innovative canal disinfection techniques; such as cold-plasma disinfection and/or laser-light therapy.

Supported by: University of Iowa Department of Endodontics; Iowa Institute for Oral Health

69. Utilizing AIC to Determine Best Representation of Longitudinal Dietary Variables

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The Akaike Information Criterion (AIC) is both a well-known tool for variable selection in multivariable modeling and a tool to help determine the optimal representation of explanatory variables collected in longitudinal studies. However, it has been discussed infrequently in the dental literature. The purpose of this presentation is to demonstrate use of AIC in determining the best representation of dietary variables.

The Iowa Fluoride Study (IFS) enrolled children at birth and dental examinations were conducted at ages 5, 9, 13, and 17. High (N=93), medium (N=126) and low (N=126) decayed or filled surfaces (DFS) trend clusters were created based on age 13 DFS counts and age 13-17 DFS increments for participants in the IFS using Ward's clustering method. Dietary intake data (water, milk, 100% juice, soda pop, and total sugared beverages) were collected bi-annually using a food frequency questionnaire. Multinomial logistic regression models were fit to predict DFS cluster groups. With the large amount of data collected, multiple approaches to summarize the dietary variables data could be used, including considering them as individual data points, averaging across all surveys as an overall cumulative measurement, or averaging over different shorter time periods to capture age trends. AIC was used to help determine the best representation of dietary variables.

Averaging data for all five dietary variables for the whole period from age 9 to 17.5 provided a better representation in the full model (AIC=751.3) compared to other methods assessed in multivariable full models (AICs=761.6 for ages 9 and 9-13 increment dietary measurements and AIC=775.2 for ages 9, 13, and 17 individual measurements). This was true both when the dietary data were displayed as total ounces and as percentages of total beverage consumption.

AIC can help researchers determine the best way to summarize information and include it in a statistical model.

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70. Direct Conversion of Dental Epithelial Cells to Dental Mesenchymal Cells by Overexpressing *Pax9* and Inhibiting microRNA-200a

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Purpose: There are many protocols used for regeneration therapies to develop dental tissue structures. Current tooth regeneration practices rely heavily on the use of stem cells, however, these can be difficult to obtain and culture. We have previously introduced a new method showing overexpression of Pituitary Homeobox2 (*Pitx2*) and microRNA-200a-3p in oral epithelial and odontoblast mesenchymal cells can produce amelogenin producing dental epithelial cells. Currently, we are inducing oral epithelial cells into odontoblast like mesenchymal cells through overexpression of Paired Box 9 (*Pax9*) and Plasmid-based MicroRNA Inhibitor System 200a (PMIS-200a).

Methods: Oral epithelial LS-8 cells were utilized for reprogramming into dental mesenchymal cells. Transgenic DNA was introduced using the lentivirus packaging system. The microRNA inhibitor system PMIS-200a was constructed by the NaturemiRI.

Conclusion: The goal of this study is to induce dental epithelial and mesenchymal cells through the use of various transcription factors, microRNAs, and microRNA inhibitors to promote tooth regeneration through epithelial and mesenchymal interactions

Supported by: NIH grant DE1394; University of Iowa internal funding; University of Iowa College of Dentistry; Carver College of Medicine Bioinformatics and RNA Sequencing Core

71. microRNA-26b-5p Regulates Molar and Incisor Development

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A *miR-26b* over-expression (OE) mouse was generated to understand the role of *miR-26b* during embryonic craniofacial development. The *miR-26b* over expression mice have craniofacial defects including a lack of incisors, molars and hair. *miR-26b* over-expression mice have arrested early tooth development coincident with decreased epithelial progenitor cell proliferation. *miR-26b* targets *Lef-1* to modulate *Lef-1* transcriptional activity. Both cyclin D1 and c-myc expression are decreased as well as other cell proliferation mechanisms. *miR-26b* expression correlates with the transition of *Lef-1* expression in the dental epithelium. *miR-26b* regulates all *Lef-1* isoforms and Wnt signaling, dependent on the *Lef-1* isoform expressed in specific dental tissues. *miR-26b* expression can reverse the incisor growth defects caused by overexpression of *Lef-1*. This is the first demonstration of a mouse model for miRNA regulation that has tooth agenesis. *miR-26b* regulation of *Lef-1* is essential for normal tooth and craniofacial development.

Supported by: Support for this research was provided by funds from the University of Iowa Colleges of Dentistry and Medicine and grant DE 13941 from the National Institute of Dental and Craniofacial Research to B.A.A.

72. CAD/CAM Ceramic Laminate Veneers: Fact or Myth

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This table clinic will present a clinical case of computer-aided design/computer-aided manufacturing (CAD/CAM) ceramic laminate veneers in a patient with discolored composite restorations and moderate misalignment of the maxillary anterior teeth. The presentation will elaborate on the case selection criteria, diagnosis, treatment planning and multidisciplinary approaches using digital dental technologies, including digital photography, smile analysis and CAD/CAM technology.

Challenging esthetic treatment requires a multidisciplinary approach to meet the purposes of both the dentist and the patient. Appropriate case selection and a well-sequenced treatment plan are essential for a successful clinical outcome. Digital documentation and smile analysis play a vital role in the planning phase. Digital photography, smile design concepts and parameters help in understanding the esthetic issues, along with color, shape, size, length and bodily position of the patient's teeth as well as improving dentist-patient communication. An innovative, simplified protocol for digital documentation and smile analysis will be demonstrated during the presentation.

Recent advances in dental materials and digital technologies have changed the way of contemporary clinical dentistry. This clinical case involved the design and fabrication of multiple ceramic laminate veneers using chairside CAD/CAM technology. The digital approaches to impression making, designing and restoration fabrication coupled with strong ceramic materials are paving the way to a less time consuming process, and to more predictable and satisfactory esthetic results.

The step-by-step process of the digital workflow will be presented, with a discussion of the advantages and disadvantages of this innovative system. In addition, a cementation protocol and the use of lithium disilicate ceramic as the restorative material will be discussed in this clinical case presentation.

73. Efficiency and Satisfaction Regarding Isolation Techniques for Sealant Placement

D.M. Pelzer¹, *A.I. Owais¹*, *W. Liu¹*, *D.V. Dawson¹*, *M.K. Geneser¹*, *K. Weber-Gasparoni¹*, *M.J. Kanellis¹*, *S. Kelly¹*, *K.S. Leary¹*, *T.R. Mabry¹*, *M.C. Skotowski¹*

¹University of Iowa, Iowa City, IA

Purpose: Evaluate patient and operator acceptability and satisfaction after the placement of dental sealants under Isolite® vs. cotton roll isolation. An additional goal is to compare the procedural time required for each of the two isolation techniques.

Methods: In this ongoing split-mouth, randomized clinical trial, the study population consists of healthy children aged 6-16 years with at least two non-carious premolar and/or permanent molar teeth across the same arch in need of first time sealant placement. Survey results of acceptability and satisfaction are reflected via different categorical answers and duration of the procedure is represented by direct time. Univariate and bivariate analyses, as well as logistic regression models are used to test the potential differences of survey results and procedural time between both isolation techniques ($\alpha=0.05$).

Results: TBD

Conclusions: TBD

Supported by: Delta Dental of Iowa Foundation; University of Iowa Department of Pediatric Dentistry

Disclosure: Isolite® donated 8 Isolite® and 100 Isolite® mouthpieces for use in this study. No promises regarding publication or outcome were made.

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