Tufts University School of Dental Medicine

CELEBRATING EXCELLENCE AND ACHIEVEMENT IN RESEARCH

2015–2016 Research Abstracts
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HISTORY OF BATES-ANDREWS DAY

Since the 1930s, this day is held annually to honor George A. Bates, an alumnus of Tufts University School of Dental Medicine, who taught Tufts medical and dental students. He was regarded by his students as an inspiring instructor in histology. Bates Day at TUSDM helps to promote student research and thereby enhance the opportunities for professional growth of our students, alumni, and faculty.

The Robert R. Andrews Society is a student-run organization that was formed in 1921 in honor of Dr. Andrews, an outstanding researcher and distinguished dental surgeon. The Andrews Society seeks to promote dental research and to honor those who excel in it.

MESSAGE FROM THE DEAN

Welcome to Bates-Andrews Day 2016, a showcase of our predoctoral and postgraduate students’ research activities. This year’s event will be the largest yet, with 80 student poster presentations. We appreciate your attendance and support of our students’ efforts.

We are honored to have as our keynote speaker Fiorenzo Omenetto, Ph.D., who will talk about “Materials from the Past Looking toward the Future.” Professor Omenetto is associate dean for research at the School of Engineering and professor in the Department of Biomedical Engineering at Tufts University. He leads the laboratory for ultrafast nonlinear optics and biophotonics.

Bates-Andrews Day gives our students the chance to share with the rest of the Tufts community their accomplishments in fields of special interest. I applaud them for their initiative and achievements.

New this year is the “Bring Your Own Device (BYOD) Peer Engagement” opportunity in which visitors can give student posters direct feedback online using a smart phone, tablet, or laptop. This is an exciting addition to our Bates-Andrews Day event, and I hope people will participate. Jennipher Murphy in Academic Affairs deserves appreciation for her efforts in making this happen.

Strengthening and increasing research activity and creating an environment that encourages and supports student participation in research are integral parts of the School’s strategic plan. Student research is also a key accreditation standard for dental education programs.

I appreciate the dedication of the faculty advisors to their mentorship. Special thanks go to the judges and the participating commercial exhibitors who help make this event possible. Finally, Eileen Doherty’s guidance as director of predoctoral student research and Dr. Gerard Kugel’s leadership as associate dean for research are highly valued as the expertise of these two mentors enhances our students’ research experiences.

Huw F. Thomas, B.D.S., M.S., Ph.D.
Dean and Professor of Pediatric Dentistry
MESSAGE FROM DR. KUGEL

The research mission of Tufts University School of Dental Medicine promotes integration of innovative studies in basic science, clinical practice, and public health. This book is evidence of the progress we have made and will continue to make at the Dental School.

TUSDM welcomes the valuable partnerships and contributions of corporations, foundations, the NIH, and the NIDCR’s tour mission. Working together, we have the means to perform ethical, meaningful research in oral and general healthcare that can be applied for the benefit of the scientific community and the public at large.

Researchers at TUSDM conduct studies in many areas, including bench and clinical studies in dental materials, devices, and pharmaceuticals. We are presently pursuing groundbreaking techniques in tissue engineering, bone remodeling, and Sjögren’s syndrome. Tufts also provides a wealth of opportunities for interdisciplinary research with our schools of nutrition, biomedical sciences, veterinary medicine, and engineering.

The combination of disciplines and talent at Tufts University provides the ideal environment for collaborative research and materials testing. Our record of contributions to the sciences and our potential to influence the future of dental medicine are extensive.

As we continue to promote oral health and improve the quality of life for the general population, we remain aware that strategic partnerships are vital to our efforts. We recognize the power of shared knowledge and are always looking to share resources and ideas. The pages that follow reveal a sample of our achievements thus far.

Gerard Kugel, D.M.D., M.S., Ph.D.
Professor and Associate Dean for Research
ACKNOWLEDGEMENTS

Corporate Partners

We would like to recognize and thank the following organizations and individuals for their support:

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Special thanks to the following Tufts faculty and students

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Dr. Ronald Kulich  Dr. Driss Zoukhri

Bates Student Research Group and Andrews Society Officers

Rachel Cohen, President
Jonathan Bishop, Vice President
Jessie Reisig, Secretary
Kathryn Weber, Treasurer
Jason Berglund, PR/Community Service Representative
Bates-Andrews Day 2016
Wednesday, March 2, 2016

Schedule of Events

11:00 AM – 3:00 PM  Predoctoral and postdoctoral student posters on display
                      Commercial Exhibitors

3:30 PM – 4:30 PM   Keynote Speech

4:30 PM             Awards Presentation and Reception

Keynote Address

Materials from the Past Looking toward the Future

Fiorenzo Omenetto, Ph.D.
Associate Dean for Research, School of Engineering
Professor, Department of Biomedical Engineering
Frank C. Doble Professor

Fiorenzo (Fio) Omenetto leads the laboratory for ultrafast nonlinear optics and biophotonics at Tufts University. He also holds an appointment in the Department of Physics. His research interests cover optics, nanostructured materials (such as photonic crystals and photonic crystal fibers), nanofabrication, and biopolymer-based photonics.

Since joining Tufts at the end of 2005, he has proposed and pioneered (with David Kaplan) the use of silk as a material platform for photonics, optoelectronics, and high-technology applications, is co-inventor on over 70 disclosures (published and unpublished) on the subject, and is actively investigating novel applications that rely on this technology base.

Applications of this material platform have received extensive press coverage and have been featured in MIT’s Technology Review magazine in 2010 as TR10—“top ten technologies likely to change the world.” He was named one of the top 50 people in tech by Fortune magazine in a class of 50 featuring Steve Jobs, Jeff Bezos, and Shigeru Miyamoto, among others.

Professor Omenetto was formerly a J. Robert Oppenheimer fellow at Los Alamos National Laboratory, a 2011 Guggenheim fellow, and is a fellow of the Optical Society of America.
BATES-ANDREWS RESEARCH DAY 2016
BATES-ANDREWS DAY 2016 AWARDS

Best Postgraduate Poster Presentation
Zuhair Natto — “Effect of Mucograft® Seal on Postextraction Ridge Preservation Using Bone Allograft: A Randomized Controlled Clinical Trial and Radiographic Evaluation”

Best Scientific Research Presentation by a Senior (Andrews Society Award)
Hannah Gilman — “Geographic Distribution of Dental Patients with Intellectual and Developmental Disabilities”

ADA/DENTSPLY Student Clinician Award for Best Overall Predoctoral Table Clinic
Matthew Coletti — “Adhesive Thickness Influence on the Decision to Replace Composite Restorations”

Second Place Award for Predoctoral Table Clinic
Jacob Donohue — “Ion-Releasing Materials, Demineralization, and Shear Strength of Orthodontic Brackets”

Third Place Award for Predoctoral Table Clinic
Lauren Gerkowicz — “Promoting Wellness in Dental Students: A Survey Study of Perceived Stress and Stress Management”

Research Committee Award for Basic Science Research
Kathryn Weber — “Silencing Snai1 with siRNA and shRNA in Murine BM-MSCs”

Massachusetts Dental Society and ASDA Public Health Award
Khusbu Patel — “Oral Health Quality of Life in Intellectually/Developmentally Disabled Individuals”

Omicron Kappa Upsilon (OKU) Hilde Tillman Award
Gayathri Shenoy — “Evaluation of the Evidence-Based Clinical Questions Presented during the Basic and Clinical Sciences Spiral Seminar Series”

Dr. Chad Anderson Family Award for Innovative Methodology and Research
Alissa Mariano — “Irradiance Comparison of Various Curing Lights under Different Distance Positioning”

Dr. Aikaterini Papatheanasiou Award for Promotion of Esthetic Dentistry
Michelle Ta — “Microleakage Evaluation of Elevated Temperatures in Adhesive Systems”

Scientific Merit Award for First-Time Presenters
Jennifer Denike — “Self-Assessment Accuracy of Third-Year Dental Students in Operative Dentistry”

Oral Health Disparities Award
Douglas Kim — “Retrospective Study to Assess an Oral Health Program in Zambia”

Bates Student Research Group “Peer-Reviewed” Award
Andrew Lum — “Association between Sinus Membrane Thickness and Perforation during Sinus Augmentation”

ADEA Student Group Educational Research Award
Kathleen Molgaard — “Changing Demographics of Published Authors in U.S. Dental Journals”

Procter & Gamble AADR Traveling Fellowship Award
Nancy Epstein — “Comparison of Compressive Strength of Liner Materials”

AADR Student Research Day Award
Kunal Dani — “Comparison of Different Delivery Techniques for Placing Bulk-Fill Composites”
PREDOCTORAL STUDENT PRESENTATIONS

Note: Where indicated, the Tufts University Health Sciences Institutional Review Board (IRB) reviewed and approved the study or determined that it was not human subject research.

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Jonathan Bishop, D16 (p. 27)
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Salivary PRP3 as a Diagnostic Biomarker for Sjögren’s Syndrome

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1Tufts University School of Dental Medicine, 2The Forsyth Institute

OBJECTIVES: Although Sjögren’s syndrome (SjS) is among the significantly morbid autoimmune disorders, confirming the diagnosis remains difficult to achieve due to the lack of definitive diagnostic methods. Development of protein biomarker profiles would allow for a highly sensitive and specific diagnostic method to prevent disease progression and ensure proper treatment. The purpose of this study was to determine whether salivary proline-rich protein 3 (PRP3) could be used as a biomarker for SjS diagnosis.

METHODS: Twenty-four SjS patients and 18 age-matched healthy controls were recruited. Unstimulated, stimulated whole saliva and submandibular/sublingual glands saliva were collected. One hundred mg of 10 SjS and 10 healthy samples were digested using trypsin for proteomics analysis on a nano LC-MS/MS. Protein identification was performed using Proteome Discoverer with Mascot and Sequest HT algorithms against Swiss-Prot Human protein database. Label-free quantitative analysis was performed using Sieve 2.2 software. Ten mg of 13 SjS and 18 healthy samples were separated by SDS-PAGE followed by transfer to PVDF membranes for Western blotting using an anti-PRP3 antibody. Immunoreactive bands were visualized and quantified using the Odyssey® Infrared Imaging System.

RESULTS: SjS and healthy subjects’ demographics are summarized in Table 1. Unstimulated and stimulated salivary flow rates were significantly reduced in SjS compared to control subjects. In the proteomics results, PRP3 protein was identified in all the samples from SjS patients and in eight of 10 healthy samples. The PRP3 protein sequence was GRPQGPPQQGGHQQGPPPPGGKPQGPPQGGRPQGPQQGSPQ (26.51% sequence coverage). Quantification of the Western blots showed an average 46.8% increase in PRP3 protein amount in SjS when compared to control subjects (Chart 1).

Table 1. Summary of patients’ characteristics

<table>
<thead>
<tr>
<th></th>
<th>SjS (N=24)</th>
<th>Healthy (N=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age1</td>
<td>57±10 (35–67)*</td>
<td>54±7 (45–68)*</td>
</tr>
<tr>
<td>Sex (F/M)</td>
<td>(24/0)</td>
<td>(18/0)</td>
</tr>
<tr>
<td>Disease Duration2,3</td>
<td>8±5 (2–20)*</td>
<td>N/A</td>
</tr>
<tr>
<td>Salivary flow rate4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unstimulated</td>
<td>0.264±0.286</td>
<td>0.735±0.339</td>
</tr>
<tr>
<td>Stimulated</td>
<td>0.949±0.816</td>
<td>2.178±0.896</td>
</tr>
</tbody>
</table>

1Median (years)±SD
2Since diagnosis.
3Mean (years)±SD
4Mean (mL/min)±SD
*Range (years)
CONCLUSION: Though PRP3 was found as a constituent of healthy and SjS patients’ saliva, PRP3 was overexpressed in SjS patients. Thus, PRP3 can be included in the development of a protein biomarker profile to be used as a noninvasive method of SjS diagnosis.

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1599.*
Effects of Disinfection and Storage Methods on Shear Bond Strength
Alisha Anand,* Gerard Kugel, Sarah Pagni, Jeffrey Daddona, and Britta Magnuson

OBJECTIVES: To test the effects of storage methods on extracted teeth used for shear bond strength (SBS) tests of bonded composite to dentin and enamel.

METHODS: Extracted human teeth were used for enamel and dentin samples, which were divided into 10 groups (N=8 per group). Groups were stored according to the Centers for Disease Control and Prevention sterilization and storage methods as well as an additional control group. Length of storage time was determined based on previous literature and educational standards. Enamel specimens (groups 1, 2, 3, 4, and 5) were etched for 30 seconds, dentin specimens (groups 6, 7, 8, 9, and 10) for 15 seconds (Ultra-Etch®, Ultradent), and then rinsed. Adhesive (ExciTE® Total-Etch Adhesive, Ivoclar Vivadent) was placed according to the manufacturer's instructions. Composite (Filtek™ Supreme Ultra Universal Restorative, 3M ESPE) was added and lightcured for 30 seconds (DEMI™, Kerr). Samples were stored in deionized water for 24 hours. SBS was tested using a universal testing machine (Instron®, Norwood, Massachusetts); crosshead speed moved at 5 mm/m until failure. One-way ANOVA and Tukey’s HSD were used for analysis.

RESULTS: Means and SDs for compressive stress at maximum compressive load were calculated. The enamel group difference was not statistically significant (p-value=0.668). The dentin group difference was statistically significant (p-value=0.003), with differences between groups 2 and 10 (p-value=0.002) and between groups 4 and 10 (p-value=0.040).

CONCLUSIONS: Storage method did not impact the SBS results for enamel. For dentin, the mean of group 10 (deionized water) was significantly less than groups 6 and 8 (bleach for one week and formalin). This may have an impact on future studies, as storage methods did not appear to negatively affect the SBS results on enamel; however, there was a difference in SBS results for the dentin samples.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1651.
**Relationship between *Streptococcus mutans*, *Lactobacillus*, and Caries in Xerostomic Patients**

*Kelly Barbera,* Sarah Pagni, and Athena Papas

**OBJECTIVES:** The aim of this record review study was to identify the correlation between *Streptococcus mutans* (SM) and *Lactobacillus* (LB) levels and caries prevalence in medication-induced xerostomic subjects. Our goal was to identify a threshold level of SM and LB associated with caries prevalence (in cfu/mL), as well as to identify a threshold level of salivary hypofunction that caused increased SM and LB levels (in mL/m).

**METHODS:** We analyzed data from subjects with medication-induced xerostomia, including unstimulated saliva (US), stimulated saliva (SS), SM and LB levels, and total caries (TC). A correlation analysis was performed on 115 de-identified study files to determine if US, SS, and TC were correlated with SM, LB, and total SM+LB. Categorical variables of US and SS were created to determine if there was a difference in bacterial levels between three levels of saliva flow. Quintiles of US and SS were created to test for a difference in median bacteria count between quintiles (see Table 1).

**RESULTS:** There was significant positive correlation between SM and TC (Spearman’s rho=0.2806; Prob>|t|=0.0025), LB and TC (Spearman’s rho=0.2869; Prob>|t|=0.0020), and total SM+LB and TC (Spearman’s rho=0.3153; Prob>|t|=0.0006). There was no significant correlation between SS or US and bacterial levels. Since 99 subjects had US of 0, it was difficult to look at US differences. There was a statistically significant difference in median SM between patients in SS quintiles 2 and 3, suggesting that closer attention should be paid when flow falls below 1.24 mL/m.

**CONCLUSIONS:** It was confirmed that patients with higher bacterial levels experienced a higher prevalence of caries. It was unclear how clinically relevant the difference in median SM counts between quintiles was, given how much bacteria levels fluctuated between SS quintiles.

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1766.*
The Relationship between Predoctoral Dental Research Training and Academic Success

Jason Berglund* and Eileen Doherty

PURPOSE: Predoctoral dental research programs are touted as a means to increase students’ critical-thinking skills and encourage evidence-based decision making, but there is little empirical analysis of the outcomes and benefits of such programs. If our hypothesis proved true, and participation in research as a dental student at Tufts University School of Dental Medicine (TUSDM) can be correlated with an increase in graduating dental school grade point average (GPA), it would add a measure of success to previous studies utilizing student satisfaction surveys and percentages of students entering postgraduate specialty training or employed in teaching.

METHODS: Prior to the study, IRB approval was achieved and complete lists of research students were compiled for the TUSDM graduating classes of 2008 to 2015. Of the total number of graduated students (N=1,259) from 2008 to 2015, 191 students (N=191) had participated in at least one year of research activities. Incoming science GPA, Dental Admissions Test (DAT) scores, and final dental school GPAs were collected. Incoming science GPA was collected as reported on Associated American Dental Schools Application Service (AADSAS) student applications, and included all previous science coursework. Stata statistical software (version 13.1) was used for all statistical analyses.

RESULTS: Those students participating in research while in dental school had a significantly higher median graduating GPA (3.48) than those who had not performed any research (3.30) (p< 0.001). However, there was no statistically significant difference in the median graduating GPA when investigating the number of years that students were involved in research while in dental school (p<0.0827). There was no statistically significant difference between the median incoming science GPA of research students (3.33) and those not partaking in research (3.31) (p=0.367). The median DAT academic average of students participating in research was significantly higher in research students (p< 0.001), although the difference only resulted in a median score increase from 19 to 20.

CONCLUSION: Our study provides empirical evidence demonstrating that students who have done research while in dental school tend to have a slightly higher academic average than their peers who did not engage in research activities.

Presented at the 2016 ADEA Annual Session in Denver, Colorado. Abstract #PO-021.
**In Vitro Universal Adhesive Bond Strength Testing Five Core Build-Up Materials**

Jonathan Bishop,* Christina Penn, Astrit Kastrati, Ronald Perry, and Gerard Kugel

**OBJECTIVE:** Bonding techniques and the material used are a crucial source of high retention of a core build-up and overlying restoration. This study compared the shear bond strength of different adhesives when bonded to iBond® Universal (Heraeus Kulzer) (IBUN).

**METHODS:** Bovine incisors (N=8) within six months after extraction were halved and embedded in a resin for easier handling. A standard dentin surface was prepared by grinding the teeth with silicon carbide abrasive paper with a grit size of P120 and P320 under running water. IBUN was applied according to manufacturer’s instructions and light cured (Translux® Wave LED, Hereaus Kulzer) for 10 seconds. The specimens were inserted into a bonding jig (Ultradent Products, Inc., South Jordan, Utah) and the different core build-up materials: LuxaCore® Automix SC (LASC) (DMG), Rebilda SC (RB) (VOCO), Build-it™ FR (BI) (Pentron), Core Paste® (CP) (Denmat), and Fluorocore® 2+ (F2) (DENTSPLY) were applied to the mold (2.39 mm diameter by 3 mm height) according to manufacturer’s instructions. The specimens were stored at 37°C for 1 hour before removing from the mold after removal samples were stored in water at 37°C. Shear bond strength (SBS) was tested after 24 hours or after additional thermocycling to simulate aging (5,000 cycles between 5°C/55°C with 10 s dwell time). The results were analysed using ANOVA statistical analysis.

**RESULTS:** See Table 1. No statistically significant difference was observed between 24-hour groups nor was there any significance when viewing differences between 24-hour and post-thermocycling testing in the LASC group.

Table 1. Bond strength testing results: Mean (Standard Deviation) (in MPa)

<table>
<thead>
<tr>
<th></th>
<th>After 24 hours</th>
<th>After thermocycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>LASC</td>
<td>11.2 (7.0)</td>
<td>12.9 (10.3)</td>
</tr>
<tr>
<td>RB</td>
<td>17.1 (5.2)</td>
<td>-</td>
</tr>
<tr>
<td>BI</td>
<td>21.0 (10.9)</td>
<td>-</td>
</tr>
<tr>
<td>CP</td>
<td>10.7 (8.6)</td>
<td>-</td>
</tr>
<tr>
<td>F2</td>
<td>11.8 (7.2)</td>
<td>-</td>
</tr>
</tbody>
</table>

SBS series (N=8 bovine teeth ground to dentin were used)

**CONCLUSIONS:** Despite variation in mean bond strengths between each core build-up material, no statistical difference was observed. For practitioners, this observation shows that the product brands tested can be intermixed without losing bond strength. There appears to be no detriment if practitioners use different core build-up materials when paired with IBUN. Further testing is needed.

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0357.*
Blood Transfusions in Orthognathic Surgery

Mina Boulos,* Corey Decoteau, Maria Papageorge, Archana Viswanath, and Matthew Finkelman

OBJECTIVE: Orthognathic surgery is the surgical correction of abnormalities of the mandible, maxilla, or both. Since craniofacial structures are very vascular, one complication of orthognathic surgery is intraoperative blood loss (BL). In general, as a routine standard of practice for elective surgery, preoperative autologous blood donation (PABD) is done for all patients. If autologous blood is not used during surgery, it is wasted and cannot be transfused to other patients. If blood is needed, a homologous blood donation is used. Given that most patients undergoing orthognathic surgery are young and healthy, there is debate in literature about PABD for orthognathic surgery. The objective of this retrospective chart review study is to analyze if PABD is necessary for orthognathic surgeries and if there are certain factors that predispose patients to increased BL.

METHODS: This study was conducted in the Department of Oral Surgery at Tufts University School of Dental Medicine. Following IRB approval, medical records from patients who underwent orthognathic surgery in the past five years (2010–2015) were reviewed. The following variables were analyzed: demographic data, medical history, BMI, hemoglobin concentrations, number of units of blood cross-matched and used, length of operation, grade of anesthetist, history of complications, type of orthognathic surgery, and amount of BL.

RESULTS: One hundred charts were reviewed, with close to equal gender distribution (females: 51%, males: 49%). The age distribution was 14–59, and a majority underwent BSSO, LeFort, and genioplasty procedures. The records show that autologous blood was not transfused in any patients who underwent orthognathic surgery during the five years reviewed. The association between amount of BL and analysis variables was calculated using Spearman’s correlation. There was weak association between variables analyzed and amount of BL during the procedure.

CONCLUSION: Due to the weak association between factors and low occurrence of complications, PABD is not supported in most cases.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0735.
Fluoride Release Comparison of Glass Ionomer Materials

Tyler Brady,* Jeffrey Daddona, and Ronald Perry

OBJECTIVE: Glass ionomers (GI) are among the many dental materials introduced every year. One of the key benefits of GI is the fluoride release over time, which may help remineralize the surrounding tooth structure and potentially prevent tooth decay. We aim to show that GI materials vary in their fluoride release significantly over time.

METHODS: Ten samples (N=10) of four different GI materials were tested, totaling 40 samples. The disc samples measured 2 mm thick with a 5 mm diameter. They were submersed in 5 mL of artificial saliva (KH2PO4+NaN3+KCl+CaCl2+MgCl2) for one month. The materials were IONO Star Plus, VOCO™ (IS); Fuji IX, GC™ (F); Ketac Molar, 3M ESPE™ (KM); and Chemfil Rock, DENTSPLY™ (CFR). Fluoride release was measured using a Thermo Scientific Orion™ Star ISE Meter at 6, 12, 24, and 48 hours, and later at 1, 2, 3, and 4 weeks after submersion at a pH of 5.5. The fluoride release was measured in cumulative ppm, and the four types of GI were compared to see if there was significant difference of ion release between the four sample types.

RESULTS: Using ANOVA one-way data analysis, IS and F had significantly higher fluoride release than KM and CFR throughout the assay. Additionally, IS was significantly higher than F, showing that IS releases more fluoride over time than the other materials tested.

Table 1. Cumulative fluoride ion release over time in ppm

<table>
<thead>
<tr>
<th></th>
<th>6 Hours</th>
<th>12 Hours</th>
<th>24 Hours</th>
<th>48 Hours</th>
<th>1 Week</th>
<th>2 Weeks</th>
<th>3 Weeks</th>
<th>4 Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS</td>
<td>5.67±1.22</td>
<td>7.23±1.18</td>
<td>10.16±1.42</td>
<td>10.34±1.44</td>
<td>12.79±1.38</td>
<td>16.80±1.61</td>
<td>17.60±2.25</td>
<td>19.72±2.02</td>
</tr>
<tr>
<td>F</td>
<td>4.77±0.93</td>
<td>6.20±0.96</td>
<td>7.69±1.38</td>
<td>8.66±1.77</td>
<td>9.42±1.41</td>
<td>12.26±2.43</td>
<td>13.04±2.48</td>
<td>14.25±2.89</td>
</tr>
<tr>
<td>KM</td>
<td>1.80±0.25</td>
<td>2.39±0.17</td>
<td>3.42±0.30</td>
<td>3.69±0.31</td>
<td>4.82±0.43</td>
<td>7.18±0.58</td>
<td>9.06±0.50</td>
<td>9.33±0.61</td>
</tr>
<tr>
<td>CFR</td>
<td>2.40±0.64</td>
<td>3.11±0.75</td>
<td>4.41±0.67</td>
<td>4.75±0.69</td>
<td>5.25±0.68</td>
<td>6.96±0.75</td>
<td>7.77±0.90</td>
<td>8.04±0.88</td>
</tr>
</tbody>
</table>

*All values based off of mean±SD. P-value<0.05

CONCLUSION: Findings suggest possible advantages of working with specific GI materials in regard to fluoride release. The materials that released fluoride in higher concentrations will (likely) perform better in remineralizing surrounding tissues, and possibly prevent the spread of caries. Dentists working with GI with greater fluoride ion release may have greater chance of remineralization and caries prevention. These results will help dentists decide which of the GI tested yield the most fluoride release.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1351.
Microleakage and Voids of Bulk-Fill Restorations Using Various Composite Systems

Christopher Beninati, William Brown,* Carlos Munoz, Ronald Perry, and Gerard Kugel

OBJECTIVE: Compare the microleakage and internal voids of SonicFill2™ (Kerr) SF to other commercially available bulk-fill composites.

METHODS: Twenty human molars were cleaned and stored in a solution of 4% Chloramin T at 4°C. Forty class II preparations were made with diamond burs, using the mesial and distal of each tooth. The preparations were: 4 mm bucco-lingually and 5 mm mesio-distally with a depth of 4 mm. The proximal box was placed 0.5 mm below the CEJ. The preparations were randomized into four groups (N=10) and restored as follows: group CX, Xeno IV™ with SureFil™ and CeramX™ (DENTSPLY); group BB, Optibond XTR™ (Kerr) with Beautifil Bulk™ (Shofu); group SF, Optibond XTR with SonicFill2™ (Kerr); and group HU, Optibond XTR™ with Herculite Ultra™ (Kerr), and completed according to manufacturer’s instructions. After thermocycling between 5 and 55°C for 1,000 cycles with a 30-second dwell time, the samples were painted with two layers of nail polish, except for 1 mm around the margins. The specimens were immersed for 24 hours in 5% fuchsine dye. Teeth were sectioned with a diamond saw, the microleakage was evaluated under a 40X microscope (Leica GZ6), and internal voids of the restorations were noted for each specimen using subjective scales. Results were analyzed via generalized estimating equations using SAS 9.4 statistical software.

RESULTS: Tables 1–3 present results for cervical, occlusal, and void, respectively, by restorative material. The difference between restorative materials was not significant for cervical (p=0.427) or void (p=0.306); significance was found for occlusal (p=0.018). Post-hoc tests showed that SF exhibited significantly less microleakage than CX and HU.
## Table 1. Cross-tabulation between restorative material and observed microleakage (cervical)

<table>
<thead>
<tr>
<th>Restorative Material</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CX</td>
<td>N 14</td>
<td>11</td>
<td>4</td>
<td>11</td>
<td>0.427</td>
</tr>
<tr>
<td>%</td>
<td>35.0%</td>
<td>27.5%</td>
<td>10.0%</td>
<td>27.5%</td>
<td></td>
</tr>
<tr>
<td>BB</td>
<td>N 21</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>52.5%</td>
<td>20.0%</td>
<td>15.0%</td>
<td>12.5%</td>
<td></td>
</tr>
<tr>
<td>SF</td>
<td>N 16</td>
<td>14</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>40.0%</td>
<td>35.0%</td>
<td>22.5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>HU</td>
<td>N 14</td>
<td>10</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>35.0%</td>
<td>25.0%</td>
<td>20.0%</td>
<td>20.0%</td>
<td></td>
</tr>
</tbody>
</table>

## Table 2. Cross-tabulation between restorative material and observed microleakage (occlusal)

<table>
<thead>
<tr>
<th>Restorative Material</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CX</td>
<td>N 7</td>
<td>6</td>
<td>17</td>
<td>10</td>
<td>0.018</td>
</tr>
<tr>
<td>%</td>
<td>17.5%</td>
<td>15.0%</td>
<td>42.5%</td>
<td>25.0%</td>
<td></td>
</tr>
<tr>
<td>BB</td>
<td>N 9</td>
<td>11</td>
<td>16</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>22.5%</td>
<td>27.5%</td>
<td>40.0%</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td>SF</td>
<td>N 18</td>
<td>15</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>45.0%</td>
<td>37.5%</td>
<td>12.5%</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>HU</td>
<td>N 13</td>
<td>11</td>
<td>12</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>32.5%</td>
<td>27.5%</td>
<td>30.0%</td>
<td>10.0%</td>
<td></td>
</tr>
</tbody>
</table>

## Table 3. Cross-tabulation between restorative material and the presence of voids

<table>
<thead>
<tr>
<th>Restorative Material</th>
<th>No Voids</th>
<th>Voids</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CX</td>
<td>N 32</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>80.0%</td>
<td>20.0%</td>
<td></td>
</tr>
<tr>
<td>BB</td>
<td>N 33</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>82.5%</td>
<td>17.5%</td>
<td></td>
</tr>
<tr>
<td>SF</td>
<td>N 37</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>92.5%</td>
<td>7.5%</td>
<td></td>
</tr>
<tr>
<td>HU</td>
<td>N 37</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>92.5%</td>
<td>7.5%</td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** While there were no statistically significant differences on voids amongst the tested products, SF exhibited significantly less microleakage, while SF had the highest microleakage and void formation. Clinicians can use this knowledge on the materials tested and apply it to their practice when working on patients.

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1357.*
Surface Deposition Analysis of Bioactive Restorative Material and Cement

William Chao,* Ronald Perry, and Gerard Kugel

OBJECTIVE: To investigate the surface deposition of calcium and phosphorous from a bioactive restorative material and luting cement.

MATERIALS AND METHODS: The bioactivity of ACTIVA™ Bioactive-Restorative A2 shade (Pulpdent) and ACTIVA™ Bioactive-Cement (Pulpdent) were studied. Disc-shaped specimens of each material (N=3) were created with the dimensions of 4 mm in thickness and 5 mm diameter by placing the materials in a polypropylene mold and photo-polymerizing for 40 seconds on each side. The specimens were removed and polished on 200 Grit SiC paper. Two specimens of each material were hung vertically in 10 mL Dulbecco's phosphate-buffered saline (PBS) for specified times of 14 or 28 days. The specimens were removed and the buffered saline solution was thoroughly washed off with distilled water to remove adhering foreign ions on the surface. The remaining specimens of each material served as the control samples and were polished and rinsed with saline, but were not treated in PBS. Samples were placed on half-inch SEM Al stubs with double-sided adhesive tape. The stubs were sputter-coated using an Au-Pd target from a Denton Vacuum Desk II sputter coater for 80 seconds. The specimen surfaces were then subjected to Amray 3300 FESEM [SEMTech (STS)] field scanning electron microscope (SEM) imaging and PulseTor SDD (Silicon Drift Detector) energy-dispersive X-ray spectroscopy (EDS) analysis to determine the structural morphology and the characterization of precipitated material on the surface.

RESULTS:

| Table 1. Concentrations in % for Luting Cement vs. Storage Period at 3000x |
|------------------|------------------|------------------|
|                   | Control | 14 days | 28 days |
| Phosphorous       | 1.745   | 5.783   | 5.485   |
| Calcium           | 2.805   | 5.196   | 4.582   |

| Table 2. Concentrations in % for Restorative Composite vs. Storage Period at 3000x |
|-------------------------------|------------------|------------------|
|                               | Control | 14 days | 28 days |
| Phosphorous                   | 1.278   | 2.603   | 4.992   |
| Calcium                       | 1.179   | 2.956   | 4.810   |

CONCLUSION: Both materials tested showed higher concentrations of calcium and phosphorous on the surface of the material at 14 days and 28 days compared to the control.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1313.
Comparison of Initial Stickiness of Glass Ionomer Restoratives
Rachel Cohen,* Alissa Mariano, Matthew Finkelman, Gerard Kugel, and Ronald Perry

OBJECTIVE: The handling of restorative materials is highly important to the dentist and is particularly crucial in the use of self-cure glass ionomers (GIs), in which very little time is available to apply and shape the material. Contouring GIs following placement can cause voids when the material sticks to the instrument, making a material that exhibits low stickiness ideal. The aim of this study was to quantify and compare the initial stickiness of various GI restorative materials.

METHODS: Seven commercially available GIs were tested (Table 1). Restoratives were activated and mixed according to manufacturers’ instructions and extruded into a heated cavity (34°C). A spatula was used to level the surface. Initial stickiness of GIs was assessed using a Texture Analyzer (load cell 10 N) by measuring the displacement and withdrawal work (N*mm). Thirty seconds after mixing commenced, a metal ball plunger (4 mm diameter) was lowered and embedded 2 mm into the sample at a constant speed (3 mm/s). The plunger was then withdrawn at the same speed. Height was calibrated between measurements. Stickiness was defined as the ratio of the withdrawal work to the displacement work and expressed as a percentage, with lower percentages indicating less stickiness. Data were analyzed using one-way ANOVA, with Tukey’s HSD for post-hoc tests.

RESULTS: A statistically significant difference (p<0.05) in stickiness was found among the materials tested (Table 1).

Table 1. Mean and standard deviation of stickiness ratio for each product.

<table>
<thead>
<tr>
<th>GI Restorative</th>
<th>Manufacturer</th>
<th>Sample Size</th>
<th>Mean Stickiness (%)</th>
<th>Standard Deviation (%)</th>
<th>Significance Grouping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketac™ Universal Aplicap™</td>
<td>3M ESPE</td>
<td>30</td>
<td>23.71</td>
<td>10.03</td>
<td>A</td>
</tr>
<tr>
<td>Ketac™ Fil Plus Aplicap™</td>
<td>3M ESPE</td>
<td>29</td>
<td>47.28</td>
<td>16.88</td>
<td>B</td>
</tr>
<tr>
<td>IonoStar® Plus</td>
<td>VOCO</td>
<td>30</td>
<td>52.34</td>
<td>13.26</td>
<td>B C</td>
</tr>
<tr>
<td>EQUIA® Fil</td>
<td>GC</td>
<td>29</td>
<td>60.49</td>
<td>7.78</td>
<td>C D</td>
</tr>
<tr>
<td>EQUIA® Forte Fil</td>
<td>GC</td>
<td>29</td>
<td>61.70</td>
<td>5.80</td>
<td>D</td>
</tr>
<tr>
<td>Fuji IX GP®</td>
<td>GC</td>
<td>30</td>
<td>62.48</td>
<td>11.35</td>
<td>D</td>
</tr>
<tr>
<td>Riva Self Cure</td>
<td>SDI</td>
<td>30</td>
<td>71.98</td>
<td>2.47</td>
<td>E</td>
</tr>
</tbody>
</table>

1Means that do not share a letter are significantly different.

CONCLUSION: This evaluation quantified stickiness and indicated that GI materials display significantly different degrees of initial stickiness. Ketac™ Universal Aplicap™ (3M ESPE) was found to be least sticky. GIs with low stickiness have the potential to improve ease of handling for dentists. Additional studies should evaluate stickiness at different intervals within the working time of GIs.

This work was supported by 3M ESPE.
Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0383.
Adhesive Thickness Influence on the Decision to Replace Composite Restorations

Matthew Coletti,* Gerard Kugel, Steven Eisen, Aruna Ramesh, and Sarah Pagni

OBJECTIVE: This study aimed to evaluate the validity of the decision to replace a composite restoration based upon the bonding thickness of contemporary adhesive systems.

METHODS: Class II mesial cavities were prepared on 75 third molars. The teeth were randomly divided into five groups of 15 teeth, with each group receiving different restorative treatment. Clearfil™ SE Bond (Kuraray Medical Inc.; CF), ExciTE® F (Ivoclar-Vivadent; EF), Peak® Universal Bond (Ultradent; PU), and All-bond SE® (BISCO Inc.; AB) were applied in the experimental groups according to the manufacturers’ instructions, while no bonding agent was used in the control group. Following restoration, digital radiographs were obtained and independently evaluated by two operative dentistry faculty members to determine the need for replacement. If disagreement arose, a third independent evaluator determined the majority decision. The teeth were sectioned through the restoration midline and adhesive film thickness, pooling, and void presence were examined at the tooth-restoration interface using an optical light microscope. Inter-reader variability was evaluated by Cohen's kappa statistic. Sensitivity, specificity, and negative and positive predictive values were calculated. Statistical differences in film thickness were determined using the Kruskal-Wallis test and pairwise comparisons were made with Dunn's test.

RESULTS: CF was best for identifying nonadapted restorations with the highest positive predictive value (PPV=0.80). EF, PU, and AB were best for identifying well-adapted restorations, all with the highest negative predictive value (NPV=1.00). PU had the highest false positive scores, while CF had the highest false negative scores. PU was the only adhesive significantly different than all other experimental groups for film thickness, while CF was statistically different from EF and PU for adhesive pooling (p<0.05).

CONCLUSION: This investigation demonstrates that although small bonding layers correlate to high false-positive replacement decisions, overall it is difficult to make accurate replacement decisions for composite restorations based on digital radiographs.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0362.
Pathosis of Retained Roots in Relation to Distance of Submergence

John Constantine,* Brett Henson, Matthew Finkelman, and Robert Amato

OBJECTIVES: The objective of this study was to compare pathosis, via periapical index (PAI), of retained root tips at varying distance of submergence from the alveolar crest. The hypothesis was that greater distance of a root tip from the alveolar crest would be associated with an increased chance of clinical success (no pathosis). Success is defined as nonpathologic retention of root tips. In addition, the association between the length of the root tips and pathosis was investigated.

METHODS: A radiographic review was conducted on 76 retained and submerged root tips at Tufts University School of Dental Medicine (TUSDM). The distance from the alveolar crest and length of root tips was compiled and examined. Root tips were evaluated using the (PAI) to determine if the distance from the alveolar crest has an association with higher rates of pathosis of retained root tips. All root tips were evaluated by a minimum of two evaluators who took note of submergence distance, length of root tip, and PAI score. A third rater was used in the event of PAI disagreement. Data were analyzed via generalized estimating equations (GEE) using the statistical software package SAS (Version 9.4).

RESULTS: Sixty-nine of 76 root tips (91%) were concluded to be successfully submerged (nonpathological). The association between submergence and success was not statistically significant (p=0.92). The association between length of root tips and success was not statistically significant (p=0.43). The kappa statistic for inter-rater reliability of success/failure was 0.861.

CONCLUSIONS: Ninety-one percent of reviewed root tips showed no pathosis. No statistically significant association was found between submergence distance and success or between length of root tips and success. Future studies of these associations should include a larger sample size.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1048.
**Novel Bioactive Peptide Comb1 Binds Multiple Proangiogenic Receptors**

*Stephen Cronk,* Anthony Sheets, and Ira Herman

**OBJECTIVE:** Healing of chronic and acute full-thickness wounds remains a significant challenge in the management of diabetic patients. Previous studies from our laboratory have produced several novel bioactive peptides using *Clostridium histolyticum* collagenase to degrade the extracellular matrix of endothelial cells. The resulting peptide fragments were found to accelerate cell migration, proliferation, angiogenesis, and other processes critical to wound healing in *in vitro* studies. Peptide-promoted enhanced wound closure was also demonstrated in a mouse model of impaired wound healing. Out of these studies, a peptide named comb1 produced the highest magnitude of these effects. We now focus on the identification of the receptors for comb1.

**METHODS:** Several primary mammalian epithelial cell culture populations were grown, wounded, and allowed to recover before being harvested. The resulting lysate samples were separated by SDS-PAGE and transferred to nitrocellulose membrane. The membranes were then incubated with varying combinations of labeled, unlabeled, or control peptides and detected with anti-FITC antibodies. Bands that were found to strongly and selectively bind FITC-tagged peptides were then analyzed via mass spectrometry to find their possible amino acid structures.

**RESULTS:** Using this technique, we identified several putative receptors whose binding sites recognize sequences found in our bioactive peptide and many of which are proangiogenic.

<table>
<thead>
<tr>
<th>Candidate Receptor</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extracellular Matrix Protein-1</td>
<td>Pro-angiogenic cell surface and ECM-associated protein that interacts with DINECE, as in comb1 N-terminal</td>
</tr>
<tr>
<td>Integrin-β4</td>
<td>Laminin-5 receptor, known to stimulate endothelial and keratinocyte migration</td>
</tr>
<tr>
<td>Myoferlin</td>
<td>Membrane-associated protein implicated in VEGFA secretion and EGFR activity</td>
</tr>
<tr>
<td>Synembryn A (RIC8A)</td>
<td>Membrane-associated GEF that interacts with comb1 N-terminal precursor</td>
</tr>
<tr>
<td>Elastin Binding Protein</td>
<td>Recognizes XGXXPG consensus sequence, as in comb1 C-terminal (EGLEPG)</td>
</tr>
</tbody>
</table>
| Galectin-3-Binding Protein    | Pro-angiogenic
Recognizes XGXXPG consensus sequence, as in comb1 C-terminal |

**CONCLUSION:** This new information about receptor identities for comb1 will inform further studies in similar bioactive peptides derived from MMP degradation of ECM. While already promising, these peptides may hold potential to be improved further in their efficacy and developed into medicines for diabetic wound healing that could one day be used in practice. In a broader sense, characterizing how MMP digestion leads to accelerated wound healing will enable a better understanding of wound healing in general.
Comparison of Different Delivery Techniques for Placing Bulk-Fill Composites

Kunal Dani,* Gerard Kugel, Aikaterini Papathanasiou, and Steven Eisen

OBJECTIVES: To evaluate the effect of three different delivery techniques of placing bulk-fill composite restorations (prewarming, sonic vibrations, and conventional method) on the microleakage performance of these restorations.

METHODS: Thirty-three extracted caries-free human molars were prepared with a standard-slot Class II preparation using Midwest Supply Traditional F/O Push Button Handpiece with #245 bur (Brasseler USA®) with the following dimensions: 4 mm Occluso-cervical height, 1.5–2.0 mm mesio-distal and 3.0–4.0 mm bucco-lingual. The cavities were etched (Ultra-Etch®, Ultradent, 37% Phosphoric acid) for 30 s and bonded for 20 s (ExciTE® F; Ivoclar Vivadent). The samples were randomly divided into three groups (N=11). Tetric Evoceram® Bulk-Fill (Ivoclar Vivadent) was used as the bulk-fill composite. Group 1 was placed using conventional placement of 4 mm. Group 2 was placed using the Sonicfill™ handpiece (Kerr). Group 3 was placed after prewarming the composite to 54°C using Calset™ composite warmer (AdDent). The samples were kept in a water bath (37°C) for 24 hours. All 33 samples were thermocycled for 10,000 cycles between 5°C and 55°C with a dwell time of 30 seconds. Following varnish application, samples were kept in a 2% methylene blue stain for eight hours. Samples were cut longitudinally and dye penetration was observed with a digital microscope (Olympus SZX16) by two independent examiners. Statistical analysis was performed using the Kruskal-Wallis test (p=0.05).

RESULTS: See Table 1: In the pre-warming group better microleakage performance was found (18.2% with no microleakage) compared to sonic vibration (36.4% samples showing maximum microleakage). Results were not statistically significant (p-values>0.05).

Table 1. Microleakage Performance

<table>
<thead>
<tr>
<th>Microleakage</th>
<th>0 (0.0%)</th>
<th>1 (27.3%)</th>
<th>2 (27.3%)</th>
<th>3 (18.2%)</th>
<th>4 (27.3%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td></td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Group 2</td>
<td>0 (0.0%)</td>
<td>4 (36.4%)</td>
<td>1 (9.1%)</td>
<td>2 (18.2%)</td>
<td>4 (36.4%)</td>
</tr>
<tr>
<td>Group 3</td>
<td>2 (18.2%)</td>
<td>4 (36.4%)</td>
<td>2 (18.2%)</td>
<td>0 (0.0%)</td>
<td>3 (27.3%)</td>
</tr>
</tbody>
</table>

Legend: (0) no dye penetration  
(1) dye penetration to 25% of the gingival floor  
(2) dye penetration to 50% of the gingival floor  
(3) dye penetration to 75% of the gingival floor  
(4) dye penetration to the axial wall

CONCLUSIONS: All three different delivery techniques of placing bulk-fill composite restorations showed similar results with prewarming group showing better microleakage performance. Further studies comparing other physical parameters are recommended.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1356.
Knowledge and Attitude of Dental Students in the Philippines toward Dental Public Health

Risha De Leon,* Arlene Alfaro, Joseph De Leon, and Tofool Alghanem

PURPOSE: The field of public health dentistry plays an essential role in educating the public about oral health, yet most dental students remain uninterested and uninformed when it comes to issues of public health. Public health is rarely chosen as a specialty by dental students. Compared to medical students, dental students are less knowledgeable about the importance of public health and have a less favorable attitude toward public service. Given these shortcomings in public health education among dental students, educators have a responsibility to provide students with a better understanding of the role, methods, and knowledge of public health. This study aims to investigate dental students' knowledge and attitudes toward dental public health in order to identify ways of encouraging dental students to get more involved with public health practices.

METHODS: Two surveys were conducted at the University of the Philippines, before and after a dental public-health seminar. In each survey, students answered questions about their attitude towards public health as a career and how they viewed the importance of public health to the field of dentistry. Student responses were entered using a five-point Likert scale.

FINDINGS: A total of 66 surveys were completed. The mean age of the respondents was 24 years, and 53 (80%) of the respondents were female. Before the seminar, 31 respondents (47%) reported a lack of knowledge about public health careers; after the seminar, only one respondent reported a lack of knowledge. Before the seminar, 41 respondents (62%) disagreed with the statement “dental public health offers easy employment”; after the seminar, 13 respondents (19.6%) disagreed. Before the seminar, 35 respondents (53%) disagreed with the statement, “my future career plans involve dental public health”; after the seminar, 17 respondents (25.8%) disagreed. Before the seminar, 46 of the respondents (70%) expressed interest in working with underserved populations; after the seminar, 61 respondents (92.4%) expressed interest.

CONCLUSION: The changes in student responses in these two surveys show that student attitudes towards public health can be significantly influenced by brief-duration seminars. These results suggest that it might be useful to introduce public health into the dental school curriculum—as an essential and early component—in order to increase students’ awareness of dentistry public health and to motivate more students towards careers that are involved with public health.

Presented at the 2016 ADEA Annual Session in Denver, Colorado. Abstract #PO-015.
Self-Assessment Accuracy of Third-Year Dental Students in Operative Dentistry

Jennifer Denike,* Matthew Finkelman, and Steven Eisen

OBJECTIVES: This study aimed to determine the accuracy of third-year dental students in self-assessing their work after extensive preclinical and clinical training, by comparing their self-assessments to faculty-given grades on two simulated operative dentistry competencies taken in the third year of the curriculum.

METHODS: Throughout the 2015–2016 academic year, the Tufts University School of Dental Medicine Class of 2017 (D17) completed two simulated operative dentistry competency examinations, each consisting of a graded preparation immediately followed by a graded restoration. Students were given a self-grading sheet for each portion. Prior to faculty grading, students were asked to self-assess their work and turn in the respective form. Both students and faculty used identical but separate grading forms using the same grading scale. The faculty and student grading forms were added up for a numerical score, and the scores were coupled using student identification number.

RESULTS: One hundred and eighty-seven (N=187) D17s were eligible to participate. The first competency had a 52.4% response and the second had a 43.9% response. The mean scores for students and faculty grading, respectively, were 82.7 and 86.1 on the first competency and 88.48 and 90.15 on the second. Comparing the raw scores of the participants, 20.4% graded themselves the same as faculty on the first competency and 36.6% graded themselves the same on the second. Considering students within five points of faculty scoring to be “the same,” 51% and 59.8% of participating students scored the same as faculty on the first and second competencies, respectively.

CONCLUSIONS: Students demonstrated higher self-assessment accuracy on the second competency than the first competency. However, a high percentage of students graded themselves differently than faculty on both competencies, with the mean student grades lower than the mean faculty grades. This finding indicates a discrepancy in student-faculty grading standards.
A Record Audit on the Effect of TNF Alpha Modulating Therapy on Alveolar Bone Loss in Rheumatoid Arthritis Patients


OBJECTIVE: Periodontal disease (PD), a long-standing inflammatory process causing destruction of the dental alveolar bone, shares many similarities with rheumatoid arthritis (RA) in terms of hard and soft tissue destruction, pathological progression, and immunological profile. A growing body of research supports a connection between the two, but the dynamics of this relationship remain unclear. Tumor necrosis factor alpha (TNF-α) is a common mediator in the two disease processes and is a target in immune modulating therapy for RA treatment. Studies have shown that RA patients taking TNF-α inhibitors demonstrate improved clinical periodontal parameters, such as reduction in plaque index, bleeding on probing, and pocket depths. No study to date has reported radiographic evidence of attenuated periodontal destruction; our study aims to demonstrate this by examining bitewing radiographs of patients of record at Tufts University School of Dental Medicine.

METHODS: A query search was run to select patients who self-report having RA and divided into two groups: taking vs. not-taking TNF-α inhibitors. Patients reporting diabetes, pregnancy, obesity, smoking, or cardiovascular disease, and subjects without adequate bitewing radiographs were excluded. Only subjects responding to a questionnaire requesting their medication information were used for the study. Posterior bitewing radiographs were analyzed and distances from the cementoenamel junction to the crestal bone height were measured. Any measurement equal to or greater than 2.5 mm was considered periodontal bone loss likely caused by PD.

RESULTS: Data collected show no statistically significant difference between RA and TNF-α in terms of percent of patients in each group with ≥1 site of PD, frequency of PD sites among measurable sites, or the average amount of bone loss. However, the data do demonstrate a potential trend in these three parameters.

<table>
<thead>
<tr>
<th>Group</th>
<th>RA without TNF-α (N=16)</th>
<th>RA with TNF-α (N=7)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% population ≥1 PD site</td>
<td>Result</td>
<td>SD</td>
<td>Result</td>
</tr>
<tr>
<td>% population ≥1 PD site</td>
<td>56.3%</td>
<td>±32%</td>
<td>28.6%</td>
</tr>
<tr>
<td>% PD sites/total measured</td>
<td>24%</td>
<td>±32%</td>
<td>6%</td>
</tr>
<tr>
<td>Average amount of bone loss</td>
<td>1.91 mm</td>
<td>±0.7</td>
<td>1.57 mm</td>
</tr>
</tbody>
</table>

CONCLUSION: Our analysis demonstrates no statistically significant difference between the two groups in terms of percent demonstrating PD, frequency of PD sites among measurable sites, or average amount of bone loss. However, a trend is evident and demonstrates a need for further investigation into this relationship. An increased sample size and a better controlled sample population would enhance the study.
Ion-Releasing Materials, Demineralization, and Shear Strength of Orthodontic Brackets

Jacob Donohue,* Sarah Pagni, Ronald Perry, and Gerard Kugel

OBJECTIVES: This study compared the shear bond strength and demineralization of two conventional bracket adhesives to a new bioactive material.

METHODS: Three groups of bonded orthodontic brackets were analyzed for shear bond strength (SBS) (MPa) and demineralization [DIAGNOdent™, KaVo (DAG) score]. A total of 36 teeth (N=12) were assigned to the following groups: composite resin (RelyX™ Unicem 2 Clicker™, 3M ESPE) (U); resin modified glass ionomer (Vitrebond™, 3M ESPE) (VB); and a bioactive restorative (ACTIVA BIOACTIVE™, Pulpdent) (AB). Teeth were initially screened to determine no demineralization was present. Brackets were applied to the buccal surface of each tooth using the respective material (AB, U, or VB) and light cured (Translux® Wave, Heraeus Kulzer) for 30 seconds. Samples were placed in 0.05 M acetate buffer pH 5.0 for 30 days and upon removal were tested for demineralization using a DAG and SBS (MPa) using an Instron 5566A™ (Norwood, Massachusetts). Differences in demineralization and shear strength between the three materials were compared using the Kruskal-Wallis test with Dunn’s test for post-hoc pairwise comparisons (State version 13.1).

RESULTS: Lower mean demineralization was noted with AB (6.75±2.70) compared to both U and VB groups; however, it was not statistically significant (p>0.05), (Table 1). AB showed greater SBS (5.99±4.09) compared to U (1.81±1.11) and VB (3.72±1.46); however, not statically significant from VB (p=0.0003 and p=0.43) (Table 2).

Table 1. DIAGNOdent Scores

<table>
<thead>
<tr>
<th></th>
<th>AB</th>
<th>U</th>
<th>VB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD</td>
<td>6.75±2.70</td>
<td>13.08±11.22</td>
<td>8.83±6.73</td>
</tr>
<tr>
<td>Median±IQR</td>
<td>7.50±2.50</td>
<td>7.00±13.00</td>
<td>6.00±2.00</td>
</tr>
<tr>
<td>p</td>
<td>&gt;0.05*</td>
<td>&gt;0.05*</td>
<td>&gt;0.05*</td>
</tr>
</tbody>
</table>

N=12 per group; *Compared to AB; p-value based on median

Table 2. Shear Bond Strength

<table>
<thead>
<tr>
<th></th>
<th>AB</th>
<th>U</th>
<th>VB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SD (MPa)</td>
<td>5.99±4.09</td>
<td>1.81±1.11</td>
<td>3.72±1.46</td>
</tr>
<tr>
<td>Median±IQR (MPa)</td>
<td>5.41±4.88</td>
<td>1.98±1.81</td>
<td>3.53±1.72</td>
</tr>
<tr>
<td>p</td>
<td>0.0003*</td>
<td>0.43*</td>
<td></td>
</tr>
</tbody>
</table>

N=12 per group; *Compared to AB; p-value based on median

CONCLUSIONS: Demineralization was less with AB compared to both U and VB; however, it was not statistically significant between groups (p>0.05). Statistical significance was noted between SBS of AB and U (p<0.05), but not between AB and VB (p>0.05). The results of this study indicate that AB has increased SBS and may exhibit less demineralization of tooth structure. Clinically, this material may offer better strength of orthodontic brackets while reducing the presence of white spot lesions.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1082.
3D Accuracy Comparison between Digitally Fabricated and Traditionally Fabricated Dentures

Daniel Dooley,* John Orfanidis, Zuhair Natto, Yukio Kudara, and Ronald Perry

OBJECTIVE: This study compared the accuracy of traditionally fabricated dentures to digitally fabricated dentures against a baseline model.

METHODS: A single maxillary edentulous model was obtained to serve as the baseline case (Nissin Dental Soft Gingiva Edentulous Dentoform). A total of 16 impressions were taken (N=8) and separated into two groups: group 1= digital denture fabrication and group 2= traditional denture fabrication. All 16 impressions were taken following Heraeus Kulzer’s Pala® Digital Denture recommendations using Flexitime® Fast & Scan heavy and light body PVS materials (Heraeus Kulzer). The impressions from group 2 were poured up with Microstone (Golden, ISO Type 3) to obtain eight casts. The baseline case model, the eight casts from group 2, and the eight impressions from group 1 were all then scanned with a 3D digital scanner (Evolve, Open Technology modified by Evolution Dental Lab) to obtain 3D Steriolithography (STL) file renderings. Each individual cast and impression 3D rendering was then directly compared using Geomagic Wrap® Software, back to the baseline case 3D rendering by superimposing all tissue surfaces and evaluating for overall accuracy. The data were analyzed using the Independent Samples t-test and Mann-Whitney U test. P-values less than 0.05 were considered to be statistically significant.

RESULTS: See Table 1.

Table 1: T-Test. Variable: RMS Estimate

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Standard Error</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>0.1411</td>
<td>0.0372</td>
<td>0.0132</td>
<td>0.0846</td>
<td>0.2133</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>0.6039</td>
<td>0.2300</td>
<td>0.0813</td>
<td>0.3302</td>
<td>0.9243</td>
</tr>
<tr>
<td>Diff</td>
<td></td>
<td>−0.4628</td>
<td>0.1647</td>
<td>0.0824</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No statistically significant difference was observed between groups in Max Distance negative using Mann-Whitney or Average Distance negative using Independent Samples t-test. Statistically significant differences were seen with RMS Estimate (group 1=0.141±0.037 and group 2=0.604±0.230), Max Distance positive, and Average Distance negative using Independent Samples t-tests (p<0.05).

CONCLUSION: In accuracy comparison of traditional denture fabrication vs. digital denture fabrication, according to RMS estimate, a statistically significant difference existed favoring the accuracy of digital denture fabrication.

Study funded by Heraeus Kulzer.
Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1756.
Substance Abuse in Oral and Maxillofacial Surgery Training Programs
Pasquale Eckert,* Matthew Finkelman, and Morton Rosenberg

**PURPOSE:** To assess the prevalence of substance abuse in oral and maxillofacial surgery (OMS) training programs in the United States over a 10-year period and to compare rates of abuse to earlier studies. Substance abuse is often a concern in medical training programs such as anesthesiology, surgery, and emergency medicine; however, despite similar risks, substance abuse is less discussed and documented in OMS residencies. In anesthesiology, meperidine and fentanyl are the most commonly cited drugs of abuse potential. The purpose of this study aimed to determine what substances are most abused in OMS. Furthermore, such substance abuse is a serious risk to a resident’s health and care giving; early identification of abused substances and impaired residents by program heads is crucial in conducting intervention and recovery. By identifying the incidence of abuse within OMS training programs, the profession will be better able to educate new residents about the risks and warning signs of abuse.

**METHODS:** A prospective study was conducted by sending a questionnaire to the program directors and chairs of the 101 OMS graduate training programs accredited by the Council of Dental Accreditation. Eight survey questions asked respondents to recall suspected or encountered substance abuse cases over the last 10 years at their program. Additional questions also asked opinions on substance abuse incidence, education on abuse, and the impact abuse may have on an OMS’s career.

**RESULTS:** One hundred and forty-one OMS department directors and chairs were surveyed. Forty-six (32.6%) responded, representing 45.5% of the OMS training programs. When asked what impact substance abuse may have on the career of an OMS, 32 (69.6%) of the respondents stated that a history of substance abuse “sometimes” precludes a career in OMS. Substance abuse education is taught at 27 (58.7%) of the respondents’ programs. Sixteen (34.8%) programs reported at least one suspected or encountered incident of substance abuse, with 19 total cases of reported abuse. Among the respondents noting abuse, the most abused substances were alcohol and narcotics, with nine (56.3%) and six (37.5%) cases, respectively.

**CONCLUSION:** As in other medical specialty residencies, substance abuse is a concern in OMS. The prevalence of abuse has decreased since Rosenberg reported 51% of programs with suspicion of abuse in 1986, but it still is a real concern. It is imperative for faculty to be aware of the possibility of abuse among their residents and to provide education, wellness programs, and appropriate early diagnosis and treatment of suspected or confirmed substance abusers.
An Institutional Review of Age-Associated Care

Alec Eidelman,* Sarah Pagni, Matthew Johnston, and Britta Magnuson

OBJECTIVE: Dental insurance expansion under the Affordable Care Act (ACA) expanded pediatric and Medicaid coverage beginning January 1, 2014. The aim of this study was to look at treatment distributions over the last five years, including 1.5 years since the ACA expansion.

METHODS: Tufts University School of Dental Medicine (TUSDM) axiUm electronic dental records (EDR) of 165,286 patients were retrospectively examined reviewing five years of fiscal year data (July 2010–June 2015). Data was categorized by age [infant (0–1 years), pediatric (2–17), adult (18–64), and geriatric (65+)], insurance carrier (private, uninsured, and public), and treatment provided. Data were analyzed across all years using chi-squared to test association, calculate odds ratios, and perform logistic regression.

RESULTS: A summary of the data comparing fiscal year 1 and 5 for age is in Table 1, for health insurance is in Table 2, and in preventative treatment is in Table 3. Additionally, there was a statistically significant decrease in odds of being uninsured in year 5 as in comparison to year 1 (p-value<0.001).

<table>
<thead>
<tr>
<th>Table 1. Fiscal Year 1 to 5 Age Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Odds-ratio</strong></td>
</tr>
<tr>
<td>Pediatric</td>
</tr>
<tr>
<td>Adult</td>
</tr>
<tr>
<td>Geriatric</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2. Fiscal Year 1 to 5 Public Health Insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Odds-ratio</strong></td>
</tr>
<tr>
<td>Pediatric</td>
</tr>
<tr>
<td>Adult</td>
</tr>
<tr>
<td>Geriatric</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3. Fiscal Year 1 to 5 Preventive Care Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Odds-ratio</strong></td>
</tr>
<tr>
<td>Pediatric</td>
</tr>
<tr>
<td>Adult</td>
</tr>
<tr>
<td>Geriatric</td>
</tr>
</tbody>
</table>

CONCLUSION: Overall, the odds of being uninsured were found to decrease over the study period, potentially indicating an increase in insurance utilization. The geriatric population showed an increase in care received, also potentially due to increased insurance utilization. The adult group was found to have an increase in preventative treatments, while pediatric showed no significant change between years 1 and 5. The odds of being a pediatric patient or a geriatric on public insurance had a statistically significant decrease between years 1 and 5, while the odds of being an adult on public insurance increased. These trends in public health insurance age distribution differ from what might be expected after implementation of the ACA. Therefore, further exploration of these trends is needed, as is a longer time frame of data after implementation of the ACA.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1002.
Comparison of Compressive Strength of Liner Materials

Nancy Epstein,* Gerard Kugel, Ronald Perry, Jennifer Towers, and Sangita Murali

OBJECTIVE: Restorations use liner materials to increase the longevity of the restoration. The purpose was to compare the compressive strengths (MPa), modulus of elasticity (MPa), and deflection at break (mm) of three base liner materials.

MATERIALS AND METHODS: Thirty (N=30) 4 mm by 8 mm samples were prepared from three different liner materials: N=10 from ACTIVA™ BioACTIVE Base/Liner (Pulpdent) (group 1); N=10 from Vitrebond™ (3M ESPE) (group 2); and N=10 from Fuji Liner™ LC (GC) (group 3). Samples underwent compressive strength testing in a universal testing machine (4 mm/m). Modulus of elasticity was calculated using the stress/strain curves and deflection at break was measured by the amount of deformation under the crushing load prior to break.

RESULTS: In group 1, compressive strength was significantly higher (160.59±37.51 MPa) than in other groups (group 2 and 3=53.87±15.28 MPa and 60.05±43.10 MPa, respectively) (p<0.001). Group 1 also had significantly higher deflection of break (2.10±0.29 mm) than the other groups (group 2 and 3=0.80±0.13 mm and 0.94±0.36 mm, respectively) (p<0.001). No significant difference in compressive strength or deflection of break was found between groups 2 and 3. There was no statistically significant difference (p>0.05) in modulus of elasticity between group 1 (6.18±0.76 MPa), group 2 (5.28±1.08 MPa), and group 3 (5.45± 2.96 MPa).

CONCLUSIONS: ACTIVA BioACTIVE Base/Liner withstood the greatest maximum compressive strength and had the highest deflection at break under a crushing load compared to Vitrebond and Fuji Liner LC. The results suggest that restorations using ACTIVA BioACTIVE Base/Liner would have greater longevity than those made with liners of the other two groups.

Figure 1. Stress (MPa)-strain (mm/mm) curve of N=30 samples. N=10 from ACTIVA BioACTIVE Base/Liner (group 1), N=10 from Vitrebond (group 2), and N=10 from Fuji Liner LC (group 3).

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0653.
Evaluating Student Experiences and Perceptions with Global Service Learning Outreach

Yamila Garber,* Sarah Pagni, Leopoldo Correa, John Morgan, and Britta Magnuson

OBJECTIVES: To formulate a survey consisting of validated questions adapted from two previously published surveys and use it to gauge student perceptions of and confidence in academic and personal growth, as well as civic responsibility, before and after attending a global service learning (GSL) outreach trip at Tufts University School of Dental Medicine (TUSDM).

METHODS: A 17-question presurvey comprised of five-point Likert-scaled statements was administered to 21 TUSDM students who attended a GSL trip to the Dominican Republic. This survey was administered three days prior to the trip. A 28-question postsurvey comprised of five-point Likert-scaled statements was administered to the students upon return. The Wilcoxon signed rank test was used to analyze the data.

RESULTS: After IRB approval, 16 students completed the pretrip survey and 21 completed the post-trip survey. For one question asked there was a statistically significant difference between the answer pre- and post-trip (p=0.0265), with students reporting believing that there would be moments of disunity/conflict among team members, then reporting less agreement with this statement upon return.

CONCLUSION: Only one question showed a statistically significant difference between pre- and post-trip, with others not showing a significant change. For questions asked post-trip the students reported agreeing or strongly agreeing with being able to work with people different than themselves, being aware of needs in the community, and having a responsibility and a role in service to the community. These were positive responses reported in the postsurvey following the GSL trip. Future studies should be done to compare opinions of students who attended a GSL trip with those who did not.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1192.
Promoting Wellness in Dental Students: A Survey Study of Perceived Stress and Stress Management

Lauren Gerkowicz,* Michael Arrigo, Sarah Pagni, Christina Pastan, and Ellen Patterson

OBJECTIVES: To measure the severity of stress symptoms reported by first- and second-year dental students.

1. To identify the activities or behavioral strategies most commonly used by dental students to promote relaxation and manage stress.

2. To explore the association between socio-demographic and behavioral variables and students’ perceived stress.

METHODS: Surveys were distributed to all students of the 2018 and 2019 classes in the fall of 2015 using an online survey software. The survey instruments included the following validated measures: perceived competence for learning scale, perceived stress scale, self-compassion scale, and the depression, anxiety, and stress scale (DASS-21). Additionally, socio-demographic information, stress management/relaxation methods, and variables linked to stress were obtained.

RESULTS: Three hundred and sixty-seven students completed the survey. The preliminary data analysis showed that 34.74% of the D19 class and 36.69% of the D18 class scored in the high stress range on the perceived stress scale. The mean scores on the three components of the DASS-21 (depression, anxiety, and stress) fell within normal for both the D19 and D18 classes; however, the SDs were noteworthy. In the D19 class, 21.28% were moderately to extremely severely stressed on the DASS-21, 25.4% were moderately to extremely severely anxious, and 16.49% were moderately to extremely severely depressed. In the D18 class, 19.64% were moderately to extremely severely stressed on the DASS-21, 23.95% were moderately/extremely severely anxious, and 19.64% were moderately to extremely severely depressed. Relaxation methods used more than once a week or every day were: caffeine (>70% of students in both classes); alcohol (10.64% in the D19 class and 18.18% for D18); meditation (6.92% in the D19 class and 7.27% for D18); and yoga (5.32% for D19 and 4.85% for D18).

CONCLUSION: The preliminary data show that a marked percentage of students are moderately to extremely severely distressed, as measured along axes of depression, anxiety, and stress. A variety of relaxation methods are used, with a minority of students partaking in mind-body exercises on a weekly basis. A second round of survey distribution is planned to explore yearlong trends and the relationship of stress-related variables to academic success.
Geographic Distribution of Dental Patients with Intellectual and Developmental Disabilities

Hannah Gilman, Jane Steffensen, Carolyn Talmadge, Patrick Florance, Sarah Pagni, and John Morgan

1Tufts University School of Dental Medicine, Boston; 2Geospatial Technology Services, Research Technology, Tufts Support Services (TTS), Tufts University, Medford, Massachusetts

OBJECTIVE: Barriers in access to, and utilization of oral health services are reported among individuals with intellectual and developmental disabilities (IDD) and among individuals residing in rural areas. This study assesses geographic distribution of adults with IDD who received dental care at Tufts Dental Facilities (TDF) and compares their demographic and clinical status in geographical areas of Massachusetts.

METHODS: This cross-sectional, retrospective study analyzed clinical and demographic data from axiUm electronic records of dentate adults with IDD aged >20 years who received an oral examination between April 1, 2009 and March 31, 2010 at seven TDF clinics in Massachusetts and provided a residential zip code. Zip codes were categorized as urban, suburban, or rural (Census 2010 classification). Selected variables of the patient population and zip code classification were analyzed using Stata 13.1. Associations were tested using chi-squared analysis.

RESULTS: Of the 4,732 adults with IDD, 4,517 reported residential zip codes [mean (SD) age=49.3 years (14.28), age range=20–90 years, 42.3% female]. Over half (58.0%) of zip codes in Massachusetts were represented. Of these, 74.7% were urban, 23.1% suburban, and 2.2% rural. From chi-squared expected cell counts, more males were receiving care in rural areas and more females were receiving care in suburban areas than expected (p=0.038). ESRI ArcMap Software was used to investigate these results with spatial analysis and to study additional variables including untreated caries, caries experience, and dentition status. Maps were generated to illustrate communities utilizing TDF services and reveal the geographic areas not reached through TDF sites.

CONCLUSIONS: Spatial analysis and statistical analysis were used to look at the distribution of disease in rural, urban, and suburban areas. Based on preliminary findings, strategies need to be considered to provide oral health services for Massachusetts individuals with IDD living in rural areas.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1561.
Assessing the Efficacy of Learning Catalytics in the Dental School Curriculum

Sara Golkari* and Rebecca Lufler

PURPOSE: Increasingly large classrooms and long lecture times pose a threat to the development of critical thinking and problem solving that are essential to the Dental School curricula. Recently, the use of audience response systems (ARS) has been integrated into educational settings in order to increase student engagement and encourage active learning. While the efficacy of ARS has been evaluated in many different educational settings, its impact and place within the Dental School curriculum remain largely unevaluated. The objective of this study is to examine a new cloud-based response system, Learning Catalytics, within the Dental School’s oral pathology course. This study investigates whether the use of Learning Catalytics is effective in engaging students and improving academic performance during a large didactic lecture-based course. The potential benefit of this research is to broaden the utilization of Learning Catalytics in the dental curriculum if found to be effective in engaging students.

METHODS: Prior to the study, IRB approval was obtained. The effectiveness of Learning Catalytics was assessed by comparing performance on individual exams and overall course grades of students who participated in the course using Learning Catalytics compared to previous years (before 2014). In addition, an anonymous survey was disseminated to the students who used Learning Catalytics in order to obtain students’ subjective feedback on its effectiveness. The survey measured Learning Catalytics’ effectiveness, level of engagement, and future recommendations using a 10-point Likert scale (1=strongly disagree and 10=strongly agree). A two-tailed t-test was conducted to compare mean exam scores and final grades between those who used Learning Catalytics (2014 and 2015) and those who did not (2011, 2012, and 2013). All data were collected anonymously and were not linked to identifiable information.

FINDINGS AND CONCLUSIONS: A total of 865 students’ exam scores were evaluated; 496 students did not use Learning Catalytics (prior to 2014) and 369 students used Learning Catalytics. Preliminary results show a significant difference between groups, with those using Learning Catalytics gaining a higher final grade than those who did not use Learning Catalytics ($t = -10.11, p < 0.0001$). Students’ performance on each individual exam was also higher for the Learning Catalytics group, with three out of four exams showing statistically significantly higher averages as compared to those who did not use Learning Catalytics. A total of 176 students responded to the survey. Preliminary survey results show that students responded positively and found that Learning Catalytics helped to highlight important course concepts (mean=8.35). Students also agreed that the use of Learning Catalytics helped keep them engaged (mean=7.99) and enhanced critical thinking skills (mean=7.79). Furthermore, students felt that the instructor used the software in an effective manner (mean=8.74) and recommended its use in future Dental School lectures (mean=7.02). Based on these preliminary data, the use of Learning Catalytics in the oral pathology course was effective in improving students’ academic performance as well as stimulating students during long lectures. While the usefulness of Learning Catalytics will greatly depend on faculty utilization of this tool, the use of this technology could greatly augment students’ retention and learning experience within the Dental School curricula.

Presented at the 2016 ADEA Annual Session in Denver, Colorado. Abstract #PO-038.
Correlating Reflective Exposure to LED Light with Various Loupe Magnifications

Alexander Gomes,* Britta Magnuson, Peter So, Yang-Hyo Kim, Carrie Brown, and Melissa Ing

OBJECTIVE: Previous research on LED light has shown a relationship between high intensity and extended duration of exposure to light with macular degeneration of the retina. This study assessed the correlation between reflective exposure from LED light with various loupe magnifications and working distances.

METHODS: A controlled dark room experimental loupe and light mounted adjustable apparatus were constructed to record LED light reflectance through dental loupes of varying magnifications at working distances of 14, 16, and 18 inches. LED light reflectance intensities were quantified from a standard white surface using Image J software with a Logitech® Pro 9000 Webcam. Six pairs of dental loupes of 2.5X, 3.3X, 3.5X, 3.8X, and 4.5X magnifications were provided from two loupe manufacturers: Designs for Vision, Inc. (DFV) Standard Field Dental Telescopes and Orascoptic™ (O) HDL™ loupes. All loupes were tested three times at each distance. A control group with no magnification was also tested. Means and standard deviations were computed. Data were analyzed using a repeated measures linear regression model.

RESULTS: Light intensities measured the greatest at the 14-inch distance with the 2.5X magnification. Mean intensity values decreased as both magnifications increased (p<0.001) and working distance increased (p<0.001) (see Table 1).

Table 1. Mean Measured Light Intensity by Lens and Distance

<table>
<thead>
<tr>
<th>Lens</th>
<th>Distance (in)</th>
<th>Light intensity</th>
<th>Light intensity</th>
<th>Light intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
<td>16</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Standard Deviation</td>
<td>Mean</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>2.5X Loupe DFV</td>
<td>181.72</td>
<td>4.39</td>
<td>160.80</td>
<td>1.70</td>
</tr>
<tr>
<td>2.5X Loupe O</td>
<td>163.69</td>
<td>2.34</td>
<td>146.78</td>
<td>1.67</td>
</tr>
<tr>
<td>3.3X Loupe O</td>
<td>168.53</td>
<td>6.34</td>
<td>156.95</td>
<td>1.56</td>
</tr>
<tr>
<td>3.5X Loupe DFV</td>
<td>152.79</td>
<td>0.15</td>
<td>146.37</td>
<td>3.24</td>
</tr>
<tr>
<td>3.8X Loupe O</td>
<td>140.68</td>
<td>3.29</td>
<td>127.30</td>
<td>2.28</td>
</tr>
<tr>
<td>4.5X Loupe DFV</td>
<td>126.89</td>
<td>3.75</td>
<td>125.44</td>
<td>0.86</td>
</tr>
<tr>
<td>Control (without Loupe)</td>
<td>154.42</td>
<td>2.60</td>
<td>132.79</td>
<td>3.57</td>
</tr>
<tr>
<td>All</td>
<td>155.53</td>
<td>17.47</td>
<td>142.35</td>
<td>13.52</td>
</tr>
</tbody>
</table>

CONCLUSION: It was shown to be statistically significant that with increasing magnification and working distance, the mean light intensity values decreased. Therefore, it is possible that loupes with greater magnification and lengthened working distance may minimize LED light exposure to a clinician's eyes. Future research is needed to assess these parameters in a clinical setting.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0411.
Water Absorption and Solubility of Four Dental Cements

Joshua Hall,* Zuhair Natto, Jeffrey Daddona, Ronald Perry, and Gerard Kugel

OBJECTIVE: To determine the water absorption and solubility of four dental cements.

METHODS: Four dental cements (N=10 for each group) [ACTIVA™ BioACTIVE Cement (ABAC); Pulpdent, Unicem RelyX™ Cement (URC) 3M; Ceramir® Crown & Bridge (CCB) Doxa; and FujiCEM™ 2 Cement (FC2C) GC America] were used to create molds of approximately 15 mm in diameter and 1 mm in depth according to manufacturer’s specifications. Forty total samples were prepared and treated following ISO4049 (2010). Weight and exact dimensions (thickness and diameter at 4/5 points) were measured at start, after seven days in DI water at 37°C, and after three weeks in a desiccator at room temperature. Samples were allowed to cure in the desiccator at 37°C for 22 hours followed by ambient temperature overnight prior to initial measurements. Water absorption percentage (WAP), water absorption (WA) per μg/mm³, water solubility percentage (WSP), and water solubility (WS) per μg/mm³ were calculated and analysis was conducted using one-way ANOVA and Kruskal-Wallis tests. Results were considered significant if p<0.05. SAS version 9.3 was used in the analysis.

RESULTS: CCB showed the highest mean WAP and WA (p<0.05) and the lowest WSP and WS (p<0.05) of all other groups, while ABAC and URC showed no significant difference between them. FC2C was significantly different (p<0.05) than all other groups for all parameters tested.

CONCLUSIONS: ABAC and URC are both resin-based cements, which may play a role in the lower WA than the resin-modified glass ionomer (RMGI) FC2C and the conventional glass ionomer CCB. The RMGI FC2C showed significantly higher WSP and WS than ABAC and URC.

Sponsored by Pulpdent.
Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1126.
**Assessment of Blood-Borne Pathogen Exposure at TUSDM between 2010 and 2014**

*Gabriel Hayek,* Kanchan Ganda, Sarah Pagni, and Gülsün Gül

**OBJECTIVES:** The purpose of this retrospective record review was to assess the different types of blood pathogen exposures and associative factors among different provider groups in a dental school setting.

**METHODS:** For this IRB-approved study, data were collected from reports filed by Tufts Medical Center following potential blood-borne pathogen exposures. Data were analyzed for 241 incidents and included date, time, and location of incident (undergraduate vs. postgraduate clinic), provider type (faculty, resident, student, or staff), type of exposure (percutaneous vs. mucocutaneous), safety device utilization (whether safety features were used or not), and what infectious agents the source patient had (hepatitis B, hepatitis C, or human immunodeficiency virus). Fischer's exact and Pearson chi-squared tests were used to analyze the data.

**RESULTS:** Results showed no statistically significant results between: provider type, clinic location, and exposure type; provider type and time of day; positive HIV or HCV exposure and provider type; HBV or HCV exposure and the year; exposure type and HBV or HCV; or means of exposure and HBV or HCV. There was a statistically significant result for the means of exposure and the clinic location (p=0.005), with needle, bur, and instrument sticks occurring more in UG clinics, whereas scalpel and suture sticks occur more often in PG clinics; for location of clinic and clinic session (p=0.003), with exposures occurring more in the morning and evening in UG clinics versus the afternoon and after-hours for PG clinics; between provider status and HBV exposure (p=0.018); and for the year and HIV exposure (p=0.003).

**CONCLUSIONS:** It seemed evident that there is a need to enforce needle-stick/percutaneous injury management guidelines to prevent discrepancy between different floors and clinical sessions.

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0998.*
Focus Group of Patients Treated for Skeletal Disharmony of the Jaws Corrected with Orthognathic Surgery

Alexis Irby,* Maria Papageorge, Harshiv Vyas, Neha Sharma, and Archana Viswanath

BACKGROUND: The number of patients treated with orthognathic surgery (corrective jaw surgery) is steadily increasing despite the possibility of psychological disturbances leading to patients seeking esthetic alteration through plastic surgery. Currently, the oral surgeon is limited in the management of the psychological aspect of patients undergoing orthognathic surgery since there is a lack of a validated tool for assessment. To this end, our goal is increasing understanding of this issue. It is estimated that 1.2 million people in the United States could benefit from these procedures. The motivations for undergoing orthognathic surgery vary from correcting a functional handicap to improving esthetics. It is well-documented that there is a high prevalence to develop a patient-reported instrument that could be used to assess orthognathic surgery patients’ perspectives about their appearance prior to and after surgery. Based on the study results, we plan to conduct future studies in conjunction with the department of psychology to provide supportive therapy for these patients before and after surgery.

METHODS: One 90-minute focus group session, based on the Eliot & Associates guidelines, was conducted in the Oral Surgery Department of Tufts University School of Dental Medicine with four oral surgery patients. The chosen sample size will foster optimal patient participation without exclusion. Following IRB approval and informed consent, the participants were read the pre/post-operative questionnaire out loud and were asked to discuss their opinions about each item. Participant responses were audio recorded, securely stored, and transcribed for the development of the final questionnaire.

RESULTS: Participants were generally in agreement that the questionnaire tool was appropriate. Responses varied based on anecdotal experiences and individual level of experience with statistics and survey design. Modifications were implemented that included rewording, elimination of similar items, and providing additional space for questionnaire participants to freely write reflections regarding positive and negative pre/post-surgical experiences.

CONCLUSION: The incorporation of patients in questionnaire design through a focus group is imperative as it provides a well-balanced evaluation from the perspective of the physician and the patient. The newly developed tool will be delivered to patients preoperatively followed by a postoperative delivery for analysis and comparison.
Orthognathic Surgery in Patients Over 40 Years of Age: Risk Factors and Complications

Alexis Irby,* Matthew Finkelman, Maria Papageorge, and Archana Viswanath

BACKGROUND: Corrective jaw, or orthognathic, surgery is performed by an oral and maxillofacial surgeon (OMS) to correct a wide range of minor and major skeletal and dental irregularities, including the misalignment of jaws and teeth. The average patient receiving orthognathic surgery is usually in their second or third decade of life. Over the past decade there has been a significant increase in the amount of patients seeking orthognathic surgery, including those over the age of 40. With this increase in the older population (>40 years old), this retrospective study sought to identify perioperative and postoperative difficulties that are significantly different for this population as compared to their younger (<40 years old) counterparts. Surgeons will benefit from an increased understanding of this cohort of patients and, furthermore, they will have more information to better educate patients postoperatively.

METHODS: This retrospective cohort study of patients was conducted by the Department of Oral Surgery at Tufts University School of Dental Medicine. Following IRB approval, we reviewed medical records of all patients who underwent orthognathic surgery in the past 10 years (April 1, 2005, through April 1, 2015). The dependent variable was age on date of procedure, and the independent variables were age, gender, race, BMI, medical history, type of insurance, type of orthognathic surgery, and duration of the surgery. Descriptive statistics were computed for all variables. The Mann-Whitney U test and Spearman's correlation were applied to clinical variables and age.

RESULTS: This retrospective chart review included 120 patient charts. The average length of hospital stay for patients >40 years old was higher than that of patients <40 years old (64.55 hours vs. 51.67 hours, respectively). Patients >40 years old lost more blood, in liters, compared to those <40 years old (0.212 vs. 0.175, respectively). Greater complications were experienced by the <40 years old group due to various mandibular fracture while those >40 years old experienced more complications related to excessive bleeding.

CONCLUSION: Retrospective chart review is an essential methodology that has the potential to provide oral surgeons with valuable research opportunities. It is imperative that further studies with larger core groups be conducted to expand upon this foundation and provide better supportive care for patients >40 years old.
Evaluation of the Domestic Violence Education at TUSDM

Mansi Jailwala,* Sarah Pagni, Kanchan Ganda, and Gülsün Gül

OBJECTIVES: The study aims: 1) to assess dental students’ knowledge and attitudes toward intimate partner violence (IPV) patients; 2) to compare the IPV curriculum experience of third-year dental students as they progress through their dental education; 3) to evaluate if the TUSDM curriculum and clinical experience enhance students’ knowledge and attitudes.

METHODS: A prevalidated survey tool, Physician Readiness to Manage IPV Survey (PREMIS), was used to survey third-year dental students. The survey had three sections: background experience, IPV knowledge, and opinions. An online survey tool, Qualtrics, was used to survey students. Statistical analyses were performed with Stata (version 13.1). Surveys were scored following the PREMIS guidelines. The survey was administered in September 2015 and will be repeated in January 2016. The repeated survey data will be compared to track how the students change in their level of preparedness, knowledge, and opinions.

RESULTS: Twenty-six third-year students responded to the survey. 77% were basic sciences major, 23% had no IPV training prior to dental school, 54% had 1–5 hours of IPV training (lecture), and the remaining 23% had 6–15+ hours of training. Students’ preparedness in working with IPV patients was 3–4 on a scale of 1–7 (not prepared to quite well-prepared). In the knowledge section, 64% were knowledgeable on multiple choice questions and 15% were not informed on the true/false section. The opinion section had 88% agreement on “healthcare providers having responsibility to ask all patients about IPV.” But 71% of the students felt uncomfortable discussing IPV with their patients.

CONCLUSIONS: These preliminary results indicate many students did not have much training in IPV prior to coming to TUSDM. There is a need to address this disparity given the high prevalence of IPV. The lower scores on the knowledge section indicate a need for curriculum improvement. The statements in the opinion section reiterated that students feel the obligation to inquire about IPV; however, it is a sensitive and difficult skill to develop. It is important for the students to get exposure to real-life situations to translate classroom learning into a skill they feel comfortable practicing.
Searching the Internet to Determine Whether Oral and Maxillofacial Surgeons Have Adopted Current ASA NPO Guidelines for Ambulatory Anesthesia

Robert Johnson III,* Pasquale Eckert, William Gilmore, Archana Viswanath, Matthew Finkelman, and Morton Rosenberg

PURPOSE: To use the internet to determine whether oral and maxillofacial surgeons (OMFSs) in private practice in the United States have integrated the current American Society of Anesthesiologists (ASA) guidelines regarding nil per os (NPO) into their preoperative instructions. The ASA Guidelines recommend fasts of two and six hours from clear liquids and solid foods, respectively, prior to ambulatory anesthesia.

METHODS: To begin, 900 OMFSs were identified in the 2015 AAOMS Membership Directory. A systematic online search was implemented to locate practice websites and, specifically, to identify whether NPO instructions were published. When this information was found, data were collected regarding: NPO instructions for clear liquids; NPO instructions for solid food; whether or not separate NPO instructions for clear liquids and solid foods were given; year OMFS graduated from residencies; whether the OMFS had dual degrees (M.D. in addition to D.D.S./D.M.D.); state; and region (Northeast, Midwest, South, or West, as defined by U.S. Census Bureau). Statistical significance of associations was assessed via the chi-squared test and Fisher’s exact test, with the level of significance set at 0.05; 95% confidence intervals were also calculated.

RESULTS: The study sample included 431 (47.9%) of the 900 searched OMFSs for whom NPO instructions were found. The majority (99.1%) recommended fasts other than two hours for clear liquids and six hours for solid foods. However, recommendations of two hours or greater for clear liquids were made by 99.8% and recommendations of six hours or greater for solid foods were made by 99.3% of OMFSs. Only 4.4% of OMFSs had different recommendations for clear liquids and solid foods. No significant association was found between whether OMFSs adopted the most current ASA guidelines and year graduated from residencies or whether they held a dual degree.

CONCLUSION: OMFSs in private practice are overwhelmingly recommending longer fasting times for clear liquids and solid foods on their websites when compared to the current ASA guidelines prior to ambulatory anesthesia.
Comparing Amalgam vs. Composite Usage in U.S. Dental Schools

Kyle Jonna,* Steven Eisen, Gerard Kugel, Sarah Pagni, and Britta Magnuson

OBJECTIVE: To compare amalgam and composite usage rates as restorative materials for posterior teeth placed in student clinics at U.S. dental schools.

METHODS: Data was mined from BigMouth data repository to compare five major U.S. dental institutions. The search query included time, record numbers, restorative material (amalgam or composite), tooth number, and number of surfaces. Data were analyzed over two time periods, January 1, 2007, to December 31, 2010, and January 1, 2011, to December 31, 2014. Individual patient data were available, so clustering was considered. Generalized estimating equations were used for analysis.

RESULTS:

<table>
<thead>
<tr>
<th>University</th>
<th>Time Period 1</th>
<th>P-Value</th>
<th>Time Period 2</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.35%</td>
<td>&lt;0.001</td>
<td>30.13%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2</td>
<td>46.73%</td>
<td>&lt;0.001</td>
<td>42.78%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3</td>
<td>76.62%</td>
<td>&lt;0.001</td>
<td>62.38%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>4</td>
<td>47.02%</td>
<td>&lt;0.001</td>
<td>33.66%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>5</td>
<td>37.65%</td>
<td>&lt;0.001</td>
<td>20.56%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Figure 1: This figure shows the percentage of amalgam used at universities 1–5 and the corresponding p-values using a chi-squared analysis with a null hypothesis of no significant difference between the schools’ amalgam usage. This was performed separately for both time periods.

<table>
<thead>
<tr>
<th>University</th>
<th>Time Period 1</th>
<th>Time Period 2</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32.35%</td>
<td>30.13%</td>
<td>0.0605</td>
</tr>
<tr>
<td>2</td>
<td>46.73%</td>
<td>42.78%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3</td>
<td>76.62%</td>
<td>62.38%</td>
<td>&lt;0.001</td>
</tr>
<tr>
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</tr>
<tr>
<td>5</td>
<td>37.65%</td>
<td>20.56%</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Figure 2: This figure depicts the percentage of amalgam used at universities 1–5 in the two time periods and the corresponding p-values using a chi-squared analysis with a null hypothesis of no change in percent amalgam use rates over the two periods.

A statistically significant difference in amalgam usage was found between universities (p<0.001), except for universities 1 and 5 (p=0.316) with no regard to time period. Amalgam usage rates as a whole between all of the universities in two time periods were also analyzed. Amalgam rates decreased from 49.98% to 39.12%, a statistically significant decrease in usage rates between the two periods (p<0.001). Universities 2, 3, 4, and 5 follow the trend and have a statistically significant decrease in amalgam usage between the
two time periods (p<0.001), while university 1 does not show a statistically significant decrease in amalgam usage (p=0.0605) (Figure 2). When comparing the five universities with regard to separate time periods, a statistically significant difference was found in usage rates between each school, during both periods (p<0.001) (Figure 1).

CONCLUSION: Overall, amalgam usage has decreased between the two time periods, showing a decline in its usage in the student clinic setting. Additionally, during each time period, each school was using amalgam and composite at a statistically significantly different rate in their student clinics. With a curriculum fueled by evidence-based dentistry in place, it might be expected that there would be more similar treatment provided between dental schools nationally. Future studies are needed to explore how these curriculums may affect clinical procedures.
OBJECTIVE: The purpose of this study is to determine the oral health related quality of life in patients with Sjögren's syndrome (SS), primary and secondary, using a questionnaire, and to determine a correlation to salivary flow rates.

METHODS: A survey was distributed to patients with primary and secondary SS from Tufts University School of Dental Medicine. After IRB approval, potential subjects were approached about participation at a normal clinical appointment. After the survey was distributed, the unstimulated (USF) and stimulated salivary flow (SSF) rates for each participant were obtained. There were 14 questions that dealt with oral health impacted profile (OHIP). The answers to the questions were coded as follows: never=0, hardly ever=1, occasionally=2, fairly often=3, and very often=4. A higher value indicates a worse quality of life. Table 1 reports the correlation between each question and the USF and SSF rates. The Spearman's correlation between salivary flow rates and OHIP-14 items was calculated using SPSS 22.

RESULTS: Preliminary analysis contained 21 participants. All the participants were female and the median age was 60 (interquartile range=18). Only 10 of the 14 OHIP-14 questions were analyzed due to missing responses. The only significant correlation was reported for Q4, which asked, “How often have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or denture?” and SSF. The correlation coefficient was −0.546 (p=0.010); the negative correlation indicates that lower SSF was associated with a worse quality of life for this item.

CONCLUSIONS: Primary and secondary Sjögren’s patients in this study showed an association between decreased quality of life when eating and decreased stimulated salivary flow. The lack of statistical significance in most analyses may be due to limited data at this time; therefore, more data will be collected to further examine the association between additive OHIP-14 score and salivary flow.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0149.
Retrospective Study to Assess an Oral Health Program in Zambia

Douglas Kim,* Zuhair Natto, and John Morgan

OBJECTIVE: The aim of this study was to describe and assess the impact of an oral health program focusing on education and prevention in a rural Zambian community using oral health indicators. The study secondarily aims to make recommendations for the use of effective oral health indicators in dental aid organizations (DAOs).

METHODS: Data were collected from screening examinations and treatment records collected during annual visits to a rural health center in Zambia from 2007 to 2014. Screening examinations performed by qualified oral health providers included treatment urgency scores (TU) as defined by the Association of State and Territorial Dental Directors (0=no obvious problem; 1=early dental problem; and 2=urgent dental care required), extractions recommended, and extractions completed. Patient information was de-identified, entered into an Access database, and analyses completed in SAS (Version 9.3).

RESULTS: Preliminary results indicated that 4,093 screening visits were completed from 2007 to 2014. Of 193 visits in 2007, mean age was 25.2±15.5 years and % female was 58.6%. Of 713 visits in 2014, mean age was 20.6±7.2 years and % female was 55.3%. Percentage of TU=0 vs. TU=2 was 28.7% vs. 45.1% in 2007 and 50% vs. 27.2% in 2014, respectively. Patients recommended for extractions vs. patients with extractions completed in 2014 was 270 vs. 86 respectively.

CONCLUSION: DAOs aim to improve the oral health of under-resourced communities using different approaches. However, DAO impact on oral health is unclear due to lack of reported outcomes data. An increase in TU=0 over time in this study is consistent with nonsymptomatic patients seeking oral health services and with the program’s emphasis on education and prevention. TU scores and extraction data have potential to be used as effective oral health indicators in assessing community needs and program outcomes.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1901.
Comparison of Microleakage under Ceramic Flash-Free and Prepasted Orthodontic Brackets

Julia Kim,*1 Matthew Finkelman,1 M. Lee,2 and Georgios Kanavakis1
1Tufts University School of Dental Medicine; 2Division of Orthodontics, Saint Barnabas Hospital, Bronx, New York

OBJECTIVE: To compare the microleakage under the APC™ Flash-Free Adhesive Coated System bracket (Flash-Free) and the APC™ PLUS Adhesive Coated System bracket (PLUS) (3M Unitek).

METHODS: Forty caries-free extracted human maxillary premolars were obtained and stored in a 0.1% thymol solution. The teeth were randomly divided into two groups (N=20). Flash-Free brackets were bonded on one group and PLUS brackets were bonded on the other group. The brackets were bonded following the manufacturer’s instructions, using Transbond™ Plus Self Etching Primer (3M Unitek) and a curing light (DEMI™, Kerr). After bonding, the samples were incubated in a water bath at 37°C for 24 hours. Apices of teeth were blocked with wax and teeth surfaces were coated with clear nail polish except for 1 mm around the bracket margins. The samples were thermocycled for 5,000 cycles between 5°C and 50°C with a dwell time of 30 seconds. Then the samples were immersed in a 2% methylene blue solution for 24 hours for dye penetration, embedded into acrylic, and sectioned in the bucco-lingual direction using a slow speed diamond saw (IsoMet® 1000 Precision Saw, Buehler). Microleakage under the brackets was observed from the occlusal and gingival margins of the bracket base. The extent of the microleakage was measured with a light microscope (Olympus SZX16) and recorded using an imaging analysis program (Buehler OmniMet™ 9.0). Statistical analysis was conducted using the Mann-Whitney U test.

RESULTS: As Table 1 shows, the median for microleakage was higher for the Flash-Free group. However, the difference between the two groups was not statistically significant (p=0.738 for occlusal and p=0.301 for gingival).

Table 1. Median and interquartile range of microleakage for the two groups in millimeters.

<table>
<thead>
<tr>
<th></th>
<th>Flash-Free</th>
<th>PLUS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Occlusal</td>
<td>Gingival</td>
</tr>
<tr>
<td>Median</td>
<td>0.35</td>
<td>0.41</td>
</tr>
<tr>
<td>Interquartile range</td>
<td>0.69</td>
<td>0.30</td>
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</table>

CONCLUSIONS: There is no significant difference between the extent of microleakage underneath APC Flash-Free Adhesive Coated System bracket and the APC PLUS Adhesive Coated System bracket (p>0.05).

Sponsored in part by 3M ESPE.
Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1081.
Factors Affecting Duration of Stay following Orthognathic Surgery

Hannah Leahey,* Sajal Swaroop, Maria Papageorge, Archana Viswanath, and Matthew Finkelman

BACKGROUND: Inpatient care for orthognathic surgery is necessary to monitor recovery from anesthesia, potential airway instability, hemostasis, pain control, and unanticipated surgical complications. Increased duration of inpatient stays contributes to the overutilization of available hospital resources. The use of resources is expensive, and decreasing the duration of a patient’s hospital stay following orthognathic surgery has the potential to reduce costs and increase patient turnover. Increased knowledge of the causes of increased duration of inpatient stays following orthognathic surgery will improve treatment planning and cost. Prior knowledge of factors contributing to increased hospital stays could give providers opportunity to mitigate their effects. Appropriate changes in treatment could reduce the cost to the patient and reduce use of hospital resources.

PURPOSE: The purpose of this study was to investigate the factors affecting length of hospital stay (LOS) after orthognathic surgery.

METHOD: This retrospective cohort study of patients was conducted by the Department of Oral Surgery at Tufts University School of Dental Medicine. Following IRB approval, we reviewed medical records of all patients who underwent orthognathic surgery in our department in the past 10 years (April 1, 2005–April 1, 2015). The dependent variable was LOS in hours and the independent variables were age, gender, race, BMI, medical history, type of insurance, type of orthognathic surgery, and duration of the surgery. The procedures included in this investigation were bilateral sagittal osteotomy (BSSO), Lefort, genioplasty, and surgically assisted rapid palatal expansion (SARPE). Descriptive statistics were computed for all variables. The Mann-Whitney U test and Spearman’s correlation were applied to clinical variables and LOS.

RESULTS: Medical records of 99 (53 female and 46 male) patients have been analyzed. The majority of patients underwent both BSSO and Lefort concurrently, while the second largest subgroup received both BSSO and genioplasty concurrently. The mean LOS was 51.66 hours, with an interquartile range of 20 hours (~one day). The correlation between LOS and age (p=0.371), BMI (p=0.100), and gender (p=0.099) was not statistically significant.

CONCLUSIONS: The results of this preliminary analysis did not show any statistically significant correlation between LOS and age, BMI, or gender. This investigation was limited to a small sample size. The LOS was trimodal distribution with the majority of patients staying ~two days. For those patients with a LOS beyond two days, further investigation is needed to determine the factors contributing to the expended stay.
Dental Student and Faculty Perspectives of Clinical Mentoring Styles at TUSDM

Heather Leung,* Britta Magnuson, Matthew Finkelman, and Yun Saksena

PURPOSE: The Mentoring in Teacher Education (MINT) tool is one of several instruments that are used to determine mentoring styles. The MINT instrument classifies mentoring into five styles: letting go, active listening, advisory, prescribing, and cooperative. This study aimed to explore the types of mentoring styles used by the clinical faculty and to examine the characteristics and qualities of faculty that students find the most effective in the clinical education setting at Tufts University School of Dental Medicine (TUSDM).

METHODS: For this study, the MINT tool was used to survey faculty and a modified version was created to survey students. Following IRB approval, pretesting of the student MINT survey was performed to assess the validity and reliability of the survey questions. The twenty-five item questionnaire was emailed electronically (via Qualtrics) to 180 clinical faculty at TUSDM. Similarly, the pretested student MINT survey was administered to 190 predoctoral students of the 2016 class at TUSDM. Frequency distributions (counts and percentages) were calculated and Fisher’s exact test was used to compare the primary and primary preferred mentoring styles of faculty and students, respectively. Independent samples t-tests were used to compare faculty and students’ scores for each mentoring style. All statistical analyses were performed using SPSS Version 22.

FINDINGS: A total of 18 students and 22 clinical faculty completed the survey (N=40), resulting in an overall response rate of 10.8%. The difference between students (mean=15.89, SD=1.45) and faculty (mean=17.68, SD=2.12) was statistically significant for active listening (p=0.004). Fisher’s exact test revealed that the difference between students and faculty was not statistically significant for primary mentoring style (p=0.181).

CONCLUSIONS: This study found that the difference between students and faculty was statistically significant for active listening and that the difference between students and faculty was not statistically significant for primary mentoring style. However, due to our low response rate, more work needs to be done before meaningful conclusions can be drawn.

Presented at the 2016 ADEA Annual Session in Denver, Colorado. Abstract #PO-024.
Diabetic Foot Ulcer-Derived Fibroblasts Retain a Diabetic Phenotype Characterized by Altered Fibronectin and ECM Deposition in 3D Tissues

James Leung,* Anna Maione, Avi Smith, Vanessa Yanez, Olga Kashpur, Ryan Imbriaco, Marjana Tomic-Canic, David Mooney, Aristedes Veves, and Jonathan Garlick

Diabetic foot ulcers (DFU) are a debilitating complication of diabetes and many remain refractory to current therapies. Extracellular matrix (ECM) proteins produced by fibroblasts are critical for normal wound healing; however, it remains unclear how their composition, deposition, and organization are altered in DFUs. My research studied the capacity of multiple, primary DFU-patient derived fibroblast cell lines to produce and assemble a three-dimensional (3D) ECM in a 3D, in vitro tissue model that mimics granulation tissue in the wound microenvironment. Previous research in our lab found that gene expression microarray analysis revealed DFU-derived fibroblasts had significantly altered expression of ECM proteins and ECM-regulatory genes when compared to nonwound, diabetic patient-derived fibroblasts and control healthy donor-derived fibroblasts. Using ECM targets identified by this array analysis, I found that DFU-derived fibroblasts produced thin, fibronectin-rich ECM tissues in 3D tissues, which responded to transforming growth factor-beta (TGF-β). Levels of fibronectin were measured by RT-PCR and were found to return to normal with TGF-β treatment in both 2D cultures and 3D tissues. This was confirmed by immunohistochemical staining of 2D cultures for ECM proteins (fibronectin, ED-A fibronectin, and Type I Collagen). These results provide new evidence that primary, DFU-derived fibroblasts produce an altered ECM that may contribute to the pathogenesis of nonhealing DFUs.
Evaluation of Film Thickness and Microleakage in Fifth-Generation Adhesives

Diana Li,* Matthew Coletti, Jeffrey Daddona, Steven Eisen, Carrie Brown, and Zuhair Natto

OBJECTIVE: This study aims to determine if there is a difference in film thickness between two different fifth-generation total etch adhesives, and if that difference correlates with the amount of microleakage in restorations using those adhesives. A sixth-generation self-etch adhesive was used as the control.

METHODS: Thirty-nine class II slot preparations (3x3x3 mm) were performed on noncarious human molars and randomly assigned to one of three groups (N=13): group A, Peak® LC Bond (Ultradent); group B, ExciTE® F (Ivoclar Vivadent); and group C (control), Clearfil™ SE Bond (Kuraray). All adhesives were applied according to manufacturers’ instructions and the preparations were filled with Filtek™ Supreme Ultra (3M) composite. The completed restorations were thermocycled for 1,000 cycles between 5°C and 55°C with a dwell time of 30 seconds. Samples were immersed in 2% methylene blue dye for 24 hours and then embedded in acrylic resin and sectioned mesio-distally. The film thickness of each bonding agent was evaluated under a stereomicroscope (Olympus, SZX16®) with Buehler OmniMet 9.0 software. A dye-penetration to axial wall scale was used on the gingival floor: 0=no dye penetration; 1=penetration less than one-third of the gingival width; 2=penetration beyond one-third of the gingival; and 3=penetration along the axial wall. Statistical analyses were performed using SAS program. The median of the microleakage and thickness were compared using Kruskal-Wallis tests. Further analyses were conducted to evaluate the differences between each pair of groups using Mann-Whitney U tests with Bonferroni correction.

RESULTS: The median film thickness was significantly lower in group A than in groups B and C (p<0.0001, Table 1). However, there were no statistically significant differences in microleakage between the three groups (p=0.1290, Table 2).

Table 1. Film Thickness (µM)

<table>
<thead>
<tr>
<th>Material</th>
<th>Mean±SD</th>
<th>Median [IQR]</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>13.01±2.91</td>
<td>12.23 [11.76–13.59]b</td>
<td>&lt;0.0001*</td>
</tr>
<tr>
<td>Group B</td>
<td>18.89±5.97</td>
<td>17.66 [14.95–21.74]a</td>
<td></td>
</tr>
<tr>
<td>Group C</td>
<td>36.60±34.97</td>
<td>23.14 [20.44–29.93]a</td>
<td></td>
</tr>
</tbody>
</table>

*p-value<0.05. Under the Median column, superscripts with the same letters do not differ significantly.

Table 2. Microleakage (scale)

<table>
<thead>
<tr>
<th>Material</th>
<th>Mean±SD</th>
<th>Median [IQR]</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>1.31±1.11</td>
<td>1.00 [0.00–2.00]</td>
<td>0.1290</td>
</tr>
<tr>
<td>Group B</td>
<td>2.00±1.68</td>
<td>2.00 [0.00–4.00]</td>
<td></td>
</tr>
<tr>
<td>Group C</td>
<td>2.38±1.12</td>
<td>2.00 [2.00–3.00]</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSION: There was a difference in film thickness between the fifth-generation dental adhesives; however, the film thickness did not correlate with microleakage.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1650.
Association between Sinus Membrane Thickness and Perforation during Sinus Augmentation

Andrew Lum,* Yumi Ogata, Sarah Pagni, and Yong Hur

OBJECTIVE: When treatment planning for dental implants in the edentulous posterior maxilla, lateral window sinus augmentation is a viable option for patients who lack adequate alveolar ridge height. However, intraoperative perforation of the maxillary sinus membrane is a serious and unpredictable complication that can lead to graft loss, sinusitis, and implant failure. The purposes of the present study were:

1. To examine association between membrane thickness and sinus perforation using cone-beam computed tomography (CBCT) and
2. To assess the impact of Schneiderian membrane thickness on perforation rates during lateral window sinus augmentation.

METHODS: A total of 551 patients received sinus augmentations using the lateral window approach at Tufts University Dental Clinics between June 1, 2006, and July 31, 2015, retrospectively. One hundred and sixty-seven patients who had preoperative CBCT images were selected. Schneiderian membrane thickness (mm), perforation rate, sinus anatomy, residual/grafted bone height, and surgical complications were assessed through the axiUm database. Membrane thickness and perforation rate were examined for a possible association. Wilcoxon rank sum test was used at p<0.05 levels. This protocol received approval from the IRB.

RESULTS: Out of 167 patients who received lateral window sinus augmentation, 47 patients had Schneiderian membrane perforation (28.1%). The average thickness of perforated membranes was 0.84 mm±0.67 and 2.65 mm±4.02 for membranes without perforation. There is a statistically significant difference in membrane thickness between the patients who had a membrane perforation and the patients who did not have a membrane perforation (p<0.01).

CONCLUSION: Within the limits of this study, there was an association between maxillary sinus membrane thickness and sinus perforation during lateral window sinus augmentation. Schneiderian membranes were, on the average, thinner in those patients with sinus perforation than in patients without. Further randomized controlled trials are recommended to confirm the findings.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1596.
**Irradiance Comparison of Various Curing Lights under Different Distance Positioning**

*Alissa Mariano,* *Rachel Cohen, Ronald Perry, and Gerard Kugel*

**OBJECTIVE:** Some curing lights offer a more homogenous irradiance distribution across the optical cross-section of the tip than others. The goal of this study was to evaluate the irradiance and assess the influence of eccentric and distant positioning of curing lights.

**METHODS:** The irradiance of five LED dental curing lights—EDC, UVC, BS, DU, and CS3—were measured using the check Marc™ device from BlueLight Analytics™ with 4 mm apertures. Centric irradiance was measured at distances of 0.5 mm, 3.0 mm, and 7.0 mm (N=3). The more homogenous the beam-profile the less decline in irradiance when moved from centric to noncentric position. Offset measurements were taken at distances of 3.0 mm and 7.0 mm at 2.0 mm off-centric position at 3, 6, 9, and 12 o’clock (N=3). Visualization of the beam homogeneity was accomplished with beam camera WinCamD™ (DataRay Inc.) imaging on ground-glass. Statistical analysis was conducted using ANOVA (p<0.05). IFU irradiance values were confirmed with photo spectrometer with integrating sphere (Table 1).

**Table 1**

<table>
<thead>
<tr>
<th>Name</th>
<th>Code</th>
<th>Manufacture</th>
<th>Irradiance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elipar™ DeepCure-S</td>
<td>EDC</td>
<td>3M ESPE</td>
<td>1,470 mW/cm²</td>
</tr>
<tr>
<td>Valo® Cordless</td>
<td>UVC</td>
<td>Ultradent</td>
<td>1,400 mW/cm²</td>
</tr>
<tr>
<td>Bluephase® Style</td>
<td>BS</td>
<td>Ivoclar-Vivident</td>
<td>1,100 mW/cm²</td>
</tr>
<tr>
<td>Demi™ Ultra</td>
<td>DU</td>
<td>Kerr™</td>
<td>1,100 mW/cm²</td>
</tr>
<tr>
<td>S.P.E.C. 3™</td>
<td>CS3</td>
<td>Coltene®</td>
<td>1,600 mW/cm²</td>
</tr>
</tbody>
</table>

**RESULTS:** EDC demonstrated the highest irradiance in centric position at distances of 3.0 mm and 7.0 mm (Table 2). In off-centric position EDC and UVC irradiance values were comparable at 3.0 mm distance but significantly higher than the other lights. At 7 mm distance EDC was significantly higher compared to all tested lights. Irradiance imaging showed EDC and UVC to have the most homogeneous beam-profiles while BS, DU, and CS3 beams demonstrated dramatic peaks.
### Table 2

<table>
<thead>
<tr>
<th></th>
<th>Mean Irradiance in Centric (mW/cm²)</th>
<th>Mean Irradiance in Off-Centric (mW/cm²)</th>
<th>Standard Deviation in Centric</th>
<th>Standard Deviation in Off-Centric</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.0 mm</td>
<td>7.0 mm</td>
<td>3.0 mm</td>
<td>7.0 mm</td>
</tr>
<tr>
<td>EDC</td>
<td>1,483^A</td>
<td>895^A</td>
<td>804^A</td>
<td>631^A</td>
</tr>
<tr>
<td>UVC</td>
<td>948^D</td>
<td>463^D</td>
<td>724^A</td>
<td>438^B</td>
</tr>
<tr>
<td>BS</td>
<td>1,083^C</td>
<td>509^C</td>
<td>574^B</td>
<td>324^C</td>
</tr>
<tr>
<td>DU</td>
<td>806^E</td>
<td>320^E</td>
<td>501^B</td>
<td>228^D</td>
</tr>
<tr>
<td>CS3</td>
<td>1,367^B</td>
<td>604^B</td>
<td>335^C</td>
<td>203^D</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** EDC demonstrated the highest and most uniform beam at distances between 3.0 mm and 7.0 mm. Additionally, EDC showed the least decline in irradiance when moved from centric to off-centric positions. Irradiance imaging revealed a more uniform dome-shaped beam profile of EDC compared to all tested lights. This has clinical relevance in curing deep restorations in off-centric/nonideal curing conditions.

*Sponsored in part by 3M ESPE.*

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1094.*
Demographics and Operative Dentistry: Do Age and Gender Affect Preclinical Performance?

Lauren Marzouca,* Steven Eisen, Michael Thompson, and Matthew Finkelman

OBJECTIVE: In an earlier study entitled “Student Self-Assessment vs. Faculty Evaluation of Operative Dentistry Practical Examinations,” first-year Tufts University School of Dental Medicine (TUSDM) students self-assessed six operative dentistry practical examinations throughout the 2013–2014 academic year. The results indicated not only improved self-assessment ability, but also an increase in hand skills. Statistical analysis revealed that students self-assessed closest to faculty grades by the sixth practical examination. The overall trend showed students consistently self-assessing their work higher than if faculty graded. Given these results, one wondered what induced the discrepancy between faculty and students. Thus, the purpose of the current study was to analyze the demographics of the TUSDM class of 2017 (D17s). This evaluation would ideally shed light on whether age and/or gender could influence self-assessments. It was hypothesized that there would be no statistical difference between the genders self-assessments with respect to faculty grading. It was also hypothesized that age of the student would not affect self-assessment scores.

METHODS: Prior to the study, IRB approval was achieved. The D17s were informed of the study’s voluntary nature and shown the consent form. After completing each examination, students self-assessed their work. Two randomized, calibrated faculty members then collaboratively graded each student’s typodont. Both parties used separate but identical grading forms featuring a 10-point scale. Self-assessment and faculty score were coupled using seat number. Data was not linked to identifiable information. De-identified demographics were collected from the registrar. Using seat number, the demographics were linked to self-assessments and grades. Mann-Whitney U tests compared gender in terms of average absolute and average nonabsolute differences with reference to faculty scoring. Spearman’s correlations compared student age to average absolute and average nonabsolute differences with reference to faculty scoring.

RESULTS/CONCLUSION: The statistical analysis included only instances whereby both student and faculty participated on at least one practical examination; thus N=187 (89 males and 98 females) despite a class size of 192. When comparing the average absolute difference (students faculty) between gender with respect to faculty scores, the difference was not statistically significant (p=0.320). However, when comparing gender in terms of the nonabsolute difference with respect to faculty grades, the discrepancy was statistically significant (p=0.008). It was determined that males, on average (median=0.333), self-assessed themselves higher than if faculty graded. Meanwhile, females, on average (median=0.0833) self-assessed almost equally above and below faculty grades. To ensure this difference was a gender-based discrepancy, not a gender-bias grading process, the average faculty-given score was examined. Faculty scores were revealed to vary only minimally between males (median = 8.1) and females (median=8.0), and the difference was not statistically significant (p=0.190). Meanwhile, Spearman’s correlation between age and average absolute difference with faculty revealed that higher age is associated with a higher average absolute difference (p=0.039). However, the correlation was weakly positive and very close to 0 (SC=0.153).

Presented at the 2016 ADEA Annual Session in Denver, Colorado. Abstract #PO-035.
Changing Demographics of Published Authors in U.S. Dental Journals

Kathleen Molgaard* and Nadeem Karimbux

PURPOSE: This project is a retrospective study investigating how the trends of author demographics, specifically the country of the principal author, have changed over time in high impact U.S. dental journals. Examination of demographic trends provides insight into the journals that students and practitioners turn to for vital information when practicing evidenced-based dentistry. This information is also important to gauge global trends in research based on the country of the submitting author. The establishment of a change in the demographics over time prompts further investigation into the global development of dental research.

METHODS: IRB exemption was granted to perform this study. Investigation journals were selected by researching the highest Science Citation Index (SCI) dental journals in the United States, as reported by the Journal Citations Reports. The focus was then narrowed to journals with an impact factor greater than 2.5 that have been in publication since 1994. The final list of journals under examination consisted of: *Journal of Dental Research*, *Journal of Endodontics*, and *Journal of Periodontology*. For each journal, five complete sample years were investigated: 1994, 1999, 2004, 2009, and 2014. For each given journal and year, all research articles were examined to establish if the principal investigator, determined as the last author listed, was based in the United States or elsewhere. Data were recorded by journal and year in Excel. Descriptive statistics, counts, and percentages were computed. The Friedman test was used to compare the number of journal articles originating in the United States and those articles originating outside the United States over the time period collected. The assumption of normality was assessed graphically and with the Shapiro-Wilk test. All p-values less than 0.05 were considered statistically significant. The statistical analyses were performed using the statistical software Stata (version 13.1).

FINDINGS: A total of 2,915 articles were analyzed. Inspection of the median values showed an increase in the overall number of articles published within the dental journals over the study period 1994–2014. There was no statistically significant difference in the number of journal articles published by U.S. authors. There was a statistically significant difference in the number of journal articles published by non-U.S. authors as analyzed by the Friedman test. Inspection of the median values showed an increase in the number of articles published by non-U.S. authors.

CONCLUSION: Overall, there was an increase in the total number of journal articles published in the *Journal of Dental Research*, *Journal of Endodontics*, and *Journal of Periodontology* over the 20-year period of the study. The number of articles published by U.S. authors stayed constant while the number of articles published by non-U.S. authors increased.

*Presented at the 2016 ADEA Annual Session in Denver, Colorado. Abstract #PO-042.*
Rpetitiv e delflection of Luting Cements between Dentin and Celtra Duo

Sahar Mostafavi,* Michelle Ta, Jeffrey Daddona, Sarah Pagni, Gerard Kugel, and Ronald Perry

OBJECTIVE: Data on retentive strength of luting cements between zirconia-reinforced lithium silicate (Celtra Duo) crowns and dentin is currently limited. This study aimed to examine in vitro retention strength of luting cements between Celtra-Duo buttons and dentin using repetitive deflection.

METHODS: Thirty Celtra™ Duo (DENTSPLY) buttons measuring 2.5 mm in width, 4 mm length, and 4 mm height were cemented onto dentin samples along their length using six cements (N=5): RelyX™ Ultimate (3M ESPE) (RU), Multilink® Automix (Ivoclar Vivadent) (ML), Maxcem Elite™ (Kerr) (MC), RelyX™ Unicem 2 (3M ESPE) (RX), Calibra® Ceram (DENTSPLY) (CC), and Calibra® Universal (DENTSPLY) (CU). Instron® 5566A model (Norwood, Massachusetts) was used to deflect the Celtra-Duo buttons by repetitive movement of 0.3 mm for 25 cycles or until sample breakage. Mean maximum compressive load at which samples broke or did not break was analyzed using one-way ANOVA. Post-hoc comparisons were conducted via Tukey’s HSD. Fisher’s exact test was performed to evaluate association between group and breaking.

RESULTS: Tables 1 and 2 display load exerted onto samples and number of samples per group that broke or retained the button, respectively. The mean load withstood by ML was higher than that of MC, CC, and CU with statistical significance (p-values listed in Table 3). Additionally, there is no statistically significant association between cement group and breaking for any group.

Table 1. Mean Compressive Loads Across Cements

<table>
<thead>
<tr>
<th>Cement</th>
<th>Compressive load (N)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RU</td>
<td>109.00</td>
<td>66.45</td>
</tr>
<tr>
<td>ML</td>
<td>143.67</td>
<td>45.65</td>
</tr>
<tr>
<td>MC</td>
<td>39.51</td>
<td>20.09</td>
</tr>
<tr>
<td>RX</td>
<td>70.59</td>
<td>37.38</td>
</tr>
<tr>
<td>CC</td>
<td>35.54</td>
<td>19.05</td>
</tr>
<tr>
<td>CU</td>
<td>45.50</td>
<td>37.39</td>
</tr>
</tbody>
</table>

Table 2. Counts of Broken and Retained Samples

<table>
<thead>
<tr>
<th>Cement</th>
<th>Retained</th>
<th>Broken</th>
</tr>
</thead>
<tbody>
<tr>
<td>RU</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>ML</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>MC</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>RX</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CC</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CU</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 3. Tukey Post-hoc Tests Comparing Each Group

<table>
<thead>
<tr>
<th>Groups</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>RU vs. ML</td>
<td>p=0.761</td>
</tr>
<tr>
<td>RU vs. MC</td>
<td>p=0.116</td>
</tr>
<tr>
<td>RU vs. RX</td>
<td>p=0.678</td>
</tr>
<tr>
<td>RU vs. CC</td>
<td>p=0.085</td>
</tr>
<tr>
<td>RU vs. CU</td>
<td>p=0.179</td>
</tr>
<tr>
<td>ML vs. MC</td>
<td>p=0.006*</td>
</tr>
<tr>
<td>ML vs. RX</td>
<td>p=0.088</td>
</tr>
<tr>
<td>ML vs. CC</td>
<td>p=0.004*</td>
</tr>
<tr>
<td>ML vs. CU</td>
<td>p=0.010*</td>
</tr>
<tr>
<td>MC vs. RX</td>
<td>p=0.833</td>
</tr>
<tr>
<td>MC vs. CC</td>
<td>p=1.000</td>
</tr>
<tr>
<td>MC vs. CU</td>
<td>p=1.000</td>
</tr>
<tr>
<td>RX vs. CC</td>
<td>p=0.753</td>
</tr>
<tr>
<td>RX vs. CU</td>
<td>p=0.923</td>
</tr>
<tr>
<td>CC vs. CU</td>
<td>p=0.999</td>
</tr>
</tbody>
</table>

*indicates a statistically significant value

**CONCLUSIONS:** ML withstood higher maximum compressive loads than MC, CC, and CU. However, there was no statistically significant association found between cement groups and broken/retained samples. Future studies with larger sample sizes and larger compression extension are required for further comparing luting cements. These comparisons are helpful in assessing clinical performance in cases such as thin marginal walls or bruxism.

*Sponsored in part by DENTSPLY.*

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1068.*
Fluoride Release of Bioactive Restoratives with Bonding Agents

Sangita Murali,* Nancy Epstein, Ronald Perry, and Gerard Kugel

OBJECTIVES: Fluoride is frequently added to dental restorative materials for release into the oral cavity since it is known to inhibit caries progression. The purpose of this study was to determine if the fluoride ions from a bioactive fluoride-releasing restorative material can penetrate through an adhesive bonding agent.

METHODS: A total of 40 samples of ACTIVA™ BioActive Restorative (Pulpdent) were prepared. To prepare the samples, a glass plate was placed on the bottom of a mold holder to serve as a base. Next, ACTIVA material was placed in the plastic mold 5 mm in diameter by 2 mm deep. Samples were coated with: no material as a control (group 1, N=10); with Clearfil™ SE (Kuraray) (group 2, N=10); with Scotchbond™ UNIVERSAL (3M ESPE) (group 3, N=10); and with DenTASTIC™ UNO™ (Pulpdent) (group 4, N=10). A fluoride ion analyzer (Thermo Scientific Orion™ Star A214) was precalibrated with 1 and 10 ppm buffer solutions prior to all measurements and fluoride release was measured at 1, 5, 10, 15, and 20 days.

RESULTS: Data were analyzed using a one-way ANOVA model and comparisons were considered to be significant at p<0.05. All groups showed significant fluoride release on day 1 (Fig. 1). Group 1 and group 4 showed significantly more fluoride release over 20 days. Group 2 and group 3 showed significantly equivalent fluoride release that was significantly less over 20 days than that of the other groups. By day 20, all samples exhibited very low levels of fluoride release as compared to on earlier days.

CONCLUSIONS: This study demonstrated that fluoride ions from a restorative material are able to penetrate through the adhesive bonding agents tested.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0368.
Navigating axiUm Dental Software: Creating a Reference Resource for Students and Faculty Members

Kevin Nguyen,* Andy Tran, Pamela Maragliano-Muniz, Irina Dragan, David Leader, and Nadeem Karimbux

OBJECTIVE: The axiUm Dental Software is the electronic health record (EHR) used at TUSDM for patient care, billing, and scheduling. Integrating the use of EHRs into dental education can be challenging, especially for beginners. The aim of this project was to create a resource for students and faculty members to use as a training reference for axiUm.

METHODS: A list of various topics to be covered was created and categorized, covering only the relevant functions of the program. The references included videos and documents, in order to provide multiple resources for training purposes. A software program, Camtasia, was used to record narrated instructional videos. Adobe Premiere was used to edit the recorded content. Adobe Photoshop was used to edit screenshots to insert into documents using Microsoft Word.

RESULTS: In total, there were 56 topics spanning 12 different categories: accessing records, histories/exams, hard and soft tissue charting, radiographs and photos, forms, attachments, treatment planning, scheduling, and messaging. So far, 52 of the 56 videos have been recorded and edited and are ready to be used. Training documents are currently being generated. These guides will have written instructions and illustrations corresponding to each video and can also be referenced as standalone guides. The project should be completed by May 2016. The outcomes of the use of these resources will be assessed in a future project.

CONCLUSION: Creating digital (video and PDFs) training materials for the EHR will enable students and faculty to use the EHR in an appropriate and more efficient way. Updates of the resources as the EHR is modified will allow the school and practitioners to be compliant with best practices.
**Noise Levels in a Predoctoral Dental School Setting**

*Sabrina Nguyen,* Britta Magnuson, David Frantz, Holly Fadie, Shivam Patel, Alexander Toth, Emily Schadt, Matthew Finkelman, and Melissa Ing

**PURPOSE:** Dental students and faculty are subjected to noise on a daily basis due to the use of instruments such as handpieces, ultrasonic scalers, suction, and laboratory equipment. Noise can induce stress, decrease communication and concentration, and potentially cause hearing loss in the affected individual. The permissible exposure limit (PEL) to noise from the Occupational Safety and Health Administration (OSHA) is 90 dBA for an eight-hour day. The National Institute for Occupational Safety and Health (NIOSH) has set the PEL at 85 dBA. The PEL is calculated based on an eight-hour work day, using a time weighted average. This study evaluated noise levels in predoctoral settings at Tufts University School of Dental Medicine with various dental equipment and compared it to 85 dBA.

**METHODS:** The IRB reviewed and determined this study not to be human subject research. A Casella CEL-320 Sound Level Meter/Noise Dosimeter was utilized for noise measurements. Noise levels were evaluated using the following equipment: a low-speed handpiece, nose cone on acrylic, high-speed handpiece with suction, high-speed without suction, ultrasonic scalers, suction by itself, and model trimmer. Four investigators (two faculty and two students) used equipment at a set working distance of 14 feet. Intervals of 30 seconds were measured. Ten repetitions were done by each investigator. If a measurement was ≥85 dBA, all investigators completed 10 more repetitions. Overall noise level was assessed in the following settings: preclinical laboratory, clinical floor, clinical laboratory, and preclinical practical examination. Five repetitions of 30 seconds each were recorded. If any reading had been ≥85 dBA, another 5 repetitions would have been recorded. The minimum, maximum, and average were recorded. The following statistics were computed: number and percentage ≥85 dBA; minimum, mean and standard deviation of the maximum; 95% CI; and 95% prediction interval. Statistical software package R (Version 3.1.2) was used for analysis.

**RESULTS AND FINDINGS:** Two pieces of equipment had measurements ≥85 dBA (nose cone on acrylic and model trimmer), whereas the other equipment had no readings ≥85 dBA. Nose cone on acrylic had 5 out of 80 readings (6.25%) ≥85 dBA, with a mean maximum of 78.4 dBA (SD 3.5), a minimum maximum of 72.3 dBA, a maximum of 88.9 dBA, 95% CI (2.1%, 14.0%), and 95% prediction interval (71.4 dBA, 85.3 dBA). The model trimmer had 1 out of 80 readings (1.25%) ≥85 dBA, with a mean maximum of 80.5 dBA (SD 2.6), a minimum maximum of 73.9 dBA, a maximum of 85.1 dBA, 95% CI (0.03%, 6.77%), and a 95% prediction interval (73.4 dBA, 85.7 dBA). None of the overall noise levels readings were ≥85 dBA.

**CONCLUSION:** All instruments and settings had a mean maximum below 85 dBA. Most of the instruments and all settings had maximum readings below 85 dBA. While some maximum readings (for nose cone and
model trimmer) were ≥85 dBA, none were ≥90 dBA. While there was a small percentage of maximum readings ≥85 dBA, all mean maximums were below 85 dBA, which appears to indicate that the PEL would not be breached for either OSHA or NIOSH limits over an eight-hour day. Future studies exploring students’ actual daily noise exposure and evaluating noise outside the school setting are needed. Furthermore, educating students about noise-induced hearing loss should include considerations of environmental and recreational sound exposure (e.g., loud music, subway, hair dryer, etc.).

Presented at the 2016 ADEA Annual Session in Denver, Colorado. Abstract #PO-013.
Incidence of Surgical Treatment of Fascial Space Infection from Third Molars

Christopher Paolino,* Ross Fahey, Archana Viswanath, Zuhair Natto, William Gilmore, and Maria Papageorge

OBJECTIVE: The pathological sequelae of impacted third molars include cystic changes, periodontal ligament damage, and resorption of second molars. Perhaps the most morbid sequelae of retained third molars is deep fascial space infection (DFSI), a life-threatening condition requiring emergency surgery and IV antibiotic administration, placing a burden on the healthcare system. We investigated the incidence of subjects with DFSI requiring hospital admission and surgical treatment at Tufts Medical Center (TMC) due to retained third molars compared to infections attributed to other odontogenic sources. We did this in an effort to determine synergistic factors to DFSI, and whether it is beneficial to retain or prophylactically extract third molars.

METHODS: This retrospective chart review was conducted in the Department of Oral Surgery at Tufts University School of Dental Medicine. Following IRB approval, we reviewed a five-year convenience sample of TMC electronic health records of subjects with DFSI requiring hospital admission and surgical treatment. Radiology studies, clinical notes, and OR logs were used to determine the etiology in these DFSI cases. We calculated the incidence rate and 95% confidence interval based on the number of inpatient surgically treated odontogenic DFSI attributed to retained third molars, divided by the total number of inpatient surgically treated odontogenic DFSI.

RESULTS: We reviewed 148 cases involving DFSI. One hundred and forty-four of these cases had a dentigerous origin or were due to teeth extraction, while the remaining four were due to failed hardware. Fifty-two (36.1%) instances of DFSI were due to retained third molars. In 34 cases it was impossible to determine whether the etiology of DFSI was due to retained third molars or other teeth.

CONCLUSION: Results from this preliminary analysis showed that retained third molars is one of the most common causes of DFSI. DFSI requires hospital admission, aggressive surgical intervention, and use of IV antibiotics. With an 80% prevalence of retained third molars in the adult population, appropriate treatment—especially prophylactic third molar removal—should remain a key focus of interest in healthcare.
Oral Health Quality of Life in Intellectually/Developmentally Disabled Individuals

Khusbu Patel,* Jane Steffensen, Matthew Finkelman, and John Morgan

OBJECTIVE: A paucity of information exists regarding oral health related quality of life (OHRQOL) in adults with IDD. The aim of this study was to administer an instrument to measure in OHRQOL in adults with IDD.

METHODS: A 25-item OHRQOL instrument was designed and piloted for adults with IDD using existing QOL questionnaires. Informed consent was obtained. Subjects with mild to moderate intellectual disability were administered the survey using a face-to-face interview method. Three, four, and five-point Likert scales were used for collecting responses. Oral health was screened and treatment urgency (TU) was assessed for each participant: 0=no curative treatment, 1=prompt treatment including scaling, 2=immediate treatment for pain or infection, and 3=immediate treatment for life-threatening or other severe condition with oral manifestations. Correlational analyses including Goodman and Kruskal gamma tests were conducted using SPSS 22.

RESULTS: Thirty-one subjects completed the survey with 51.6% TU=0, 38.7% TU=1, and 9.7% TU=2. Preliminary results: Seventeen percent reported requiring help while brushing while 100% received help when needed. Twenty-nine percent reported being “embarrassed due to problems with their teeth or mouth”; 35.4% reported being “worried about going to the dentist”; and 96.8% agreed with the statement: “Up until now, I felt I took good care of my teeth.” A moderate nonsignificant correlation was noted between self-reported oral health and TU scores (gamma=0.45, p=0.057). There was a strong correlation between reporting being “embarrassed by teeth or mouth” and agreeing that teeth make their appearance “look bad” (gamma=0.898, p=0.030).

CONCLUSION: Findings suggest that adults with IDD are aware of oral health and related quality of life considerations. This study shows promise that further development of OHRQOL instruments for adults with IDD would enhance understanding of oral health in this vulnerable population.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1560.
Exercise-Induced Irisin in Bone and Systemic Irisin Administration Reveal New Regulatory Mechanisms of Bone Metabolism

Cong Peng,* Jin Zhang, Qisheng Tu, Paloma Valverde, Dana Murray, Yuwei Wu, Liming Yu, Hua Jiang, Michel Dard, Jin Huang, Zhiwei Xu, and Jake Chen.

OBJECTIVE: Irisin is a polypeptide hormone derived from the proteolytic cleavage of fibronectin-type III domain-containing 5 (FNDC5) protein. Once released to circulation upon exercise or cold exposure, irisin stimulates browning of white adipose tissue (WAT) and uncoupling protein 1 (UCP1) expression, leading to an increase in total body energy expenditure by increased UCP1-mediated thermogenesis. It has been reported that type 2 diabetic (T2D) patients and postmenopausal women with previous osteoporotic fractures exhibit lower irisin levels in circulation than healthy individuals, and that exercise can increase resistance to bone fracture and improve metabolic parameters in T2D patients. However, it has not yet been described whether irisin is secreted by bone upon exercise and whether it regulates bone metabolism in vivo.

METHODS AND RESULTS: In this study, we found that two weeks of voluntary wheel-running exercise induced high levels of FNDC5 mRNA as well as FNDC5/irisin protein expression in murine bone tissues. Increased immunoreactivity due to exercise-induced FNDC5/irisin expression was detected in different regions of exercised femoral bones, including growth plate, trabecular bone, cortical bone, articular cartilage, and bone-tendon interface. Exercise also increased mRNA expression of osteogenic markers in bone and that of UCP1 expression in WAT, and led to bodyweight loss. Intraperitoneal (IP) administration with irisin led to increased trabecular and cortical bone thickness and increased osteoblasts numbers, while concurrently inducing UCP1 expression in subcutaneous WAT. IP injection with lentiviral FNDC5 increased cortical bone thickness. In vitro studies in bone cell lines demonstrated irisin increases osteoblastogenesis and mineralization and inhibits RANKL-induced osteoclastogenesis.

CONCLUSION: Taken together, our findings show that voluntary exercise for two weeks increases irisin production in bone, and that a three-fold increase of irisin levels in circulation can recapitulate part of the anabolic effects of exercise in the murine skeletal system.
Reimagining Our Dental Education Curriculum: A Collaborative Conference

Kathleen Molgaard, Shawheen Saffari, Pooyan Refahi, Tuvy Phan,* Irina Dragan, and Yun Saksena

PURPOSE: The American Dental Education Association (ADEA) Annual Session and Fall Meeting give dental students who are part of the Council of Students, residents, and fellows the valuable opportunity to discuss their respective curricula and exchange ideas on the efficacy of various educational methods embraced by their schools. The 2015 New England Curriculum Hack-a-Thon provided a setting for the discussion of dental school curriculum and its reform outside of the ADEA conferences. Students from Harvard School of Dental Medicine (HSDM), Tufts University School of Dental Medicine (TUSDM), Boston University Goldman School of Dental Medicine (GSDM), and University of New England College of Dental Medicine (UNE) were given the task of creating a predoctoral curriculum for a new dental school based on Commission on Dental Accreditation (CODA) standards.

METHODS: Twenty-five students representing the four dental schools, ranging from first through fourth year predoctoral students and postdoctoral residents, attended the conference. The students were randomly assigned to one of five groups, with five students from varying classes and schools in each group. Groups were given the presentation requirements and judging rubric. Students were given approximately four hours to discuss the content and implementation of their curriculum as well to create a multimedia presentation. Afterwards, each group had 15 minutes to present and five minutes to answer questions from a panel of judges composed of faculty members from HSDM, TUSDM, GSDM, and UNE.

CONCLUSION: Many common themes were seen in the group presentations. All the groups sought to decrease lecture time and incorporate more active and modern learning styles such as flipped-classroom models and problem-based learning. They also opted for a pass/fail grading system in order to facilitate a positive, collaborative environment, increase teamwork and peer-to-peer learning, and decrease unhealthy competition and stress. Vertical integration between the four classes, especially in regards to patient care, was seen in all the curricula. Lastly, protected elective time for students to pursue individual interests in addition to the standardized base curriculum was seen on some level in all the presentations. Each curriculum also had unique aspects. One team, which sought to create global health leaders, had community service built throughout their curriculum, with time for mission trips and community outreach programs in the final year. Another team strongly emphasized individualized, interdisciplinary tracks in which students took courses in other schools, such as public health, education, business, law, and research, as well as integrated clinical and preclinical experiences with dental hygienists and technicians. The Directed Dental Experience was an approach one group took to make their curriculum distinctive by giving students five weeks every year to pursue further training in a discipline, such as research, public health, or a dental specialty. One group had a distinct take on
vertical integration by implementing both group learning and assessments throughout biomedical science and patient care. The last group had a 3+1 curriculum model, in which the traditional dental school experience was condensed into three years, with the fourth year reserved for a general practice residency experience. Overall, the event was well received by faculty and students alike, especially as a first of its kind. Most ideas for improving the event from postconference surveys focused on increasing the working time between the groups. Other ideas included having each team work on and present on a specific aspect of a curriculum or assigning each team to focus on a different goal in the curriculum in order for more unique ideas to be presented.
The Role of the Speech Pathologist in Oral Health Promotion

Christina Piacquadio,* Sarah Pagni, and John Morgan

OBJECTIVE: To develop a survey instrument that would investigate speech language pathologists’ knowledge of oral health and to apply that knowledge in practice.

METHODS: An 18-item questionnaire was adapted from a questionnaire of speech language pathologists with regards specifically to individuals with developmental/acquired disabilities. The survey was self-administered using Qualtrics format. A review panel (nine individuals, three of each cohort, N=9) of dentists, dental hygienists, and speech language pathologists completed the survey and provided feedback by answering questions. Dentists and dental hygienists rated each question (content validity) individually using the five-point Likert scale (1=very important, 2=important, 3=moderately important, 4=of little importance, and 5=not important) and rated whether the questions should be included or excluded from the survey (0=no, 1=unsure, and 2=yes). Speech pathologists were also asked to respond to questions assessing face validity, specifically:

1. If they were comfortable answering the questions
2. If they had any trouble with the questions
3. If they had any additional feedback

RESULTS: Content validity data showed all six respondents (100%) reported that all 18 questions (100% of the questions) should be included in the questionnaire, and 0 questions (0%) were “not important” to the survey. Face validity showed 1 respondent (33%) reported that one of the questions was vague, and no respondents (0%) reported having trouble answering any of the questions. No respondents reported any recommendations to the questions themselves; therefore, no changes were made to the content of this survey.

CONCLUSIONS: No recommendations to change the survey questions were made and none were made. This survey instrument, used to assess the potential role of the speech language pathologist in oral health teams, can add to the growing body of knowledge of how to maximize the effectiveness of inter-professional collaborative practice models.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1197.
Novel Zebrafish Models for Human Mineralized Tissue Diseases

Stephen Reichheld,* Evan Brooks, John Lyons, and Pamela Yelick

OBJECTIVES: The objective of this study is to characterize the Tft152N and Tft156N zebrafish mineralized tissue mutant lines by identifying phenotypic abnormalities, their associated genetic anomalies, and the time course of skeletal defect onset and progression. These mutants were previously identified in a forward-genetic chemical mutagenesis screen performed by the Yelick Lab.

METHODS: An in vivo calcein staining protocol utilizing fluorescent microscopy was performed every week from juvenile stage (five weeks post fertilization, wpf) to adult stage (10 wpf) in order to characterize both the nature of the mutant phenotype, the time of defect onset, and mineralized tissue defect progression. Subsequent histological and immunohistochemical analyses are being performed to define mineralized and soft tissue defects in mutant fish versus age-matched wild-type sibling fish. The mutations responsible for the Tft152N and Tft156N mutant phenotypes are currently being characterized using bulked segregant analysis.

RESULTS: We found that Tft152N and Tft156N zebrafish first exhibited tissue mineralization defects at 5 wpf that persisted into adulthood (10 wpf) and exhibited phenotypes similar to human osteogenesis imperfecta (OI) and human extremity malformation diseases, respectively. Ongoing bulked segregant analyses are being conducted to identify the allelic mutations for each.

CONCLUSIONS: Our results suggest that the Tft152N and Tft156N zebrafish mutant lines are viable vertebrate models for the study of genetic mechanisms contributing to human mineralized tissue defects, including OI and human extremity diseases, respectively.

These studies were supported by NIH/NIDCR R01DE018043 (PCY) and NIH/NIAMS R21AR065761 (PCY). Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0429.
Comparison of Reliance HEMA and Bis-GMA Bonding Resins on Ceramics

Timothy Reichheld,* Gregory Monfette,* Gerard Kugel, and Ronald Perry

OBJECTIVES: With the advancement of new ceramic materials for dental crowns, improved methods of bonding orthodontic brackets to these surfaces must be attained. Currently, Emax® lithium disilicate is being used primarily for anterior crowns and zirconia is being used for the posterior. The purpose of this study is to compare the shear bond strength of Reliance HEMA (Assure®) and Bis-GMA (Assure PLUS) orthodontic bonding resins on enamel, porcelain, and zirconia materials.

METHODS: Two groups were formed, with three tested surfaces per group (N=20). The categories included premolars, zirconia rods, and porcelain rods. Group 1 was treated with Assure Universal Bonding Resin and group 2 was treated with Assure PLUS All Surface Bonding Resin. Zirconia rods (1x1x4 cm) were used to represent zirconia crowns and IPS Emax CAD rods (Ivoclar Vivadent) (1x1x2 cm) were used to represent Emax lithium disilicate crowns. Assure and Assure PLUS bonding agents were applied according to the manufacturer’s specifications, and standard edgewise universal premolar brackets were secured using Reliance Light Bond™ paste without fluoride. After 24 hours, the brackets were sheared with a universal testing machine (Instron® 5566A) and the results were recorded. Data were analyzed using an independent sample t-test. A p-value of less than 0.05 was considered statistically significant.

RESULTS: The p-values indicate that there is no statistically significant difference between group 1 and group 2. See Tables 1, 2, and 3.

<table>
<thead>
<tr>
<th>Table 1. Enamel</th>
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<tr>
<td>Group</td>
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</tr>
<tr>
<td>SBS</td>
</tr>
<tr>
<td>Group 1</td>
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<td>Group 2</td>
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<th>Table 2. Emax</th>
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<tr>
<td>Group</td>
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</tr>
<tr>
<td>SBS</td>
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<tr>
<td>Group 1</td>
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<td>Group 2</td>
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<th>Table 3. Zirconia</th>
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<tr>
<td>Group</td>
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<td>--------</td>
</tr>
<tr>
<td>SBS</td>
</tr>
<tr>
<td>Group 1</td>
</tr>
<tr>
<td>Group 2</td>
</tr>
</tbody>
</table>
CONCLUSION: Although group 1 and group 2 gave statistically equivalent results, we found that the ease of use when applying Assure PLUS All Surface Bonding Resin makes it a safer, superior product within the confines of this study. It does not require a four-minute hydrofluoric acid etch and has half the curing time when bonding to ceramic materials.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0585.
Deflection of Gingival Retraction Pastes under Varying Stress Conditions

Jessie Reisig,* Jeffrey Daddona, Zuhair Natto, Gerard Kugel, and Ronald Perry

OBJECTIVE: The objective of this study is to measure the strain of various in vitro retraction pastes under differing stress conditions and working times.

METHODS: A 4 mm × 9 mm T-shaped silicone plug made of Aquasil Ultra Light-Body (DENTSPLY), simulating gingival, was fabricated to fit a custom pressure-gauge apparatus. The apparatus, kept at 37°C, applied a force of 0.01 N/mm or 0.06 N/mm onto the silicone plug. The plug then delivered the force onto test retraction pastes of the same size. After a combined extrusion time of no more than 10 s and the working time suggested by the manufacturer, the deflection by the pastes against the plug were then recorded at 20 s and 30 s after the force was applied. The percent deflection was then calculated for each sample (N=6). Data were analyzed using two-way ANOVA and Tukey’s HSD test with SPSS Version 22.

RESULTS: See Table 1. A three-way ANOVA test revealed a statistically significant difference interaction (p<0.001) between the two forces and different products. Based on these findings, a separate two-way ANOVA test was performed within the different force groups. In the group that received the 0.01 N/mm force, the post-hoc analysis using Tukey’s HSD test showed all products were different from each other (p<0.001), However, no difference was found, regardless of whether the single product was tested for 60 s or 90 s after working time. The same results were supported under the 0.06 N/mm force, except no difference was found between the T and Ex products tested.

Table 1. Group statistics

<table>
<thead>
<tr>
<th>Group</th>
<th>Acronym</th>
<th>Working Time</th>
<th>Mean % Deflection after working time (SD)</th>
<th>Mean % Deflection after working time (SD)</th>
<th>Mean % Deflection after working time (SD)</th>
<th>Mean % Deflection after working time (SD)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.01 N/mm Force</td>
<td>0.06N/mm Force</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retraction Paste (3M)</td>
<td>RT</td>
<td>2 m</td>
<td>59.167 (4.070)</td>
<td>58.500 (3.728)</td>
<td>40.000 (6.928)</td>
<td>38.833 (7.305)</td>
</tr>
<tr>
<td>Expasyl (Kerr)</td>
<td>Ex</td>
<td>2 m</td>
<td>96.833 (1.835)</td>
<td>96.833 (1.835)</td>
<td>68.000 (6.723)</td>
<td>67.500 (6.834)</td>
</tr>
<tr>
<td>Traxodent (Premier)</td>
<td>T</td>
<td>2 m</td>
<td>19.667 (4.633)</td>
<td>19.500 (4.760)</td>
<td>74.333 (8.870)</td>
<td>74.167 (8.750)</td>
</tr>
<tr>
<td>Experimental Material</td>
<td>E1</td>
<td>20 s</td>
<td>106.000 (5.366)</td>
<td>108.167 (5.636)</td>
<td>97.500 (1.871)</td>
<td>97.833 (2.137)</td>
</tr>
<tr>
<td>(DENTSPLY)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental Material</td>
<td>E2</td>
<td>30 s</td>
<td>111.000 (5.366)</td>
<td>111.000 (5.367)</td>
<td>104.833 (1.722)</td>
<td>104.833 (1.722)</td>
</tr>
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</table>
CONCLUSION: Different retraction pastes exhibited different deflection forces, perhaps due to the nature of the mechanical or chemical properties producing retraction. The deflection of greater than 100% may represent a mechanical expansion against gingiva, whereas pastes that do not expand may retract the gingiva via chemical means. In vivo testing is needed to determine whether physical or chemical retraction leads to better clinical results.

Sponsored by DENTSPLY.
Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0656.
Assessment of Human BCC Cancer Cell Metabolism in Bioengineered Tissues
Shawheen Saffari,* Tatiana Mendez, Janet Cowan, James Baleja, and Addy Alt-Holland

OBJECTIVE: Among the many symptoms of basal cell carcinoma nevus syndrome are multiple basal cell carcinomas (BCCs) and keratocystic odontogenic tumors (KCOT). Current treatment modalities for these lesions often result in severe morbidity and cancer recurrence; thus, novel strategies to block their development are needed. To elucidate novel molecular events that regulate human BCC tumor cell growth, we investigated the behavior and metabolism of these cells in bioengineered tissues.

METHODS: We generated three-dimensional collagen scaffolds in which BCC cells and primary fibroblasts were either grown separately or together. Cell growth, tissue histology, and nuclear magnetic resonance analysis of lactate and acetate levels in the conditioned media of the tissues were analyzed.

RESULTS: When grown in individual tissues, fibroblasts maintained their spindle cell morphology and secreted significant amounts of lactate. In contrast, BCC cells showed different cell shapes and generation of circular structures. These cells secreted considerable amounts of acetate rather than lactate. When both cell types were grown in separated compartments of a tissue, the overall acetate production increased. However, when the cells were grown together within the collagen the secretion of acetate decreased and the secretion of lactate continued. The increased lactate level led to lower pH and overall acidic tissue conditions, a phenomenon that clinically has been correlated with cancer aggressiveness.

CONCLUSION: We hypothesize that changes in lactate and acetate levels can alter the tissue microenvironment and affect BCC cell behavior. The generation of in vivo-like human BCC tissues will pave the way for the construction of human epithelial KCOT tissues. Alterations in the metabolic profiles of BCC and KCOT tissues will be used to further interrogate the contribution of the metabolic activity of these cancer cells to their growth and to reveal cellular mechanisms that may serve as novel targets for therapeutic interventions for these cancers.

This study was funded by the Michael J. Rainen Family Foundation and supported by the Basal Cell Carcinoma Nevus Syndrome Life Support Network.
Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1545.
Repetitive Deflection Strengths of Adhesive Cements
Sara Samaha,* Jeffrey Daddona, Matthew Finkelman, Ronald Perry, and Gerard Kugel

OBJECTIVE: The objective of this study is to compare the maximum stress and repetitive deflection of various cement cylinders using a universal testing machine.

METHODS: Three dental cements (N=5):
  Group 1: Activa™ BioACTIVE Cement (Pulpdent)
  Group 2: Maxcem Elite™ Cement (Kerr)
  Group 3: RelyX™ Unicem Automix Cement (3M)
were used to create 4x8 mm cylinders by filling a plastic mold placed between two polyester (Mylar) films with the cement material. A glass plate and load were placed on top to displace excess material. Each cement was allowed to set according to its manufacturer’s instructions. The samples were removed from the molds and leveled while removing excess (EcoMet® 250, Buehler). All samples were stored in a 37°C water bath for 24 hours. A universal testing machine (Instron® 5566A, Norwood, Massachusetts) was used to test the deflection of the cement material by a repetitive movement of 0.3 mm for 100 cycles or until sample breakage, which was recorded. Data was analyzed using one-way ANOVA and Tukey’s HSD test.

RESULTS: Table 1 shows the mean compressive stress values for each group, while Table 2 shows the results of a one-way ANOVA on those values. There is significant difference in the mean compressive stress at maximum compressive stress and load among all three samples. Group 1 had the lowest load value and was the only cement not to have any samples fracture, unlike groups 2 and 3, which had 40% and 80% of samples fracture, respectively.

<table>
<thead>
<tr>
<th></th>
<th>Mean compressive stress at maximum compressive load (MPa)</th>
<th>Mean compressive stress at maximum compressive stress (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>75.1821</td>
<td>77.9334</td>
</tr>
<tr>
<td>Group 2</td>
<td>90.1444</td>
<td>93.4276</td>
</tr>
<tr>
<td>Group 3</td>
<td>88.8111</td>
<td>91.5157</td>
</tr>
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</table>

CONCLUSION: Over time, the 0.3 mm movement delivered a lower load to the samples that continued to contract over time, as was seen in group 1. The higher load values seen in groups 2 and 3, as well as the amount of samples fractured, indicated that these cements were less compliant and therefore received a higher compressive load, leading to fracture.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1076.
Antimicrobial Effect of Varnish on Two Strains of Bacteria

Jeremie Sauve,* Driss Zoukhri, and Ronald Perry

OBJECTIVE: Varnish application is one of the most common methods used to prevent tooth decay in children. Although it has been proven to act as a protective barrier by strengthening enamel through the formation of fluorapatite, little is known about its antimicrobial activity. This study serves to analyze the antimicrobial activity of Embrace™ Varnish by Pulpdent® (Embrace) and Enamelast™ by Ultradent (Enamelast) on Streptococcus mutans (ATCC 25175) and Enterococcus faecalis (ATCC 29212), two bacteria found in the oral cavity.

METHODS: The antimicrobial activity of Embrace, Enamelast, distilled water, and chlorhexidine were tested on S. mutans or E. faecalis through two methods. The first method was applying the reagent to a 5 mm sterile disc of filter paper. Each disc was soaked with 1 μL of reagent and placed onto an agar plate divided into quadrants, one disc per quadrant, with 16 replicates per reagent. The plates were incubated at 37°C for 24 hours and inhibition zones were measured. The second method was applying the reagent to a 2 mm well. Each agar plate was divided into quadrants, one well per quadrant. Each well was filled with 1 μL of reagent. There were 16 replicates of each type of reagent. The plates were then incubated at 37°C for 48 hours and the inhibition zone measured at 24 and 48 hours.

RESULTS:

<table>
<thead>
<tr>
<th>Strains</th>
<th>Embrace</th>
<th>Enamelast</th>
<th>Chlorhexidine</th>
<th>Distilled water</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. faecalis</td>
<td>0</td>
<td>0</td>
<td>6.1875</td>
<td>0</td>
</tr>
<tr>
<td>S. mutans</td>
<td>0</td>
<td>0</td>
<td>8.7500</td>
<td>0</td>
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<table>
<thead>
<tr>
<th>Strains</th>
<th>Embrace</th>
<th>Enamelast</th>
<th>Chlorhexidine</th>
<th>Distilled water</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. faecalis</td>
<td>0</td>
<td>0</td>
<td>6.8125</td>
<td>0</td>
</tr>
<tr>
<td>S. mutans</td>
<td>0</td>
<td>0</td>
<td>9.2500</td>
<td>0</td>
</tr>
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<table>
<thead>
<tr>
<th>Strains</th>
<th>Embrace</th>
<th>Enamelast</th>
<th>Chlorhexidine</th>
<th>Distilled water</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. faecalis</td>
<td>0</td>
<td>0</td>
<td>7.1250</td>
<td>0</td>
</tr>
<tr>
<td>S. mutans</td>
<td>0</td>
<td>0</td>
<td>9.3150</td>
<td>0</td>
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</table>

The two strains did not show any susceptibility to the varnish as there were no measurable zones of inhibition. No statistical tests were performed as the purpose of the experiment was to determine if Embrace and Enamelast have antimicrobial activity.

CONCLUSION: Embrace and Enamelast did not demonstrate any antimicrobial effect on the bacteria tested, regardless of the method of application. Although fluoride varnishes play a role in reducing tooth decay through their ability to release fluoride, this experiment does not show that they kill bacteria on the tooth surface. Further experiments will need to be done, as this was not tested on tooth surface or in the oral cavity.
Silk Fiber Films for the Localized Release of Antibiotics

Sarah Schuback,* Stephanie Phillis,* Roberto Elia, Hans-Peter Weber, David Kaplan, Driss Zoukhri, and Gerard Kugel

OBJECTIVES: The purpose of the present study was to fabricate silk fiber films for use in periodontal and oral surgeries with sustained localized release of tetracycline.

METHODS: An aqueous solvent-processing method was used to generate the silk biomaterials from B. mori. Tetracycline was loaded into the silk at the following concentrations: 0.01 mg/ml, 0.075 mg/ml, and 0.15 mg/ml. Tetracycline-loaded silk was pipetted onto silicone molds to fabricate films. After water annealing processing, the tetracycline-loaded silk films were placed into liquid culture media with S. mutans. Bacterial growth inhibition was measured for the tetracycline-loaded films using ELISA assay after 24, 48, and 72 hours against chlorhexidine as a positive control.

RESULTS: All three concentrations of tetracycline-loaded silk fiber films inhibited S. mutans growth in liquid culture as effectively as chlorhexidine controls after 24 hours (100% inhibition). After 48 hours, in comparison to the inhibition of the chlorhexidine control, the 0.01 mg/ml tetracycline-loaded silk fiber films showed 3% inhibition, the 0.075 mg/ml tetracycline-loaded silk fiber films showed 96% inhibition, and the 0.15 mg/ml tetracycline-loaded silk fiber films showed 99% inhibition of S. mutans. After 72 hours, in comparison to the chlorhexidine controls, the 0.01 mg/ml tetracycline-loaded silk fiber films had 0% inhibition, the 0.075 mg/ml tetracycline-loaded silk fiber films had 29% inhibition, and the 0.15 mg/ml tetracycline-loaded silk fiber films had 53% inhibition of S. mutans.

CONCLUSIONS: Results of this study showed that tetracycline could successfully be loaded into silk fiber films and released locally. An important implication of this study is that concentrations of 0.15 mg/ml tetracycline loaded into silk fiber films showed sustained bacterial inhibition of S. mutans comparable to chlorhexidine controls for up to 48 hours. This suggests the use of silk fiber loaded films as a medium for localized antibiotic delivery in periodontal and oral surgeries in a time period when most infections arise.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0593.
Fatigue Strength of Temporary and Permanent CAD/CAM Crowns

Daniel Seay,* Aikaterini Papathanasiou, and Gerard Kugel

OBJECTIVE: The purpose of this investigation was to evaluate the fatigue strength of PMMA-based temporary CAD/CAM crown materials [CAD Temp®, VITA North America (group 1) and Telio® CAD, Ivoclar Vivadent Inc. (group 2)] in comparison with permanent CAD/CAM restorations, Block HC, Shofu Dental Corp. (group 3).

METHODS: A maxillary first molar crown prototype was designed using CAD software (3Shape Dental System™, Sirona) with 2.0 mm thickness occlusally and 1.0 mm buccally, palatally, and proximally. Four crowns per group (groups 1, 2, and 3) were fabricated (inLab® MC XL, Sirona) to the defined specifications. Each crown was affixed with temporary cement (ResiCem Universal Resin Cement, Shofu Dental Corp.) to an acrylic ideal crown preparation embedded in an acrylic block. An electrodynamic material testing machine (TestResources, Minnesota) applied variable loads directly perpendicular to the central fossa using a 5 mm diameter hemispherical probe. Force was applied at a rate of 4 Hz for 10,000 cycles before increasing by 200 Newton increments until the crown fractured. The maximum and minimum force applied and the distance the probe traveled were recorded for each cycle (MTL Programming, TestResources). Data were analyzed using Student’s t-test (two-tailed). A p-value of <0.5 was predetermined to indicate significant differences.

RESULTS: There were no statistically significant differences between all tested materials.

<table>
<thead>
<tr>
<th>Material</th>
<th>Number of samples</th>
<th>Mean force at failure (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD Temp, Vita North America</td>
<td>4</td>
<td>900 (±258) N</td>
</tr>
<tr>
<td>Telio CAD, Ivoclar Vivadent Inc.</td>
<td>4</td>
<td>1,300 (±346) N</td>
</tr>
<tr>
<td>Block HC, Shofu Dental Corp.</td>
<td>4</td>
<td>1,200 (±163) N</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Our results indicate that temporary CAD/CAM molar restorations can withstand forces comparable to materials marketed for permanent restorations. Future studies need to consider wear-resistance, marginal accuracy, and effects on opposing dentition to fully appreciate the qualities of these temporary restorations.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0659.
Evaluation of the Evidence-Based Clinical Questions Presented during the Basic and Clinical Sciences Spiral Seminar Series

Gayathri Shenoy,* Jennipher Murphy, Nadeem Karimbux, and Irina Dragan

OBJECTIVE: The Basic Science/Clinical Science Seminar (BaSiCSsss) series teaches and assesses skills in communication, teamwork, leadership, critical thinking, self-assessment, and clinical and behavioral sciences. The aim of this study was to identify the type of population, intervention, comparison, and outcome (PICO) questions that the teams presented to support the treatment plan option for the selected case.

METHODS: Presentations compiled by 94 teams, available on the Tufts Box, were reviewed and the relevant information was tabulated to facilitate data extraction. The following data was collected: the PICO question and the references used to support the clinical question (choice of journal, year of publication, and the type of study design). The study was approved by the IRB.

RESULTS: Out of the 94 reviewed questions, 55 topics were related to the topic of implant dentistry. The significant number of PICO questions related to implant dentistry is possibly due to interest in current topics, frequency of those cases presented in the clinic, and ease of access to the clinical documentation. The most common type of study design for the publications chosen was systematic review. A total of 53% of the studies included were published between 2006 and 2010.

CONCLUSION: Dental students present a high interest in implant dentistry. The students included the latest published studies with the highest level of evidence. The BaSiCSsss course ensures that critical thinking and use of evidence-based dentistry remain at a high standard at TUSDM, according to the ADA and ADEA recommendations.
Comparison of DOC and Hardness in Composite Bulk-Fill Products

Shankeertha Sundaralingam,* Samantha Keck, Sarah Pagni, and Ronald Perry

OBJECTIVES: To evaluate and compare the depth of cure (DOC) and hardness of five commercially available bulk-fill composite materials.

METHODS: Five bulk-fill composite materials were tested: Aura Bulk Fill, SDI(ABF), Filtek™ Bulk Fill Posterior, 3M ESPE (FBF), Surefil® SDR Flow, DENTSPPLY (SDR), Tetric EvoCeram® Bulk Fill, Ivoclar (TBF), and SonicFill™, Kerr (SBF). Cylindrical samples of each material were created using a plastic mold (diameter=5 mm) and light cured using the SDI Radii Plus for 40 s on the topside only. Samples were made to depths of 2, 3, 4, 5, and 6 mm for each material. Top (T) and bottom (B) sample surfaces were buffed with a 5μ and 1μ microfinishing film. All samples were stored in a dark dry environment at 37°C for 24 hours before testing. A Buehler Hardness tester was used to evaluate each of the samples on both the top and bottom surfaces at five random sites (load=300 g). The thickness at which the ratio of hardness (B/T) becomes <80% is deemed the DOC. A one-way ANOVA test was used to determine statistical significance.

RESULTS: At thickness ≤5 mm, all products had a DOC of at least 80%. At 6 mm, all products had a DOC <80%. SBF was the hardest material (average T hardness=82.03 HV0.3) followed by FBF (65.75 HV0.3), TBF (54.25 HV0.3), ABF (53.04 HV0.3), and SDR (36.46 HV0.3).
### Table 1.

<table>
<thead>
<tr>
<th>Sample Thickness (mm)</th>
<th>Vicker Top (T) Mean Hardness</th>
<th>Vicker Bottom (B) Mean Hardness</th>
<th>Vicker B/T Hardness Ratio %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ABF</td>
<td>FBF</td>
<td>SDR</td>
</tr>
<tr>
<td>2</td>
<td>51.80 (±0.38)</td>
<td>64.50 (±1.04)</td>
<td>34.30 (±1.04)</td>
</tr>
<tr>
<td>3</td>
<td>50.26 (±1.31)</td>
<td>64.16 (±1.22)</td>
<td>35.94 (±0.97)</td>
</tr>
<tr>
<td>4</td>
<td>55.00 (±1.48)</td>
<td>66.82 (±1.21)</td>
<td>36.46 (±1.97)</td>
</tr>
<tr>
<td>5</td>
<td>53.68 (±1.18)</td>
<td>67.50 (±0.29)</td>
<td>37.46 (±0.97)</td>
</tr>
<tr>
<td>6</td>
<td>54.44 (±1.06)</td>
<td>65.78 (±1.74)</td>
<td>38.14 (±0.80)</td>
</tr>
<tr>
<td>Mean</td>
<td>53.04</td>
<td>65.75</td>
<td>36.46</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** DOC of all products was greater than 80% up to a 5 mm depth, indicating that these products are cured to a clinically acceptable degree. ABF and FBF may have a DOC closer to 6 mm as their DOC at the 6 mm depth were 78.7% and 78.1%, respectively. Variations may be due to the differences in composition of each of the materials.

*Sponsored in part by Southern Dental Industries.*

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0643.*
Microleakage Evaluation of Elevated Temperatures in Adhesive Systems

Michelle Ta,* Elisa Giordano, Matthew Finkelman, Steven Eisen, John Morgan, and Gerard Kugel

OBJECTIVE: To compare marginal microleakage across three different generations of bonding agents after heating the materials prior to placement. The delivery and storage of materials exposed to prolonged high temperatures before application may compromise their restorative properties.

METHODS: One hundred and twenty standard Class II slot preparations were performed on noncarious human molars with approximately 3 mm depth at gingival floor and 4 mm width bucco-lingually. Samples were randomly assigned to one of 12 groups (N=10). Three bonding agents were tested: ExciTE® F Ivoclar Vivadent (EF), Clearfil™ SE Bond Kurary Dental (CF), and Scotchbond™ Universal Adhesive 3M ESPE (SB). A fourth dental restoration, Activa™ bioactive restorative Pulpdent (AB), was tested for additional comparisons. Materials were placed in an incubator (Thermo Scientific™, ELED265) and heated for 120 hours at either 24°C, 40°C, or 52°C. All materials were applied according to manufacturers' instructions. Filtek™ Supreme Ultra composite 3M ESPE was placed on top of bonding agents. Completed restorations were thermocycled for 5,000 cycles between 5°C and 55°C. Samples were immersed in 2% methylene blue dye for eight hours. Samples were embedded in acrylic resin, sectioned mesio-distally, and evaluated under stereomicroscope (Olympus, SZX16). A dye-penetration-to-axial-wall (DP) score was used on gingival floor: 0=0% DP, 1=1–25% DP, 2=26–50% DP, 3=51–75% DP, and 4=76–100% DP. Counts and percentages were calculated and statistical significance was assessed via generalized estimating equations (GEE) for separate comparisons of materials and temperatures.

RESULTS: Table 1 displays counts and percentages of microleakage scores. Table 2 displays GEE analysis showing statistically significant difference (p<0.05) between materials. Table 3 displays post-hoc tests using Bonferroni correction to adjust for multiple comparisons (p<0.008). All comparisons with AB would have been significant at p<0.05, but no comparisons were found significant using Bonferroni correction.
Table 1. Microleakage Counts and Percentages

<table>
<thead>
<tr>
<th>Material</th>
<th>Temp (°C)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>24</td>
<td>6 (60%)</td>
<td>3 (30%)</td>
<td>1 (10%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>FS</td>
<td>40</td>
<td>5 (50%)</td>
<td>5 (50%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>FS</td>
<td>52</td>
<td>3 (30%)</td>
<td>6 (60%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (10%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>CF</td>
<td>24</td>
<td>6 (60%)</td>
<td>4 (40%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>CF</td>
<td>40</td>
<td>5 (50%)</td>
<td>2 (20%)</td>
<td>0 (0%)</td>
<td>3 (30%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>CF</td>
<td>52</td>
<td>3 (30%)</td>
<td>5 (50%)</td>
<td>1 (10%)</td>
<td>0 (0%)</td>
<td>1 (10%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>SB</td>
<td>24</td>
<td>5 (50%)</td>
<td>1 (10%)</td>
<td>3 (30%)</td>
<td>0 (0%)</td>
<td>1 (10%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>SB</td>
<td>40</td>
<td>5 (50%)</td>
<td>3 (30%)</td>
<td>2 (20%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>SB</td>
<td>52</td>
<td>4 (40%)</td>
<td>5 (50%)</td>
<td>1 (10%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>AB</td>
<td>24</td>
<td>8 (80%)</td>
<td>2 (20%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>AB</td>
<td>40</td>
<td>8 (80%)</td>
<td>1 (10%)</td>
<td>1 (10%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
<tr>
<td>AB</td>
<td>52</td>
<td>7 (70%)</td>
<td>2 (20%)</td>
<td>1 (10%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
</tbody>
</table>

Table 2. Score Statistics For GEE Analysis

<table>
<thead>
<tr>
<th>Comparison</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>0.028</td>
</tr>
<tr>
<td>Temperatures</td>
<td>0.355</td>
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</tbody>
</table>

Table 3. Post-hoc Tests Comparing Materials

<table>
<thead>
<tr>
<th>Comparison</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS vs. CF</td>
<td>0.632</td>
</tr>
<tr>
<td>FS vs. SB</td>
<td>0.609</td>
</tr>
<tr>
<td>FS vs. AB</td>
<td>0.012</td>
</tr>
<tr>
<td>CF vs. SB</td>
<td>0.946</td>
</tr>
<tr>
<td>CF vs. AB</td>
<td>0.017</td>
</tr>
<tr>
<td>SB vs. AB</td>
<td>0.009</td>
</tr>
</tbody>
</table>

CONCLUSION: Results suggest that there are differences in microleakage between adhesive systems, but no definitive conclusions could be drawn from gathered data.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1663.
Effect of Elevated Temperature on Adhesive Bond Strength to Dentin

Kanupriya Tewari,* Matthew Finkelman, John Morgan, and Gerard Kugel

OBJECTIVES: To investigate how storage temperatures affect shear bond strength (SBS) of fifth, sixth, and seventh generation adhesive systems and bioactive restoratives (Activa™) to dentin. This pilot study is part of a larger analysis that aims to establish recommendations for management of materials in settings where cooling systems may not be accessible (i.e., extreme climate conditions in resource-limited countries).

METHODS: Thirty extracted human teeth were obtained. Each tooth was embedded in acrylic and the dentinal surface was exposed. Fifteen groups were formed (N=5). Materials were stored for 72 hours prior to use: subgroup A=24°C, subgroup B=40°C, and subgroup C=52°C. Group 1 used ExciTE® F adhesive (Ivoclar, Vivadent), group 2 used Clearfil™ SE Bond (Kuraray Dental), group 3 used ScotchBond™ Universal Adhesive (3M ESPE), group 4 used Activa™ (Pulpdent) without bond, and group 5 Activa™ (Pulpdent) with bond (DenTASTIC™ Uno™, Pulpdent). Bonding agent was applied following manufacturer’s instructions. Filtek™ Supreme nanohybrid composite (3M ESPE) was applied using a bonding jig (Ultradent) and light cured with LED light (DEMI, Kerr). Specimens were stored in deionized water for 24 hours at 24°C. Occlusal shear bond strength was measured using a universal testing machine (Instron® Norwood, Massachusetts) with a cross head speed of 5 mm/min and cross sectional area of 3 mm². Statistical significance was assessed via a mixed model (p<0.05); Bonferroni correction was used for post-hoc tests.

RESULTS: Overall tests of adhesive (p<0.001) and temperature (p=0.014) were statistically significant. Post-hoc tests of adhesive showed that group 4 had significantly lower SBS than all other groups, and group 3 exhibited significantly higher SBS than group 5. Post-hoc tests of temperature showed that SBS at 24°C was significantly higher than at 52°C (Table 1).

Table 1. Comparison of SBS by Temperature and Adhesive

<table>
<thead>
<tr>
<th>Adhesive</th>
<th>Temperature (°C)</th>
<th>Mean SBS (MPa)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>24°C</td>
<td>34.1</td>
<td>7.28</td>
</tr>
<tr>
<td>B</td>
<td>40°C</td>
<td>26.5</td>
<td>14.5</td>
</tr>
<tr>
<td>C</td>
<td>52°C</td>
<td>25.7</td>
<td>9.81</td>
</tr>
<tr>
<td>Group 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>24°C</td>
<td>31.0</td>
<td>5.80</td>
</tr>
<tr>
<td>B</td>
<td>40°C</td>
<td>31.0</td>
<td>8.79</td>
</tr>
<tr>
<td>C</td>
<td>52°C</td>
<td>23.3</td>
<td>11.4</td>
</tr>
<tr>
<td>Group 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>24°C</td>
<td>41.8</td>
<td>9.28</td>
</tr>
<tr>
<td>B</td>
<td>40°C</td>
<td>38.9</td>
<td>11.8</td>
</tr>
<tr>
<td>C</td>
<td>52°C</td>
<td>24.8</td>
<td>9.73</td>
</tr>
<tr>
<td>Group 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>24°C</td>
<td>9.75</td>
<td>6.21</td>
</tr>
<tr>
<td>B</td>
<td>40°C</td>
<td>6.04</td>
<td>3.23</td>
</tr>
<tr>
<td>C</td>
<td>52°C</td>
<td>8.71</td>
<td>5.07</td>
</tr>
<tr>
<td>Group 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>24°C</td>
<td>27.4</td>
<td>10.5</td>
</tr>
<tr>
<td>B</td>
<td>40°C</td>
<td>13.1</td>
<td>5.10</td>
</tr>
<tr>
<td>C</td>
<td>52°C</td>
<td>20.6</td>
<td>13.3</td>
</tr>
</tbody>
</table>

CONCLUSIONS: No significant difference was found between groups 1, 2, and 3. Practitioners should use these results to guide material choices in challenging climate conditions. Further research is recommended to evaluate the rise in SBS noted for group 4 and 5 at 52°C.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1847.
Antibiotic Use following Third Molar Extractions in Dry Socket Cases at TUSDM

Jordan Thomas,* Ankur Patel, Sarah Pagni, and Archana Viswanath

BACKGROUND: Surgical extraction of third molars is one of the most common oral surgical procedures. Complications related to third molar removal range from 4.6% to 30.9%. The four most common postoperative complications of third molar extraction reported in the literature are localized alveolar osteitis (dry socket), infection, bleeding, and paresthesia. Dry socket is one of the common postoperative complications after third molar extraction.

OBJECTIVE: To assess the overall prevalence of dry socket following third molar extraction in the past five years at TUSDM Oral Surgery Clinics and identify the potential relationship between antibiotics and dry socket—the hypothesis being 0.12% chlorhexidine rinse reduces the incidence of dry socket.

METHODS: This case-control study was conducted at the Department of Oral and Maxillofacial Surgery, Tufts University School of Dental Medicine. Following IRB approval, digital dental records from patients with documented wisdom teeth removal from the past five years were compiled. TUSDM IT team performed a database search of patients that experienced a dry socket following an extraction. Seven hundred and eighty-two total patient charts were returned from this search and 300 patient charts were selected at random. Each patient chart was categorized based on the use of prophylactic antibiotics. Dental records were de-identified and analyzed using Stata13. The following variables were identified: demographics (age, sex, and social habits), medical and dental history, site of extracted teeth, position of third molar, postoperative medications, presence/absence of dry socket, and antibiotic mouth rinse prescribed.

RESULTS: The overall incidence of dry socket is 94 sites out of 782 teeth. Based on the preliminary review, there is an association between dry socket and antibacterial mouth rinse prescription (cases had fewer mouth rinse prescriptions than the controls).

CONCLUSION: Given that this was a retrospective chart review study, there is no way to ensure that the patients used the prescribed mouth rinse as directed. To better identify the effective of antibiotics in the prevention of dry socket, a prospective clinical study is required.
Shear Bond Strength of Several Dental Cements

Andy Tran,* Jeffrey Daddona, Matthew Finkelman, Gerard Kugel, and Ronald Perry

OBJECTIVE: To compare the shear bond strength (SBS) of various cements when bonded to zirconia, e.max crowns, titanium, stainless steel, and dentin.

METHODS: Products tested were: ACTIV A™ BioACTIVE Cement without DenTASTIC™ UNO™ (Pulpdent) (group 1); Rely X™ Unicem 2 Automix (3M) (group 2); Ceramir® Crown & Bridge (Doxa) (group 3); FujiCEM™ 2 Cement (GC America) (group 4); and ACTIV A BioACTIVE Cement with DenTASTIC UNO (Pulpdent) (group 5). Groups 1–4 (N=25) and group 5 (N=5) were not tested against the other four substrates. The fifth group of dentin samples was mounted in acrylic resin with the long axis of the tooth perpendicular to the surface and flattened to expose dentin using 240 grit silicon paper. Each cement was bonded using cylindrical molds, with internal diameter of 2.38 mm and height of 2 mm to the substrates according to manufacturer's instructions. All samples were cured (Translux® Wave, Heraeus Kulzer) and placed in water at 37°C for 24 hours. A universal testing machine (Instron® 5566A, Norwood, Massachusetts) was used to test the SBS with 1 mm/minute crosshead speed. The Kruskal-Wallis test was used for all the substrates except for dentin, which used one-way ANOVA.

RESULTS: The difference between products was statistically significant for each substrate (see Table 1). Compared to group 2, group 1 showed statistical significance for e.max and dentin. Group 1 compared to groups 3 and 4 showed statistical significance for all substrates. Group 2 compared to groups 3 and 4 showed statistical significance for all substrates except dentin. Groups 3 and 4 did not show any statistical significance other than e.max.
Table 1. Shear Bond Strength of Several Dental Cements

<table>
<thead>
<tr>
<th>Group</th>
<th>Substrate</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Interquartile Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>Zirconia</td>
<td>12.8</td>
<td>3.5</td>
<td>11.3</td>
<td>6.5</td>
</tr>
<tr>
<td>Group 1</td>
<td>e.max Crowns</td>
<td>14.1</td>
<td>1.7</td>
<td>13.6</td>
<td>2.7</td>
</tr>
<tr>
<td>Group 1</td>
<td>Titanium</td>
<td>4.6</td>
<td>1.3</td>
<td>4.2</td>
<td>2.0</td>
</tr>
<tr>
<td>Group 1</td>
<td>Stainless Steel</td>
<td>2.0</td>
<td>0.8</td>
<td>1.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Group 1</td>
<td>Dentin</td>
<td>12.5</td>
<td>2.1</td>
<td>11.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Group 2</td>
<td>Zirconia</td>
<td>14.6</td>
<td>3.1</td>
<td>16.7</td>
<td>5.7</td>
</tr>
<tr>
<td>Group 2</td>
<td>e.max Crowns</td>
<td>19.5</td>
<td>0.9</td>
<td>19.5</td>
<td>1.7</td>
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<tr>
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CONCLUSIONS: With the dentin substrate, the comparison between groups 1 and 5 did not show any significant difference; however, both of these products compared to the other three showed significant differences. For the other substrates, group 2 showed the highest compressive stress, followed by groups 1, 4, and 3 respectively.

*Sponsored in part by Pulpdent.*

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #0579.*
General Anesthesia Repeat Treatment in Intellectually and Developmentally Disabled Adults

Sarah Treff,* Darren Drag, Jane Steffensen, Sarah Pagni, and John Morgan

OBJECTIVE: Limited information exists investigating the outcomes of dental treatment provided under general anesthesia (GA) for individuals with intellectual and developmental disabilities (I/DD). This study explores variables that may make an I/DD patient more likely to require repeat treatment under GA.

METHODS: This retrospective study utilized demographic and clinical data recorded in aXiUm electronic health records for adults with I/DD who received initial dental care under GA at Tufts Dental Facilities from April 1, 2009, to March 31, 2010. Data were also collected for those individuals who had repeat visits under GA through June 30, 2015. Characteristics investigated include age, gender, cooperation level (recorded at most recent clinic visit prior to GA treatment and scaled 0–6 with 0=least cooperative and 6=most cooperative), periodontitis diagnosis, I/DD level (scaled 1–3 where 1=mild, 2=moderate, and 3=profound), caries experience, and untreated caries. Analysis was conducted using Stata version 13.1.

RESULTS: During the initial study year, 275 individuals (mean age 44.9±11.3, age range 20–79, 62.6% male) required dental treatment under GA. Caries experience (94.2%), untreated caries (55.3%), and periodontitis (89.9%) were reported. Of the study group, 103 individuals required repeat treatment under GA and 172 did not repeat. Repeaters (R) showed a greater percentage in the 40–59-year-old range than nonrepeaters (NR) (p<0.01) with no significant difference in gender found between the two groups. Patient cooperation levels showed a higher percentage of patients in lower cooperation levels 1 and 2 in the R group (p<0.05). I/DD level in the NR vs. R group was 1=13.8% vs. 9.1%, 2=21.8% vs. 39.0%, and 3=64.6% vs. 51.9% (p=0.05).

CONCLUSIONS: Selected characteristics varied between the NR and R groups. Studies investigating characteristics of adults with I/DD requiring dental care under GA are warranted to identify oral disease management and preventative strategies for this vulnerable population at high risk for dental diseases.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles, California. Abstract #1190.
Oral Health Perceptions of Haitian Americans: A Qualitative Pilot Study

Mikenah Vega,* Sarah Pagni, and Nicole Holland

OBJECTIVE: The aim of this study is to explore the oral health knowledge, attitudes, and beliefs of Haitian Americans. Haitians are currently the third largest immigrant group in Boston. Currently there is a lack in oral health literature that would allow dental professionals to cater to the population. We desire to understand the framework in which this population makes decisions about their oral health, while aiding dentists in providing culturally and linguistically appropriate oral health services.

METHODS: One closed-door focus group was conducted in English at a Haitian church in Boston. Eight participants (3 male; 5 female) were recruited through a church organizer to participate for a maximum of 90 minutes. The focus group was conducted using a semistructured approach, using a predetermined script by the moderator. The assistant moderator wrote notes and audio recorded the discussion. The focus group transcript was analyzed by coding for key phrases and themes.

RESULTS: From our pilot focus group, several subthemes emerged from this population, such as: halitosis as the primary indicator of an oral health problem; tooth loss as a predominately esthetic concern; and limited knowledge of dental disease. Participants also believed that they could not discuss or help someone else improve their oral health since it would be perceived as disrespectful. A majority of the group mistrusted dental professionals due to a variety of reasons such as the high cost, pain after procedures, and past interactions.

CONCLUSIONS: Preliminary focus group data analysis suggests that this group might be aware of the basic behaviors needed to maintain oral health, but lacks the knowledge needed to navigate dental disease. Culturally appropriate oral health materials are needed to improve oral health knowledge and communication between dentists and Haitian American patients. More focus group interviews will be conducted, possibly in Haitian Creole, to validate the subthemes that were discovered.
Silencing Snai1 with siRNA and shRNA in Murine BM-MSCs

Kathryn Weber,* Driss Zoukhri, Dillon Hawley, and Helene Armaos

OBJECTIVES: The transcription factor Snai1 is the master regulator of epithelial-mesenchymal transition (EMT) and mesenchymal-epithelial transition (MET). The purpose of this study was to determine the optimal siRNA and shRNA protocol for silencing Snai1 expression in murine bone marrow-derived mesenchymal stem cells (BM-MSCs) in order to induce MET.

METHODS: BM-MSCs were cultured with siRNA or shRNA according to manufacturer’s guidelines. To ensure efficiency of transfection, cells were grown on eight-well chamber slides and transfected with a fluorescently labeled siRNA. Transfected cells were lysed, RNA or proteins extracted, and RT-PCR or WB analyses were performed, respectively, to measure levels for Snai1 expression.

RESULTS: For siRNA: Transfection efficiency using Neofectin was over 80% when using a fluorescently labeled siRNA. Image J analysis of the RT-PCR was used to determine the ratio of Snai1 to GAPDH expression when compared to control nontransfected cells. All of the samples tested had no observable decrease in Snai1 mRNA expression. For shRNA: Transfection was confirmed with puromycin kill curve and therefore subsequent cell lineages were expected to have had 100% transfection. WB samples compared protein levels of Snai1 to vimentin (a mesenchymal marker) and E-cadherin (an epithelial marker) using Image J analysis, which showed no changes between transfected cell lines and control cells.

CONCLUSION: The siRNA sequences and protocols used for transfection in this study did not efficiently down-regulate Snai1 in BM-MSCs. Cell permeability using Neofectin was found to be over 80% for the siRNA and 100% for the shRNA samples selected for with a puromycin kill curve, but it is possible that the siRNA sequences or the transient transfection time were not optimal. A recent study showed promise of MET via knockdown using CRISPR mediated deletion of the Snail gene in cancer cells, which could be tested in murine BM-MSCs.

POSTDOCTORAL STUDENT PRESENTATIONS

Interprofessional Dental-Medical Collaboration in the Management of Obstructive Sleep Apnea: A Case Report

Rayyan Alfirdous,* Leopoldo Correa, and Kanchan Ganda

OBJECTIVE: Obstructive sleep apnea (OSA) is independently associated with cardiovascular and cardiometabolic risk as documented in several large epidemiologic studies. OSA leads to several physiologic disturbances as well, such as intermittent hypoxia, sleep fragmentation, and increase in autonomic tone. These disturbances have been associated with insulin resistance and type 2 diabetes mellitus (T2DM) in animal and human studies. The purpose of this case report is to show the dental management of OSA in a patient with a history of cardiovascular disease and diabetes.

METHODS: A 65-year-old male presented with a medical history of cardiac bypass surgery, controlled high blood pressure, and diabetes. He was referred by the cardiologist and sleep physician to the dental sleep clinic at Tufts Dental School to manage his medically diagnosed obstructive sleep apnea (AHI=27.7, RDI=34.2, nadir 02=78%). He had a history of previous use and failure of CPAP therapy. A mandibular advancement device (MAD) was fabricated and fitted with 80% jaw protrusion (8 mm), and final jaw protrusion was reached at 90% (9 mm) on MAD. After completion of therapy, the patient was referred back to the cardiologist and sleep physician for follow-up sleep study with MAD to assess efficacy on his apnea severity and oxygen saturation (standard of care protocols at Tufts dental sleep clinic).

RESULTS: Follow-up sleep study with MAD showed a reduction in apnea severity and increase in oxygen saturation (AHI=5.9, RDI=9.6, nadir 02=94%).

CONCLUSION: Evidence linking OSA and cardiovascular disease continues to grow, and these disease conditions commonly coexist. Recent studies have shown an increased incidence of coronary disease, heart failure, stroke, and cardiac mortality in those with OSA when compared with unaffected individuals. Dental professionals have been recognized as being part of the multidisciplinary therapeutic team for the management of obstructive sleep apnea. As professionals committed to comprehensive care, dentists are concerned about any medical condition(s) that could compromise the health of their patients and their patients’ dental experiences. The authors hope that this case report highlights the importance of mutual collaboration between medical and dental professionals.
Demographics of Patients with Special Needs Seen for Dental Rehabilitation under General Anesthesia

Naser Alkandari,* Min Chao,* Anne Chon,* Laura Johnson,* Ashley Katchky,* Sean Lee,* and Ricky Pan*

OBJECTIVE: This study investigated the demographics of age, gender, average wait time, and residence of patients with special needs who were treated in the outpatient surgical operating room for comprehensive dental rehabilitation under general anesthesia.

METHODS: Patients with special needs who were treated by the general practice residents from Tufts University School of Dental Medicine for comprehensive dental rehabilitation under general anesthesia were retrospectively evaluated. The samples were evenly gathered from two hospitals: Franciscan Hospital for Children and Lemuel Shattuck Hospital. Clinical and demographic data were collected from axiUm electronic dental records. The patient’s age, gender, distance of residence from operating room hospital, and type of procedure performed were compiled, tabulated, and then analyzed using statistical analysis software (SAS).

RESULTS: Research is currently in process. We anticipate our results to be significant for higher number of males vs. females, average age 35 years, wait time greater than nine months, and residents within 30 miles of hospitals. In addition, we anticipate significant results for higher number of operatives, extractions, and scaling and root planing procedures performed.

CONCLUSION: This retrospective study illustrates the need for more hospitals and dentists to treat and manage patients with special needs. These patients are an underserved population who are not always able to be treated in a traditional dental setting. The use of general anesthesia in operating rooms can greatly benefit this patient population and provide access to dental care.
OBJECTIVE: The purpose of the study was to assess the knowledge of pregnant women in oral health. An informational seminar session on oral health was used to determine how beneficial such training would be in improving pregnant women’s dental knowledge.

METHODS: A pre-post test design was used to evaluate the effectiveness of a seminar session given to pregnant women treated at Tufts Medical Center. Knowledge-based and belief-based questions were used to determine the level of knowledge of oral health.

RESULTS: Seventy-two subjects participated in oral health awareness sessions and completed the questionnaire. Fifty-two subjects responded to three stages, and 29 to all four stages. The mean age of participants was 30.38 (SD=5.05). Of the participants, 31.8% reported receiving information about dental care from their prenatal provider. Results show that for the knowledge-based question, the percentage of correct answers from the pretest was 94.4%, while the percentage of correct answers from the post-test (same day) was 98.6% and post-test (after fifteen months) was 93%. There was a statistically significant difference between the number of correct answers postcounseling versus any other pre- or post-test. The results suggest that pregnant women could benefit from oral health education.

CONCLUSION: Pregnancy affords a unique opportunity to educate women on the importance of oral health. Preliminary results showed that there may be potential benefit to an oral health educational session for pregnant women at Tufts Medical Center. Prenatal education should universally adopt an oral health component.

Research supported by DHHS-HRSA#D84HPP199555.
A Review of Dynamic Navigation Systems in Implant Dentistry

Thaisa Bordin,* Pooyan Refahi,* Nadeem Karimbux, and Irina Dragan

OBJECTIVE: The aim of this project is to review some of the systems available for dynamic navigated implant surgery.

METHODS: Several navigation tracking systems have been created to aid in the placement of dental implants. Although some of them have been available for many years, they have not gained widespread use among dental practitioners, mainly due to their high costs and poor design. More recently, the technology has improved and 3D imaging allows for real-time treatment planning and treatment. There are several companies that market the systems including DenX Image Guided Implantology System (Image Navigation, Jerusalem, Israel), X-Guide Dynamic 3D Navigation (X-Nav Technologies, Lansdale, Pennsylvania), Navident (ClaroNav, Toronto, Canada), and Inlant (Inlant Dental Technologies, Vancouver, Canada). As a part of the review of the literature and company brochures, the advantages, disadvantages, and commonalities of each system were compared.

RESULTS: These systems are empowered by a motion tracking technology, which tracks the positions of the dental drill and the position of the patient throughout the implant placement procedure. Each system has its own components, but they work on the same principle. The ideal implant position is planned digitally using cone-beam computed tomography in advance by the dental surgeon. Sensors attached to both the patient and the surgical handpiece transfer three-dimensional positional information to a camera or detector. This critical information allows the computer to instantaneously calculate and display the virtual position of the instruments, relative to the image data.

CONCLUSION: Computerized navigation implant surgery is a promising technology, although there is a necessity of more studies. Future research should focus on the accuracy of the systems and overcoming the current challenges. The use of this technology in dentistry may substantially contribute to an increase in the quality of the treatment rendered, similar to the medical field.
The Use of the iPad Mini as a Distraction Modality in Pediatric Dentistry

Yissell Carpentino-De Jesus,* Cheen Loo, Sarah Pagni, Alfred Rich, and Nour Gowharji

AIM: The aim of this randomized clinical control trial was to determine whether the use of the iPad Mini as a distraction modality for children has a potential influence on reducing their discomfort during placement of the rubber dam clamp on permanent first or second molars.

METHODS: Total number of 24 healthy children aged from 7 to 15 years were included. Thirteen children received an iPad Mini with wireless headphones to watch YouTube cartoons during the placement of the rubber dam clamp, while 11 children received the treatment without the iPad Mini and the headphones. During the treatment, one calibrated member observed the behavior of the child according to the Frankl Behavioral Scale. After treatment, each subject was asked to complete a portion of the Faces version of the MCDAS and Wong-Baker Scale.

RESULTS: A total number of 24 children participated in the study. The mean age of subjects at the treatment day was 11 (SD=2.65) years. Results of the Wong Baker Scale show no statistically significant difference between the case and control group (p=0.278). There was no significant difference in the Frankl Scale between the two groups (p=0.349).

CONCLUSION: The use of the iPad Mini as a distraction modality did not significantly reduce the discomfort during rubber dam clamp placement.

Research supported by DHHS-HRSA#D84HP19955
Dental Rehabilitation Programs in the Operating Room: Sustainable Practices for Success for Services for Adults with Special Needs

Susan DellaRipa,* Lia Mittelman,* Sanyukta Gandhi,* and Jeffrey Walawender*

Dental rehabilitation for adults with special needs in the operating room is a specialized service that requires manpower, effort, and funding for successful outcomes. This review will focus on current literature for information available on operating room programs for special needs compared with information from existing practices at Community Dental of Maine and the TUSDM AEGD Program.

OBJECTIVE: This retrospective chart review investigated the financial sustainability of providing dental services to patients with special needs in the operating room.

METHODS: Utilizing charts from the past year, cost effectiveness of operating with a fee for service versus a flat fee will be analyzed. The amount of production loss with scheduling, assistant time, procedure time, and costs to provide these services will also be determined and compared with costs of these factors when done in a clinical setting outside of the operating room.

RESULTS: Research is currently in progress, and we anticipate that the flat fee service provides more financial sustainability than the fee for service.

CONCLUSION: We anticipate that the flat fee will provide more financial sustainability of the program as the patients have received comprehensive dental treatment in the operating room throughout their lifetime. We anticipate the patients with special needs who are being seen routinely in the operating room will benefit from this dental treatment as there is no other provider in southern Maine that is able to provide this treatment for the population of adults with special needs in this setting.
Comparing AAPD Criteria of Treating Patients under General Anesthesia to Clinical Evaluation

Cheen Loo, Mary Ghattas,* Sarah Pagni, Monica Hanna, and Alfred Rich

PURPOSE: To investigate the referrals of children’s dental treatment for general anesthesia (GA) satisfaction of the AAPD guidelines.

METHODS: A retrospective study of 500 GA or sedation patients that were treated at Tufts Medical Center or Tufts University School of Dental Medicine from January 1, 2009, to December 31, 2014. Patients were scored based on the AAPD guidelines criteria, determining their need for GA. Patients were categorized into four groups based on their qualification to receive GA. All groups were compared to determine the accuracy of the clinical evaluation.

RESULTS: From the 250 patients that received GA, 83% qualified to receive GA, while 17% did not qualify to receive GA (p-value=0.001). The median age was 5 with 55% males and 44% females, and the mean DMFS score was 11. Male (p-value=0.03), uncooperative (p-value=0.001), and medically compromised patients (p-value=0.001) were significantly more likely to receive treatment under GA.

CONCLUSIONS: Most patients receiving treatment under GA had met the qualifications, suggesting that clinical evaluation satisfies the AAPD guidelines of referring patients to the OR.
Effect of Mucograft® Seal on Postextraction Ridge Preservation Using Bone Allograft: A Randomized Controlled Clinical Trial and Radiographic Evaluation

Zuhair Natto,* Andreas Paraschis, Bjorn Steffensen, Rumpa Ganguly, Matthew Finkelman, and Natalie Jeong

OBJECTIVES: The purpose of this prospective randomized parallel arm study was to compare clinically and radiographically the hard and soft tissue remodeling for four to five months following alveolar ridge preservation (ARP) in extraction sockets using two different membranes, Mucograft and collagen plug, in combination with bone grafting.

MATERIALS AND METHODS: Twenty-eight patients completed the research, 14 in the Mucograft group and 14 in the collagen plug group. The clinical and radiographic measurements for hard and soft tissues were performed with the same stent for standardization and recorded at two different times: before extraction and four to five months after healing. The flapless technique following atraumatic extraction was used for the two types of membranes.

RESULTS: A slight increase in the gingival thickness and a decrease in the width of keratinized tissue were observed following healing. There was more bone resorption in the buccal and crestal areas in the alveolar ridge in comparison to the palatal and apical areas. No statistically significant difference in the changes of hard and soft tissues were found between the two groups. There was a statistically significant correlation for changes in the crestal bone width and the gingival thickness following healing with the buccal plate thickness before extraction. No deleterious effect on the clinical parameters of the adjacent teeth to one extracted was observed following healing.

CONCLUSIONS: Both xenogeneic collagen membranes combined with bone allograft can maintain soft tissues as well as minimize alveolar bone resorption in all dimensions following extraction with minimal postoperative complications. The thickness of the buccal plate is an important factor that determines the amount of change in crestal gingival thickness and bone width following ARP.

Acellular Dermal Matrix Combined with Coronally Advanced Flap in the Treatment of Multiple Recession Defects in Thin vs. Thick Periodontal Biotype Population: A Controlled Clinical Investigation

Lucrezia Paterno Holtzman,* Bjorn Steffensen, Charles Hawley, Matthew Finkelman, and Wai Cheung

BACKGROUND AND AIM: Gingival recession is a common defect of the periodontal soft tissues, whose prevalence has been estimated between 50% and 70% of the population. Gingival recession is more common in individuals with thin biotype than those with thick biotype. While an autogenous connective tissue graft is the gold standard, acellular dermal matrix (ADM) is an acceptable alternative material in the treatment of such defect. The present study aims to investigate the impact of gingival biotypes on the healing of root coverage procedures performed with ADM.

MATERIALS AND METHODS: Twelve patients, 6 thick and 6 thin biotype, each with two recession defects were included. Thick biotype was defined as a GT>0.8 mm while GT<0.8 mm was considered a thin biotype. Coronally positioned flaps covering a piece of standardized sized ADM were used to cover roots. Clinical measurements including recession height (RH) and width (RW), gingival thickness (GT), keratinized tissue width (KTW), probing depth (PD), bleeding on probing (BOP), and clinical attachment level (CAL) were measured at baseline and at three months follow-up. A patient survey evaluating sensitivity, esthetics, and pain was collected at baseline and at one-week, three-week, and three-month follow-up visits. Descriptive analysis will be utilized.

RESULTS: Preliminary results will be presented.
FACULTY ABSTRACTS

Note: Names marked with an asterisk denote presenter of paper.

BEHAVIORAL, EPIDEMIOLOGIC, AND HEALTH SERVICES RESEARCH

Time since Quitting Smoking Reduces Odds of Periodontitis: NHANES 2012

Shatha Alharthi,* Jennifer Bassett Midle, Robert Gyurko, Rory O’Neil, and Bjorn Steffensen

OBJECTIVES: Research has shown that United States surveillance rates of periodontitis have been underestimated, that smoking tobacco is a strong risk factor for periodontitis, and that quitting smoking appears to improve the prognosis in periodontal patients. The association between time since quitting smoking and the odds of periodontitis in former smokers has not been researched using the 2012 National Health and Nutrition Examination Survey (NHANES) dataset. The objectives of this investigation were to use the NHANES to test and confirm the following hypotheses: 1) that smoking status is positively associated with rates of periodontitis, and 2) that time since quitting smoking is negatively associated with the odds of periodontitis in former smokers.

METHODS: This study analyzed data collected in the NHANES 2012 survey and included respondents for whom a periodontal exam and smoking status were obtained. First, a descriptive analysis (including chi-squared analysis) was used to characterize the sample. Next, among former smokers in the sample, unconditional logistic regression was conducted with time since quitting as the exposure and presence of periodontitis as the outcome, including adjustment for confounders.

RESULTS: Rates of periodontitis were highest in current smokers, lower in former smokers, and lowest in never smokers. Smoking status was statistically significantly associated with periodontal status (p<0.0001). Among former smokers, a longer time since quitting was associated with lower likelihood of periodontitis. After adjusting for confounders, each additional year since quitting smoking was associated with a statistically significant reduction in the odds ratio (OR) for periodontitis by 2.5%.

CONCLUSIONS: These findings support the idea that dental practitioners have a public health mandate to help their periodontal patients quit smoking. Future research should determine the best strategies for facilitating smoking cessation in dental patients.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #0820.

A Prospective Study Investigating Prediagnostic Leukocyte Telomere Length and Risk of Developing Rheumatoid Arthritis in Women

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1Brigham and Women’s Hospital and Harvard Medical School; 2Harvard TH Chan School of Public Health; 3Tufts University School of Dental Medicine

OBJECTIVE: To prospectively examine the association between leukocyte telomere length (LTL) and subsequent rheumatoid arthritis (RA) development in women.
METHODS: Using a case-control design nested within the prospective Nurses' Health Study (NHS), NHS II (NHSII), and Women's Health Study (WHS), each validated case of RA with a prediagnostic blood sample was matched to three controls by cohort, age, menopausal status, postmenopausal hormone therapy, and blood collection covariates. We measured telomere length in genomic DNA extracted from stored buffy coat samples using quantitative PCR. We used unconditional logistic regression to determine OR and 95% CI, and random-effects meta-analysis to combine study results.

RESULTS: In total, we analyzed 296 incident RA cases and 827 matched controls. Mean age of diagnosis among women who developed RA was 60.5 in NHS/NHSII and 61.3 in WHS. Meta-analysis demonstrated that longer prediagnostic LTL was associated with increased RA risk when women in the longest vs. shortest LTL tertile were compared (OR 1.51, 95% CI 1.03–2.23, Pheterogeneity=0.27). However, statistically significant between-study heterogeneity was observed for the intermediate tertile category (Pheterogeneity=0.008). We did not observe heterogeneity by menopausal status, inflammatory cytokine levels, age at diagnosis, age at blood collection, body mass index, seropositivity, or HLA-DRβ1 shared epitope status.

CONCLUSION: Our results do not support an involvement for short LTL preceding RA development.


Ribosomopathies: Global Process, Tissue-Specific Defects

Pamela Yelick\(^1\) and Paul Trainor\(^2,3\)

\(^1\)Tufts University School of Dental Medicine, Boston; \(^2\)Stowers Institute, Kansas City, Missouri; \(^3\)University of Kansas Medical Center, Kansas City, Kansas

ABSTRACT: Disruptions in ribosomal biogenesis would be expected to have global and in fact lethal effects on a developing organism. However, mutations in ribosomal protein genes have been shown to exhibit tissue-specific defects. This seemingly contradictory finding—that globally expressed genes thought to play fundamental housekeeping functions can in fact exhibit tissue- and cell-type–specific functions—provides new insight into roles for ribosomes, the protein translational machinery of the cell, in regulating normal development and disease. Furthermore, it illustrates the surprisingly dynamic nature of processes regulating cell-type–specific protein translation. In this review, we discuss our current knowledge of a variety of ribosomal protein mutations associated with human disease and models to better understand the molecular mechanisms associated with each. We use specific examples to emphasize both the similarities and differences between the effects of various human ribosomal protein mutations. Finally, we discuss areas of future study that are needed to further our understanding of the role of ribosome biogenesis in normal development and possible approaches that can be used to treat debilitating ribosomopathy diseases.

CRANIOFACIAL BIOLOGY

Bioelectric Signaling via Potassium Channels: A Mechanism for Craniofacial Dysmorphogenesis in KCNJ2-Associated Andersen-Tawil Syndrome

Dany Spencer Adams,1 Sebastien Uzel,2 Jin Akagi,3 Donald Wlodkowic,3 Viktoria Andreeva,4 Pamela Yelick,4 Adrian Devitt-Lee,1 Jean-Francois Pare,1 and Michael Levin1

1Tufts University, Medford, Massachusetts; 2Massachusetts Institute of Technology, Cambridge, Massachusetts; 3RMIT University, Melbourne, Australia; 4Tufts University School of Dental Medicine, Boston

ABSTRACT: Variants in potassium channel KCNJ2 cause Andersen-Tawil syndrome (ATS); however, the induced craniofacial anomalies (CFAs) are entirely unexplained. We show that KCNJ2 is expressed in Xenopus and mice during the earliest stages of craniofacial development. Misexpression in Xenopus of KCNJ2 carrying ATS-associated mutations causes CFAs in the same structures affected in humans; it changes the normal pattern of membrane voltage potential regionalization in the developing face and disrupts expression of important craniofacial patterning genes, revealing the endogenous control of craniofacial patterning by bioelectric cell states. By altering cells’ resting potentials using other ion translocators, we show that a change in ectodermal voltage not tied to a specific protein or ion is sufficient to cause CFAs. By adapting optogenetics for use in non-neural cells in embryos, we show that developmentally patterned K+ flux is required for correct regionalization of the resting potentials and for establishment of endogenous early gene expression domains in the anterior ectoderm, and that variants in KCNJ2 disrupt this regionalization, leading to the CFAs seen in ATS patients.


The Contributions of the Ribosome Biogenesis Protein Utp5/WDR43 to Craniofacial Development

Samuel Sondalle,1 Susan Baserga,1 and Pamela Yelick2

1Yale University School of Medicine, New Haven, Connecticut; 2Tufts University School of Dental Medicine, Boston

ABSTRACT: Fairly recently, it was recognized that human ribosomopathies-developmental defects caused by mutations in ribosome biogenesis proteins can exhibit tissue-specific defects rather than the expected global defects. This apparent anomaly—that seemingly ubiquitously expressed and required ribosomal proteins can have distinct functions in cell and tissue differentiation—has spurred new areas of research focused on better understanding translational mechanisms, biogenesis, and function in diverse cell types. This renewed appreciation for, and need to better understand, roles for ribosomal proteins in human development and disease has identified surprising similarities and differences in a variety of human ribosomopathies. Here, we discuss ribosomal protein functions in health and disease, focusing on the ribosome biogenesis protein Utp5/WDR43. New and exciting research in this field is anticipated to provide insight into a variety of previously understudied craniofacial dysostoses and result in significantly improved knowledge and understanding of roles for translational machinery in human craniofacial development and disease.

Zebrafish as a Model for Human Ciliopathies

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1Ocean University of China, Qingdao, China; 2Tufts University School of Dental Medicine, Boston; 3National Laboratory for Marine Science and Technology, Qingdao, China

ABSTRACT: Cilia, microtubule-based structures found on the surface of almost all vertebrate cells, play an array of diverse biological functions. Abnormal ciliary axonemal structure and function can result in a class of genetic disorders that are collectively termed ciliopathies. Model organisms, including Chlamydomonas reinhardtii and Caenorhabditis elegans have been widely used to study the complex genetic basis of ciliopathies. Here, we review the advantages of the zebrafish as a vertebrate model for human ciliopathies. We summarize the features of zebrafish cilia and the major findings and contributions of the zebrafish model in recent studies of human ciliopathies. We also discuss the new genome editing approaches being efficiently used in zebrafish and the exciting prospects of these approaches in modeling human ciliopathies.

DENTAL MATERIALS

CERASMART Composite Crowns and IPS Empress Ceramic Crowns: Fracture Strength

Nasreen Albar,* Vasiliki Tsakalelli, Marcelo Suzuki, Matthew Finkelman, Najla Chebib, and Ala Ali

OBJECTIVES: To compare the fracture strength of ceramic crowns [IPS Empress® CAD (IPS), Ivoclar Vivadent] with that of composite crowns [CERASMART™ (CE), GC America] milled with CEREC III (Sirona Dental).

METHODS: Forty molars of similar shape and size were prepared. Twenty ceramic crowns and twenty composite crowns were cemented utilizing Rely-X™ Ultimate resin cement (3M). Both groups were subjected to 5,000 cycles of thermocycling (5°–55°) followed by compressive loading to catastrophic fracture. A nonparametric significance testing (Mann-Whitney U test) was conducted to assess the difference in fracture strength between the two materials. The difference in mode of fracture between the two materials was assessed via the chi-squared test. The association between fracture strength and cement space was evaluated via the Spearman correlation, with a separate analysis conducted for each material.

RESULTS: IPS had a median (IQR) fracture strength of 5.96 (2.73) MPa. CE had a median (IQR) fracture strength of 12.64 (3.32) MPa. A statistically significant difference was found between the two groups (p<0.001). No significant correlation was found between cement space and fracture strength except for the mesial cervical line for IPS and the distal marginal ridge for CE. The study showed a 55% adhesive fracture rate for CE, a 45% adhesive fracture rate for IPS, a 45% mixed fracture rate for CE, and a 55% mixed fracture rate for IPS. The difference was not significant (p=0.527). No cohesive fractures were reported.

CONCLUSIONS: Within the limits of the present study, the performance of CE relative to that of IPS was higher as the CE demonstrated higher fracture strength than IPS.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #0604.

Two-Month Randomized Trial of Combination In-Office and At-Home Oxalate Treatments

Chad Anderson,1,2 Gerard Kugel,2 Marco Ferrari,3 Paul Sagel,4 and Robert Gerlach4
1Anderson Dental, Fresno, California; 2Tufts University School of Dental Medicine, Boston; 3University of Siena, Siena, Italy; 4The Proctor & Gamble Co., Mason, Ohio

OBJECTIVES: A randomized clinical trial was conducted to evaluate combination oxalate treatments (in-office and at-home) on dentinal hypersensitivity, and to compare possible oral hygiene impact on durable response.

METHODS: After IRB review and consent, adult volunteers with dentinal hypersensitivity were recruited within a dental practice for a two-visit, 60-day study. At baseline, sensitivity was stimulated with a one-second application of cool air from a dental air syringe and measured clinically using a standard four-point scale (Schiff) and subjectively using a tablet-based, 100-point, pain-ranking scale (VAS). Test sites were treated with professional application of an oxalate acid potassium salt solution (Super Seal® Dental Desensitizing Liner, Phoenix Dental), after which immediate sensitivity response was retested. Subjects were dispensed blinded at-home test kits containing six 1.5% oxalate gel strips (Crest® Sensi-Stop™ Strips, The Procter & Gamble Co.),
a regular manual brush, and one of two randomly assigned pastes (either 0.454% SnF₂ or 0.243% NaF) for unsupervised at-home use through the two-month recall visit.

**RESULTS:** The population consisted of 30 subjects (93% female) ranging from 19 to 66 years of age, 97% of whom completed the two-month study. The population exhibited appreciable baseline sensitivity with overall means (SD) of 2.7 (0.47) for Schiff air and 65.3 (13.8) for VAS air. In-office oxalate treatment yielded significant (p<0.004) reductions in clinical and subjective endpoints. After two months, clinical sensitivity decreased by 57% to 58% relative to baseline (p<0.0001), while VAS decreased by 37 to 46% (p<0.004). Hygiene did not significantly impact durable sensitivity response (p>0.43). One subject reported mild pain and irritation after baseline treatment, and there were no additional adverse events during the unsupervised oxalate strip-oral hygiene phase.

**CONCLUSIONS:** In practice-based research, the combination of in-office and at-home oxalate use yielded significant 37–57% reductions in dentinal hypersensitivity with two concurrent oral hygiene approaches.

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #1841.*

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**Microleakage and Voids of Bulk-Fill Restorations Using Various Composite Systems**

*Christopher Beninati,* William Brown, Gerard Kugel, and Ronald Perry

**OBJECTIVE:** To compare the microleakage and internal voids of SonicFill2™ (Kerr) SF to other commercially available bulk-fill composites.

**METHODS:** Twenty human molars were cleaned and stored in a solution of 4% Chloramin T at 455°C. Forty class II preparations were made with diamond burs, using the mesial and distal of each tooth. The preparations were: 4 mm bucco-lingually, 5 mm mesio-distally with a depth of 4 mm. The proximal box was placed 0.5 mm below the CEJ. The preparations were randomized into four groups (N=10) and restored as follows: group CX, Xeno IV™ with SureFil™ and CeramX™ (DENTSPLY); group BB, Optibond XTR™ (Kerr) with Beautifil Bulk™ (Shofu); group SF, Optibond XTR with SonicFill2™ (Kerr); and group HU, Optibond XTR™ with Herculite Ultra™ (Kerr) and completed according to manufacturer’s instructions. After thermocycling between 5 and 55°C for 1,000 cycles with a 30-second dwell time, the samples were painted with two layers of nail polish, except for 1 mm around the margins. The specimens were immersed for 24 hours in 5% fuchsine dye. Teeth were sectioned with a diamond saw and the microleakage was evaluated under a 40X microscope (Leica GZ6), and internal voids of the restorations were noted for each specimen using subjective scales. Results were analyzed via generalized estimating equations using SAS 9.4 statistical software.

**RESULTS:** Tables 1–3 present results for cervical, occlusal, and void, respectively, by restorative material. The difference between restorative materials was not significant for cervical (p=0.427) or void (p=0.306); significance was found for occlusal (p=0.018). Post-hoc tests showed that SF exhibited significantly less microleakage than CX and HU.
Table 1. Cross-tabulation between restorative material and observed microleakage (cervical).

<table>
<thead>
<tr>
<th>Restorative Material</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CX</td>
<td>N 14</td>
<td>11</td>
<td>4</td>
<td>11</td>
<td>0.427</td>
</tr>
<tr>
<td>% 35.0%</td>
<td></td>
<td>27.5%</td>
<td>10.0%</td>
<td>27.5%</td>
<td></td>
</tr>
<tr>
<td>BB</td>
<td>N 21</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>% 52.5%</td>
<td></td>
<td>20.0%</td>
<td>15.0%</td>
<td>12.5%</td>
<td></td>
</tr>
<tr>
<td>SF</td>
<td>N 16</td>
<td>14</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>% 40.0%</td>
<td></td>
<td>35.0%</td>
<td>22.5%</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>HU</td>
<td>N 14</td>
<td>10</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>% 35.0%</td>
<td></td>
<td>25.0%</td>
<td>20.0%</td>
<td>20.0%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Cross-tabulation between restorative material and observed microleakage (occlusal).

<table>
<thead>
<tr>
<th>Restorative Material</th>
<th>Score 0</th>
<th>Score 1</th>
<th>Score 2</th>
<th>Score 3</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CX</td>
<td>N 7</td>
<td>6</td>
<td>17</td>
<td>10</td>
<td>0.018</td>
</tr>
<tr>
<td>% 17.5%</td>
<td></td>
<td>15.0%</td>
<td>42.5%</td>
<td>25.0%</td>
<td></td>
</tr>
<tr>
<td>BB</td>
<td>N 9</td>
<td>11</td>
<td>16</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>% 22.5%</td>
<td></td>
<td>27.5%</td>
<td>40.0%</td>
<td>10.0%</td>
<td></td>
</tr>
<tr>
<td>SF</td>
<td>N 18</td>
<td>15</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>% 45.0%</td>
<td></td>
<td>37.5%</td>
<td>12.5%</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>HU</td>
<td>N 13</td>
<td>11</td>
<td>12</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>% 32.5%</td>
<td></td>
<td>27.5%</td>
<td>30.0%</td>
<td>10.0%</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Cross-tabulation between restorative material and the presence of voids.

<table>
<thead>
<tr>
<th>Restorative Material</th>
<th>No Voids</th>
<th>Voids</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CX</td>
<td>N 32</td>
<td>8</td>
<td>0.306</td>
</tr>
<tr>
<td>% 80.0%</td>
<td></td>
<td>20.0%</td>
<td></td>
</tr>
<tr>
<td>BB</td>
<td>N 33</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>% 82.5%</td>
<td></td>
<td>17.5%</td>
<td></td>
</tr>
<tr>
<td>SF</td>
<td>N 37</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>% 92.5%</td>
<td></td>
<td>7.5%</td>
<td></td>
</tr>
<tr>
<td>HU</td>
<td>N 37</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>% 92.5%</td>
<td></td>
<td>7.5%</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSIONS: While there were no statistically significant differences on voids amongst the tested products, SF exhibited significantly less microleakage, while CX had the highest microleakage and void formation. Clinicians can use this knowledge on the materials tested and apply it to their practice when working on patients.

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #1854.*
Resin Composite Repair for Implant-Supported Crowns

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1University of São Paulo, Bauru College of Dentistry, Bauru, São Paulo; 2Tufts University School of Dental Medicine, Boston; 3New York University College of Dentistry, New York; 4New York University Abu Dhabi, Abu Dhabi, United Arab Emirates

ABSTRACT: This study evaluated the reliability of implant-supported crowns repaired with resin composites. Fifty-four titanium abutments were divided in three groups (N=18) to support resin nanoceramic molar crowns, as follows: Lava Ultimate (LU), 3M ESPE; LU repaired with either a direct or an indirect resin composite.

Samples were subjected to mouth-motion, accelerated-life testing in water (N=18). Cumulative damage with a use stress of 300 N was used to plot Weibull curves for group comparison. Reliability was calculated for a mission of 100,000 cycles at 400 N load. Beta values were 0.83 for LU, and 0.31 and 0.27 for LU repaired with Filtek and Ceramage, respectively. Weibull modulus for LU was 9.5 and η=1047 N, m=6.85, and η=1,002 N for LU repaired with Ceramage, and m=4.65 and η=766 N for LU repaired with Filtek (p<0.10 between LU and LU repaired with Filtek). Reliability at 400 N was 100% for both LU and LU repaired with Ceramage, which were significantly higher than LU Filtek repair (32%). LU restored crowns failed cohesively. Fractures were confined within the restored material and detailed fractography is presented. The performance of resin nanoceramic material repaired with an indirect composite was maintained after accelerated-life testing compared to unrepaired controls.


New Ti-Alloys and Surface Modifications to Improve the Mechanical Properties and the Biological Response to Orthopedic and Dental Implants: A Review

Yvoni Kirmanidou,1 Margarita Sidira,1 Maria-Eleni Drosou,1 Vincent Bennani,2 Athina Bakopoulou,1 Alexander Tsouknidas,1 Nikolaos Michailidis,1 and Konstantinos Michalakis1,3
1Aristotle University of Thessaloniki, Thessaloniki, Greece; 2University of Otago, School of Dentistry, Dunedin, New Zealand; 3Tufts University School of Dental Medicine, Boston

ABSTRACT: Titanium implants have been widely used in the orthopedic and dentistry fields for many decades, for joint arthroplasties, spinal and maxillofacial reconstructions, and dental prostheses. However, despite the quite satisfactory survival rates, failures still exist. New Ti-alloys and surface treatments have been developed, in an attempt to overcome those failures. This review provides information about new Ti-alloys that provide better mechanical properties to the implants, such as superelasticity, mechanical strength, and corrosion resistance. Furthermore, in vitro and in vivo studies, which investigate the biocompatibility and cytotoxicity of these new biomaterials, are introduced. In addition, data regarding the bioactivity of new surface treatments and surface topographies on Ti-implants is provided. The aim of this paper is to discuss the current trends, advantages, and disadvantages of new titanium-based biomaterials, fabricated to enhance the quality of life of many patients around the world.

**In Vitro Adhesive Bond Strength of Cements Using iBOND® Universal**

**Christina Penn, * Jonathan Bishop, Zuhair Natto, Gerard Kugel, and Ronald Perry**

**OBJECTIVE:** Bonding techniques are crucial in the retention of fixed restorations. This study compared shear bond strengths (SBS) of four adhesive cements using iBOND® Universal bonding agent (IBU) HeraeusKulzer and two self-adhesive cements. The four adhesive cements tested, using IBU as a bonding agent, were Clearfil™ Esthetic Cement (CEC) Kuraray, NX3 Nexus® (NX) Kerr, Panavia™ F 2.0 (PF) Kuraray, and BiFix® QM (BF) VOCO resin cements. Two self-adhesive cements, SpeedCEM™ (SC) Ivoclar Vivadent and RelyX™ Unicem (RX) 3M were tested for comparison.

**METHODS:** Bovine incisors were halved and embedded in a resin for easier handling. The dentin surface was prepared by grinding the teeth under running water with silicon carbide abrasive paper, first with P120 grit and then with P320 grit. IBU was applied according to instructions for use and light cured, using a Translux Wave (Heraeus Kulzer) curing light, for 10 seconds. The specimens were inserted into a bonding jig (Ultradent Products, Inc., South Jordan, Utah) and the resin cement material was applied into the mold (2.39 mm diameter, 3 mm height) according to manufacturer instructions. The specimens were stored at 37°C for 1 h before demolding, and afterwards stored in water at 37°C. SBS was tested after 24 h or after additional thermocycling to simulate aging (5,000 cycles between 5°C–55°C with 10 s dwell time). The results were analysed using one-way ANOVA statistical analysis.

**RESULTS:** See Table 1.

<table>
<thead>
<tr>
<th></th>
<th>After 24 hours</th>
<th>After thermocycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEC</td>
<td>17.70 (8.3)</td>
<td>19.13 (6.9)</td>
</tr>
<tr>
<td>NX</td>
<td>27.49 (4.4)</td>
<td>20.50 (7.8)</td>
</tr>
<tr>
<td>PF</td>
<td>18.98 (4.4)</td>
<td>20.30 (8.2)</td>
</tr>
<tr>
<td>BF</td>
<td>13.46 (3.2)</td>
<td>24.38 (13.1)</td>
</tr>
<tr>
<td>RX</td>
<td>4.70 (2.6)</td>
<td>7.79 (6.8)</td>
</tr>
<tr>
<td>SC</td>
<td>13.28 (3.2)</td>
<td>11.50 (4.4)</td>
</tr>
</tbody>
</table>

SBS series (N=8 bovine teeth ground to dentin were used)

**CONCLUSIONS:** Data analysis showed that there was statistical significance between the SBS of the cements. After being stored in water at 37°C for 24 hours, the mean SBS of NX bonded with IBU was highest. RX self-adhesive resin cement had the lowest mean SBS. After thermocycling, BF bonded with IBU had the highest mean SBS.

*Study funded in part by Heraeus Kulzer.*

*Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #1071.*
Diagnostic Sciences

Diagnostic Sciences

Salivary PRP3 as a Diagnostic Biomarker for Sjögren’s Syndrome
Sama Abdul-Aziz, Arwa Farag, Noe Duenas, Britta Magnuson, Elizabeth Tzavaras, Athena Papas, Wanlu Qu, Markus Hardt, and Driss Zoukhri

OBJECTIVES: Although Sjögren’s syndrome (SjS) is among the significantly morbid autoimmune disorders, confirming the diagnosis remains difficult to achieve due to the lack of definitive diagnostic methods. Development of a protein biomarker profile would allow for a highly sensitive and specific diagnostic method to prevent disease progression and ensure proper treatment. The purpose of this study was to determine whether salivary proline rich protein 3 (PRP3) could be used as a biomarker for SjS diagnosis.

METHODS: Twenty-four SjS patients and 18 age-matched healthy controls were recruited. Unstimulated, stimulated whole saliva and submandibular/sublingual glands saliva were collected. One hundred mg of 10 SjS and 10 healthy samples were digested using trypsin for proteomics analysis on a nano LC-MS/MS. Protein identification was performed using Proteome Discoverer with Mascot and Sequest HT algorithms against Swiss-Prot Human protein database. Label-free quantitative analysis was performed using Sieve 2.2 software. Ten mg of 13 SjS and 18 healthy samples were separated by SDS-PAGE followed by transfer to PVDF membranes for Western blotting using an anti-PRP3 antibody. Immunoreactive bands were visualized and quantified using the Odyssey® Infrared Imaging System.

RESULTS: Unstimulated and stimulated salivary flow rates were significantly reduced in SjS compared to control subjects. In the proteomics results, PRP3 protein was identified in all the samples from SjS patients, while in eight of 10 healthy samples. The PRP3 protein sequence was GRPQGPPQGQGHPPPPGKPQGPPQGGRPQGPPQGQSPQ (26.51% sequence coverage). Quantification of the Western blots showed an average 46.8% increase in PRP3 protein amount in SjS when compared to control subjects.

CONCLUSIONS: Though PRP3 was found as a constituent of healthy and SjS patients’ saliva, PRP3 was overexpressed in SjS patients. Thus, PRP3 can be included in the development of a protein biomarker profile to be used as a noninvasive method of SjS diagnosis.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #1599.

The Accuracy of Linear Measurements of Maxillary and Mandibular Edentulous Sites in Cone-Beam Computed Tomography Images with Different Fields of View and Voxel Sizes under Simulated Clinical Conditions
Rumpa Ganguly, Aruna Ramesh, and Sarah Pagni

PURPOSE: The objective of this study was to investigate the effect of varying resolutions of cone-beam computed tomography images on the accuracy of linear measurements of edentulous areas in human cadaver heads. Intact cadaver heads were used to simulate a clinical situation.

MATERIALS AND METHODS: Fiduciary markers were placed in the edentulous areas of four intact embalmed cadaver heads. The heads were scanned with two different CBCT units using a large field of view
(13 cm × 16 cm) and small field of view (5 cm × 8 cm) at varying voxel sizes (0.3 mm, 0.2 mm, and 0.16 mm). The ground truth was established with digital caliper measurements. The imaging measurements were then compared with caliper measurements to determine accuracy.

RESULTS: The Wilcoxon signed rank test revealed no statistically significant difference between the medians of the physical measurements obtained with calipers and the medians of the CBCT measurements. A comparison of accuracy among the different imaging protocols revealed no significant differences as determined by the Friedman test. The intraclass correlation coefficient was 0.961, indicating excellent reproducibility. Interobserver variability was determined graphically with a Bland-Altman plot and by calculating the intraclass correlation coefficient. The Bland-Altman plot indicated very good reproducibility for smaller measurements, but larger discrepancies with larger measurements.

CONCLUSION: The CBCT-based linear measurements in the edentulous sites using different voxel sizes and FOVs are accurate compared with the direct caliper measurements of these sites. Higher resolution CBCT images with smaller voxel size did not result in greater accuracy of the linear measurements.

EDUCATION

Relationship among Dental Students’ Class Lecture Attendance, Use of Online Resources, and Performance

Ehab Azab, Yun Saksena, Tofool Alghanem, Jennifer Bassett Midle, Kathleen Molgaard, Susan Albright, and Nadeem Karimbux

ABSTRACT: This study aimed to evaluate the relationship among dental students’ attendance at class lectures, use of online lecture materials, and performance in didactic courses. The study was conducted with second-year predoctoral students at Tufts University School of Dental Medicine during the fall semester of 2014. Three basic science and three preclinical dental courses were selected for evaluation. Online usage for each participant was collected, and a survey with questions about attendance and online behavior was conducted. The final grade for each participant in each selected course was obtained and matched with his or her online usage and attendance. Out of a total 190 students, 146 (77%) participated. The results showed no significant relationship between students’ grades and their class attendance or online usage, except for a weak negative relationship between class attendance and online usage for the epidemiology course (p<0.001) and the overall preclinical dental courses (p=0.03). Although the results did not show strong relationships among class attendance, online usage, and course grades, most of the students reported that having the online resources in addition to the lectures was helpful.


Using a Simulated Info Button Linked to an Evidence-Based Resource to Research Drug-Drug Interactions: A Pilot Study with Third-Year Dental Students

Irina Dragan,1 Michael Newman,2 Paul Stark,1 Bjorn Steffensen,1 and Nadeem Karimbux1
1Tufts University School of Dental Medicine, Boston; 2University of California, Los Angeles School of Dentistry, Los Angeles

OBJECTIVES: Many health professions students and clinicians are using evidence-based databases that allow for quicker and more accurate clinical decisions. The aims of this pilot study were to compare third-year dental students’ speed and accuracy in researching questions about drug-drug interactions (DDI) when using two different methods: a simulated info button linked to the evidence-based clinical decision support resource UpToDate vs. traditional internet resources accessed through a computer or smart device.

METHODS: Students researched two simulated cases during two sessions. In the first session, half the students used the info button, while the other half used traditional electronic tools only. In the second session, 10 days later, a crossover took place. The sessions were timed and, after researching the case, students answered three questions on the use of antibiotics, analgesics, and local anesthetics. Of the 50 students who volunteered for the study, two were excluded, and 44 participated in both sessions and the exam.

RESULTS: The results showed that the students took a similar amount of time to identify DDI whether they used the info button (mean=286.5 seconds) or traditional tools (265.2 seconds); the difference was not statistically significant (p=0.429). Their scores using the two research methods were similar in all three content areas: antibiotics (p=0.797), analgesics (p=0.850), and local anesthetics (p=0.850). In a postintervention survey,
students were generally favorable about the info button and UpToDate, reporting the tool was easy to use (62.5%), provided the answer they were looking for (53.1%), and was fast (50%), and they would use it again (68.8%).

CONCLUSIONS: This pilot study found that the time and accuracy of these students conducting DDI research with the info button and UpToDate were about the same as using traditional internet resources.


Integration of Basic-Clinical Sciences, PBL, CBL, and IPE in U.S. Dental Schools’ Curricula and a Proposed Integrated Curriculum Model for the Future

Satheesh Elangovan,1 Shankar Venugopalan,2 Sreedevi Srinivasan,1 Nadeem Karimbux,3 Paula Weistroffer,1 and Veerasathpurush Allareddy1

1University of Iowa College of Dentistry and Dental Clinics, Iowa City, Iowa; 2University of Missouri-Kansas City School of Dentistry, Kansas City, Missouri; 3Tufts University School of Dental Medicine, Boston

ABSTRACT: The integration of basic and clinical sciences in dental curricula enhances the application of basic science principles to clinical decision making and improves students’ critical thinking. The aim of this study was to define the characteristics of U.S. dental schools’ curricula with regard to level of course integration and degree of incorporation of problem-based learning (PBL) and case-based learning (CBL). A second aim was to propose a dental curriculum that supports effective integration of courses and addresses some of the concerns facing academic dentistry. A survey was sent to 58 academic deans in U.S. dental schools. The survey included questions about integrating courses in the schools’ curricula and major changes in curricular structure or teaching pedagogy that respondents anticipated in the immediate future. A total of 31 schools responded to the survey, for a 53.4% response rate. The results showed that three-quarters of the responding schools still teach basic and clinical sciences separately, although 61.3% reported having an integrated curriculum. Among the responding schools, 16 had a PBL component integrated into their curricula (two had integrated PBL in all courses and 14 used a hybrid PBL approach). Two schools had CBL integrated in all courses, and 10 had CBL integrated in >75% of courses. Only slightly more than half agreed that their curricula foster students’ thinking “outside the box.” Faculty shortages and lack of protected time and resources were the most frequent reasons given for a lack of integrated courses. The integrated model proposed in this article has the potential to provide a low-stress environment for students and to address important issues like faculty shortages.


Existing Resources Available to LGBTQIA Students in the 135 Allopathic and 31 Osteopathic Accredited Medical Schools in the United States

Emily Geldwert,1 Rosa Drummond,1 Nicholas Spanos,1 and Amit Sachdeo2

1Tufts University School of Medicine, Boston, 2Tufts University School of Dental Medicine, Boston

OBJECTIVES: Many institutions in the United States have student organizations structured around personal and professional interests, as well as ethnic and cultural backgrounds. Medical schools are no exception; however, there is limited recognition for the lesbian, gay, bisexual, transgender, queer, intersex, and allied
(LGBTQIA) community. Medical students conceal their identities for fear of discrimination and lack of support, but it is hypothesized that medical institutions can create a more accepting environment for LGBTQIA students through nondiscrimination policies and social support groups within schools. The purpose of this study was to determine the presence or absence of an LGBTQIA student organization and a nondiscrimination policy that included sexual orientation and/or gender expression/identity at medical schools and their affiliated universities.

METHODS: The websites of all accredited allopathic and osteopathic medical schools were reviewed for indications of a LGBTQIA student organization and nondiscrimination policies that included the criteria. When websites did not provide the desired information, phone calls were made to the medical schools’ admissions, student affairs, and/or multicultural affairs offices. For medical schools that did not have a student group and/or a nondiscrimination policy, the affiliated university’s website was reviewed. We also recorded medical school institutional data including geographical region, religious affiliation, incoming class and total school size, and accreditation status. Schools that were not fully accredited (provisional or preliminary) were excluded from the data set. Descriptive statistics were calculated. The percentage of schools that have a given resource have been disaggregated by institution type (private vs. public; DO vs. MD), and size of school (total number of current students). The “size of school” variable will be dichotomized into “schools below the median number of students” and “schools at or above the median number of students” for the disaggregated analysis. STATA 14.0 was used.

RESULTS: Presence or absence of LGBTQIA student organizations was recorded for each medical school, and out of 166 schools, 70% (121 of 166) had medical school specific student groups. Out of the schools that did not have medical groups, 57% (17 of 30) had groups at the university level. Of the allopathic medical schools, 78% (105 of 135) had medical student groups, as did 55% of osteopathic schools (17 of 31). There was relatively strong evidence of an observable difference between the school type (p=0.023). It was found that 83% of medical schools (138 of 166) protected students based on “sexual orientation” and/or “gender expression/identity” through non-discrimination policies. It was necessary to call 21% of medical schools (35 of 166) to ask about student groups, an indicator of ease-of-access.

CONCLUSIONS: While most medical schools (70%) do have LGBTQIA student organizations, it was difficult to assess the level of activity of the group and support from the administration. It was often challenging to get in contact with a school administrator who readily knew about student organizations. The inaccessibility of this information makes it difficult for prospective medical students to assess the level of acceptance of LGBTQIA individuals at medical schools. This study provides baseline knowledge regarding support for LGBTQIA medical students that does not presently exist. We suggest that this information be incorporated into future publications (the Medical School Admission Requirements and the Osteopathic Medical College Information Book) that include medical school demographics.


OSCE and Case Presentations as Active Assessments of Dental Student Performance

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ABSTRACT: The aim of this study was to evaluate whether the objective structured clinical examination
(OSCE) and case presentation (CP) as forms of active assessment were effective measures of overall didactic knowledge and clinical performance in a predoctoral dental curriculum. This evaluation was conducted by statistical analysis of quality points (QP) awarded for didactic and clinical performance, CP grades, and OSCE scores for 185 students at Harvard School of Dental Medicine who graduated during the period 2010–2014. As part of the requirements for graduation, each student takes three OSCEs and presents two patient cases. Data for the study were obtained from the Office of the Registrar. The results showed no direct correlation between QP and CP grades and no correlation between CP grades and OSCE scores. However, there was a correlation between OSCE scores and QP. Students with honors-level scores on any of the three OSCEs received significantly more QP than students who did not receive honors. In addition, students with passing scores on OSCEs 2 and 3 received significantly more QP than students with failing or marginal OSCE scores. Innovative formats of active assessment such as OSCEs and CPs can promote a student-centered learning environment. These data indicated that, within this study population, there was a positive association between OSCE scores and clinical and didactic performance, supporting the value of OSCEs as a means of assessment.


How Building Customer Service Skills Now Will Pay You Dividends

Amit Sachdeo

Customer service has become an integral part of our everyday lives. From grocery shopping to planning a vacation, most of us expect top-notch service. We don't hesitate going elsewhere if we are not getting our money's worth. Dental patients are no exception and almost immediately know if they are comfortable with the dentist's chair-side manner. This paper outlines the importance of having good customer service skills not only as a dental student, but also as a faculty/staff member and a practicing dental professional.

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Existing Resources Available to LGBT Students in the 65 Dental Schools in the United States

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Most institutions in the United States have various student organizations that are structured around things like ethnic origin and professional interest. Dental schools are no exception to this, and many boast a number of active student groups on their campuses. However, there is limited recognition for the lesbian, gay, bisexual, and transgender (LGBT) community as a group of individuals, both within the dental school and as practicing professionals. The purpose of this study was to determine the existing resources available to LGBT students in the 65 dental schools in the United States, including the availability of a student organization. The study also aimed to determine how many schools included sexual orientation and/or gender identity/expression in their non-discrimination policies as a measure of a baseline level of acceptance at a school. It was found that almost all dental schools have some protections against discrimination based on sexual orientation, but that gender identity/expression is less commonly protected. Few schools offer LGBT student groups specifically for dental students, but many schools have larger LGBT student groups that dental students may be able to access. This study sheds some light on the climate of dental schools for LGBT students and can provide a starting point for further research in this area.

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Social Media in the Dental School Environment, Part A: Benefits, Challenges, and Recommendations for Use

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ABSTRACT: Social media consist of powerful tools that impact not only communication but relationships among people, thus posing an inherent challenge to the traditional standards of who we are as dental educators and what we can expect of each other. This article examines how the world of social media has changed dental education. Its goal is to outline the complex issues that social media use presents for academic dental institutions and to examine these issues from personal, professional, and legal perspectives. After providing an update on social media, the article considers the advantages and risks associated with the use of social media at the interpersonal, professional, and institutional levels. Policies and legal issues of which academic dental institutions need to be aware from a compliance perspective are examined, along with considerations and resources needed to develop effective social media policies. The challenge facing dental educators is how to capitalize on the benefits that social media offer, while minimizing risks and complying with the various forms of legal constraint.


Social Media in the Dental School Environment, Part B: Curricular Considerations

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ABSTRACT: The goal of this article is to describe the broad curricular constructs surrounding teaching and learning about social media in dental education. This analysis takes into account timing, development, and assessment of the knowledge, skills, attitudes, and behaviors needed to effectively use social media tools as a contemporary dentist. Three developmental stages in a student's path to becoming a competent professional are described: from undergraduate to dental student, from the classroom and preclinical simulation laboratory to the clinical setting, and from dental student to licensed practitioner. Considerations for developing the dental curriculum and suggestions for effective instruction at each stage are offered. In all three stages in the future dentist's evolution, faculty members need to educate students about appropriate professional uses of social media. Faculty members should provide instruction on the beneficial aspects of this communication medium and help students recognize the potential pitfalls associated with its use. The authors provide guidelines for customizing instruction to complement each stage of development, recognizing that careful timing is not only
important for optimal learning but can prevent inappropriate use of social media as students are introduced to novel situations.

Implant Design and Its Effects on Osseointegration over Time within Cortical and Trabecular Bone

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ABSTRACT: Healing chambers present at the interface between implant and bone have become a target for improving osseointegration. The objective of the present study was to compare osseointegration of several implant healing chamber configurations at early time points and regions of interest within bone using an in vivo animal femur model. Six implants, each with a different healing chamber configuration, were surgically implanted into each femur of six skeletally mature beagle dogs (N=12 implants per dog, total N=72). The implants were harvested at three and five weeks postimplantation, nondecalcified processed to slides, and underwent histomorphometry with measurement of bone-to-implant contact (BIC) and bone area fraction occupied (BAFO) within healing chambers at both cortical and trabecular bone sites. Microscopy demonstrated predominantly woven bone at three weeks and initial replacement of woven bone by lamellar bone by five weeks. BIC and BAFO were both significantly increased by five weeks (p<0.001), and significantly higher in cortical than trabecular bone (p<0.001). The trapezoidal healing chamber design demonstrated a higher BIC than other configurations. Overall, a strong temporal and region-specific dependence of implant osseointegration in femurs was noted. Moreover, the findings suggest that a trapezoidal healing chamber configuration may facilitate the best osseointegration.


Progressive Plateau Root Form Dental Implant Osseointegration: A Human Retrieval Study

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ABSTRACT: Although preclinical and sparse human histology retrieval studies have shown that the interface between implant and bone is constantly remodeling, no human retrieval database has been developed to determine the effect of functional loading time and other clinical/implant design variables on osseointegration. The present study tested the hypothesis that bone-to-implant contact (BIC) and bone area fraction occupancy (BAFO) increase over functional loading time around dental implants. Due to prosthetic retreatment reasons, 93 human implant retrievals from the same manufacturer (Bicon LLC, Boston) were obtained over a period of
approximately 15 years. The retrieved implants were under functional loading from 120 days to ~18 years and were histomorphologic/metrically evaluated. BIC/BAFO were assessed as a function of multiple independent variables: implant surface type, diameter, length, jaw (maxilla/mandible), region (anterior/posterior), and time of functional loading. The results showed that both BIC and BAFO increased over time independently of implant design/clinical variables, supporting the postulated hypothesis.


Full-Arch Implant Fixed Prostheses: A Comparative Study on the Effect of Connection Type and Impression Technique on Accuracy of Fit

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PURPOSE: The aim of this study was to assess the effect of connection type and impression technique on the accuracy of fit of implant-supported fixed complete-arch dental prostheses (IFCDPs).

MATERIALS AND METHODS: An edentulous mandibular cast with five implants was fabricated to serve as master cast (control) for both implant- and abutment-level baselines. A titanium one-piece framework for an IFCDP was milled at abutment level and used for accuracy of fit measurements. Polyether impressions were made using a splinted and non-splinted technique at the implant and abutment level leading to four test groups, N=10 each. Hence, four groups of test casts were generated. The impression accuracy was evaluated indirectly by assessing the fit of the IFCDP framework on the generated casts of the test groups, clinically and radiographically. Additionally, the control and all test casts were digitized with a high-resolution reference scanner (IScan D103i, Imetric, Courgenay, Switzerland) and standard tessellation language datasets were generated and superimposed. Potential correlations between the clinical accuracy of fit data and the data from the digital scanning were investigated. To compare the accuracy of casts of the test groups vs. the control at the implant and abutment level, Fisher’s exact test was used.

RESULTS: Of the 10 casts of test group I (implant-level splint), all 10 presented with accurate clinical fit when the framework was seated on its respective cast, while only five of 10 casts of test group II (implant-level non-splint) showed adequate fit. All casts of group III (abutment-level splint) presented with accurate fit, whereas nine of 10 of the casts of test group IV (abutment-level non-splint) were accurate. Significant 3D deviations (p<0.05) were found between group II and the control. No statistically significant differences were found between groups I, III, and IV compared with the control. Implant connection type (implant level vs. abutment level) and impression technique did affect the 3D accuracy of implant impressions only with the non-splint technique (p<0.05).

CONCLUSION: For one-piece IFCDPs, the implant-level splinted impression technique showed to be more accurate than the non-splinted approach, whereas at the abutment-level, no difference in the accuracy was found.

Impact of Placement and Restoration Timing on Single-Implant Esthetic Outcome: A Randomized Clinical Trial

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AIM: The objective of this randomized clinical trial was to investigate the influence of the time of implant placement (immediate vs. early) and the time of restoration (immediate vs. early) on esthetic outcome in maxillary anterior single implants.

MATERIAL AND METHODS: Forty-eight patients with a single failing incisor in the maxilla and a natural contralateral site were randomly distributed into four groups. Treatment variations affected the time of implant placement (immediate or early) as well as the time of restoration (immediate or early), in detail: group 1a with immediate implant placement and immediate temporary restoration, group 1b with immediate implant placement and early restoration, group 2a with early implant placement and immediate temporary restoration, and group 2b with early implant placement and early restoration. All patients received the final prosthetic restoration 10–12 weeks after implant placement. Standardized photographs were taken eight months after tooth extraction. Five competent observers analyzed the esthetic outcome according to the PES after Fürhauser. For statistical analysis, the Kruskal-Wallis test and Dunn’s post-hoc test were applied. Interobserver reliability was evaluated by Krippendorff’s alpha.

RESULTS: The overall scores of the four treatment groups revealed PES values of 8.47 (SD 2.08, group 1a), 7.93 (SD 3.21, group 1b), 6.62 (SD 3.24, group 2a), and 8.10 (SD 3.25, group 2b). The differences between groups 2a and 1a and between groups 2a and 2b were statistically significant (p=0.015 and p=0.047). The single parameter analysis displayed a certain range of fluctuation and heterogeneity.

CONCLUSIONS: Immediate implant placement and restoration appear to be a viable alternative to early implant placement if an experienced surgeon is entrusted with the implantation procedure.


Adenoviral Vector-Mediated Overexpression of Osteoprotegerin Accelerates Osteointegration of Titanium Implants in Ovariectomized Rats

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ABSTRACT: This study investigated the efficacy of human osteoprotegerin (hOPG) transgene at accelerating osteointegration of titanium implant in ovariectomized (OVX) rats. Bone marrow stromal cells transduced with Ad-hOPG-EGFP could sustainably express hOPG. Osteoclast precursor RAW264.7 cells treated by the hOPG were examined by tartrate-resistant acid phosphatase (TRAP) staining and bone slice resorption assay. The results showed differentiation and function of osteoclasts were significantly suppressed by hOPG in vitro. Ad-hOPG-EGFP was locally administered to the bone defect prior to implant placement in OVX and...
sham rats. After 3, 7, and 28 days of implantation, the femurs were harvested for molecular and histological analyses. Successful transgene expression was confirmed by Western blot and cryosectioning. A significant reduction in TRAP+ numbers was detected in Ad-hOPG-EGFP group. Real-time reverse transcriptase-PCR examination revealed that hOPG transgene markedly diminished the expression of cathepsin K and receptor activator for nuclear factor-κ B ligand in vivo. The transgene hOPG modification revealed a marked increasing osteointegration and restored implant stability in OVX rats (p<0.01), compared with the control groups (Ad-EGFP or sterilized phosphate-buffered saline) 28 days after implantation. In conclusion, hOPG via direct adenovirus-mediated gene transfer could accelerate osteointegration of titanium implants in OVX rats. Osteoprotegerin gene therapy may be an effective strategy to osteointegration of implants under osteoporotic conditions.

OPTIMIZATION OF MINERALIZED TOOTH CONSTRUCTS FOR WHOLE TOOTH BIOENGINEERING

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OBJECTIVES: Our long-term goal is to bioengineer functional, living replacement teeth as an improved alternative to currently used synthetic dental implants. Here we describe a gelatin methacrylamide (GelMA) hydrogel based biomimetic three-dimensional (3D) model as a platform for regenerative dental applications. Our previous reports identified GelMA formulas that showed elastic moduli similar to that of natural dental tissues and supported dental epithelial (DE) and dental mesenchymal (DM) cell attachment, metabolic activity, differentiation, and also promoted organized endothelial (HUVEC) network formation. In vivo implanted constructs exhibited high vascularity and mineralized tissue formation.

METHODS: Currently, we are optimizing our biomimetic 3D tooth model by defining parameters to promote increased DE and DM cell proliferation and differentiation. DE/DM/HUVEC GelMA constructs of varying cell-seeding densities were fabricated and cultured for either one or 14 days in normal media, and then an additional week in osteogenic media. Constructs were then implanted subcutaneously and grown in vivo for two and four weeks.

RESULTS: Histological, immunohistochemical, and quantitative radiographic analyses are being used to characterize DE/DM/HUVEC cell morphology, differentiation, and biomineralization of in vitro and in vivo constructs. We anticipate that dental cell interactions and organized dentin and enamel formation in biomimetic tooth constructs will improve with increased cell density.

CONCLUSION: The results from this study will further establish dental cell encapsulated 3D GelMA hydrogel constructs as biomimetic 3D models for functional tooth replacement in humans.

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How Accurate Is Information about Diagnosis and Management of Temporomandibular Disorders on Dentist Websites?

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OBJECTIVE: The purpose of this study was to determine the accuracy of information provided on websites of dental practices about the diagnosis and management temporomandibular disorders (TMDs), because patients often use the internet to get information about their condition and to seek a practitioner for treatment.

STUDY DESIGN: A web search was done to identify the types of dental providers who advertise themselves on the internet as “specialists” in the management of TMDs. Issues that were analyzed included their classification of these disorders, the presumed etiology of such problems, and the types of treatment offered.

RESULTS: Over two-thirds of the 255 dental providers identified who advertised management of TMDs on their websites were general dentists. TMDs were attributed to occlusal problems or malocclusion on 66.7% of the websites and were labeled as a single disorder rather than a group of disorders on 38.8% of the websites. Recommendations to treat occlusal problems or malocclusion to alleviate TMDs were made by 54.5% of the providers.

CONCLUSIONS: Since these findings are not in line with current concepts about TMDs, significant inaccuracies exist with regard to the diagnosis and management of TMDs on dental practice websites. Therefore, patients need to be concerned about the dentists they may select to get their treatment, and practitioners need to be prepared to deal with the issues raised by misinformed patients.


Utilizing the Concept of Geste Antagoniste for Conservative Management of Oro-Mandibular Tardive Dyskinesia: A Case Report and Mini-Review

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OBJECTIVE: This case report highlights the implication of the concept of geste antagoniste in conservatively managing oromotor dysfunction and its complications.

CLINICAL PRESENTATIONS: A 66-year-old female with a one-year history of tardive dyskinesia (TD) was referred to the Craniofacial Pain Department (CPC) at Tufts University School of Dental Medicine for management of sore labial/lingual mucosa secondary to excessive daytime involuntary activity of the tongue, lips, and mandible. A detailed head/neck examination revealed excessive involuntary movements of the tongue, lips, and mandible with generalized tenderness of her masticatory muscles. No TMJ or bone pathology was evident in a panoramic radiograph.

INTERVENTION: A lower daytime appliance with bilateral posterior contacts was fabricated to protect her oral mucosa. On reevaluation, excessive movement of the jaw/tongue was significantly reduced with the presence of the appliance in her mouth. Face/neck muscle tenderness was also greatly reduced.
CONCLUSION: The use of oral appliance therapy in TD patients plays an important role in protecting the teeth/oral mucosa. The subsequent inhibition of excessive motor activity is proposed and should be further investigated.


Shortening the Screener and Opioid Assessment for Patients with Pain-Revised: A Proof-of-Principle Study for Customized Computer-Based Testing

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BACKGROUND: The Screener and Opioid Assessment for Patients with Pain-Revised (SOAPP-R) is a 24-item self-report instrument that was developed to aid providers in predicting aberrant medication-related behaviors among chronic pain patients. Although the SOAPP-R has garnered widespread use, certain patients may be dissuaded from taking it because of its length. Administrative barriers associated with lengthy questionnaires further limit its utility.

OBJECTIVE: To investigate the extent to which two techniques for computer-based administration (curtailment and stochastic curtailment) reduce the average test length of the SOAPP-R without unduly affecting sensitivity and specificity.

DESIGN: Retrospective study.

SETTING: Pain management centers.

SUBJECTS: Four hundred and twenty-eight chronic noncancer pain patients.

METHODS: Subjects had taken the full-length SOAPP-R and been classified by the Aberrant Drug Behavior Index (ADBI) as having engaged or not engaged in aberrant medication-related behavior. Curtailment and stochastic curtailment were applied to the data in post-hoc simulation. Sensitivity and specificity with respect to the ADBI, as well as average test length, were computed for the full-length test, curtailment, and stochastic curtailment.

RESULTS: The full-length SOAPP-R exhibited a sensitivity of 0.745 and a specificity of 0.671 for predicting the ADBI. Curtailment reduced the average test length by 26% while exhibiting the same sensitivity and specificity as the full-length test. Stochastic curtailment reduced the average test length by as much as 65%, while always exhibiting sensitivity and specificity for the ADBI within 0.035 of those of the full-length test.

CONCLUSIONS: Curtailment and stochastic curtailment have potential to improve the SOAPP-R’s efficiency in computer-based administrations.

Continuous Neuropathic Pain Secondary to Endoscopic Procedures: Report of Two Cases and Review of the Literature

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ABSTRACT: Neuropathic pain encompasses a spectrum of conditions that can arise from a lesion or dysfunction of the central or the peripheral nervous system, and it may develop at variable intervals after nerve injury or inflammation. Nerve injuries arising from surgical procedures commonly occur secondarily to the surgical trauma, and in rare instances they are a complication of intubation during general anesthesia or endoscopic procedures. A series of two cases of bilateral glossopharyngeal neuropathic pain subsequent to endoscopic procedures is presented with a review of the literature concerning the mechanisms of development of neuropathic pain after these procedures. The purpose of these case reports is to make dentists aware of the occurrence, the mechanisms of nerve injuries, and the treatment of neuropathic pain after endoscopic procedures. In the first case, the patient had relief of pain with a combination therapy of clonazepam 1.0 mg in divided doses twice daily and gabapentin 300 mg in divided doses three times daily. In the second case, the patient had significant relief of pain with a monotherapy of gabapentin 1,200 mg in divided doses three times daily.


A Model for Opioid Risk Stratification: Assessing the Psychosocial Components of Orofacial Pain

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ABSTRACT: This article describes a model of opiate risk stratification with a special focus on dentistry and oral surgery. A brief overview covers the scope of the U.S. opioid abuse and misuse epidemic, and the role of the dentist in mitigating the problems of diversion and misuse of controlled substances. The expanding role of dentistry is summarized. An assessment outlines gathering critical risk information, screening questionnaires, access to state prescription monitoring programs, and communication with cotreating providers. Special populations are discussed. Barriers and possible solutions for effective implementation of these strategies are summarized.

Lubiprostone for Opioid-Induced Constipation Does Not Interfere with Opioid Analgesia in Patients with Chronic Noncancer Pain

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OBJECTIVE: To determine whether lubiprostone 24 μg twice daily (BID), administered to relieve opioid-induced constipation (OIC), affects opioid analgesia in patients with chronic noncancer pain.

METHODS: Data were pooled from three randomized, double-blind, placebo-controlled trials of lubiprostone in adults with chronic noncancer pain receiving stable opioid analgesia and who had documented OIC. In each study, lubiprostone 24 μg BID or placebo was administered for 12 weeks for relief of OIC using a common protocol. The Brief Pain Inventory short form (BPI-SF) was administered, and opioid use (expressed as morphine-equivalent daily dose [MEDD]) was recorded at baseline and months 1, 2, and 3. The BPI-SF provided patient scores for pain severity, the worst pain experienced in the past 24 hours, and pain interference with daily life.

RESULTS: The pooled patient population (N=1,300) was predominately female (62.5%) and white (82.1%), with a mean age of 50.5 years. The MEDD was 97.5 mg (range, 5–3,656 mg) in patients receiving placebo and 112.5 mg (range, 4–7,605 mg) in patients treated with lubiprostone. Lubiprostone 24 μg BID treatment did not appear to affect opioid use or pain scores; changes from baseline were not significantly different with placebo vs. lubiprostone 24 μg BID at months 1, 2, and 3 for MEDD (p≥0.435) and for BPI-SF scores for pain interference, pain severity, and worst pain (p≥0.402).

DISCUSSION: Lubiprostone 24 μg BID administered for relief of OIC in patients with chronic noncancer pain does not interfere with opioid analgesia.


Long-Term Safety and Efficacy of Lubiprostone in Opioid-Induced Constipation in Patients with Chronic Noncancer Pain

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BACKGROUND: Chronic opioid analgesic use often causes opioid-induced constipation (OIC). This open-label extension study evaluated the safety and efficacy of lubiprostone, a chloride channel (CIC-2) activator, for treatment of OIC in patients with chronic noncancer pain.

METHODS: Adults with OIC were enrolled from two 12-week, placebo-controlled, double-blind studies and received lubiprostone 24 μg twice daily for up to nine months. OIC was defined as <3 spontaneous bowel movements (SBMs)/week during the two-week baseline period, of which ≥25% were characterized by hard to
very hard stool consistency, subjectively incomplete evacuation, and/or moderate or worse straining. Inclusion criteria required consistent treatment with full opioid agonists ≥30 days prior to screening and throughout the study.

RESULTS: All 439 patients who received lubiprostone were analyzed for safety and efficacy. Overall, 24.6% of patients reported treatment-related adverse events (AEs), most commonly nausea (5.0%), diarrhea (4.6%), headache (1.6%), and vomiting (1.4%). No treatment-related serious AEs were reported. Nausea and diarrhea each led to study discontinuation in five patients (1.1%); two cases each of nausea and diarrhea were rated as severe. Rescue medication usage decreased from month one (33.0%) to month nine (18.6%). Mean weekly SBM frequency (1.4) was significantly increased from baseline at all months (p<0.001, range 4.9–5.3). Straining, abdominal bloating, abdominal discomfort, stool consistency, constipation severity, and bowel habit regularity were significantly improved from baseline at all months (p<0.001).

CONCLUSIONS: Lubiprostone treatment was well-tolerated and improved symptoms and signs of OIC in this nine-month, open-label study of patients with chronic noncancer pain.


De Novo Headache during Pregnancy and Puerperium

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BACKGROUND: A conservative estimate is that approximately 5% of pregnancies are affected by de novo headache, that is, new-onset or new-type headache.

OBJECTIVES: (1) To summarize the available literature, which is exclusively neurological, regarding de novo headache during the third trimester of pregnancy and puerperium; and (2) to review the common pathologies of pregnancy and puerperium that may be relevant to de novo headache, with a focus on the first and second trimester. We obtained the literature through a search of PubMed and references of the retrieved publications, without time limit.

RESULTS: Aneurysmal subarachnoid hemorrhage and idiopathic intracranial hypertension occur at the same rate during pregnancy and puerperium as otherwise, but symptomatic intracranial hypertension due to dural venous-sinus thrombosis is increased during the third trimester and puerperium. Stroke occurrence, whether arterial or venous, does not seem increased during pregnancy and puerperium but when stroke does occur, it is mostly during the third trimester and puerperium. Immediate postpartum headache is commonly either tension-type headache or migraine; when due to spinal-fluid hypovolemia, apart from epidural or spinal anesthesia, a labor-related dural tear should be considered. Of the medical conditions associated with pregnancy, hypothyroidism, anemia, and hypertension may have to be considered as possible causes of de novo headache.

CONCLUSION: De novo headache during pregnancy is relatively common and almost always leads to neurological referral.

Opioid Treatment of Migraine: Risk Factors and Behavioral Issues

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ABSTRACT: Migraine can impact every aspect of a person's functioning. Psychological comorbidities, cognitive constructs, and behavioral responses to pain greatly impact the perception of migraine pain, treatment efficacy and outcome, and overall quality of life and functioning. Current considerations for migraine treatment emphasize the utility of the biopsychosocial model in understanding and treating migraine, noting both the importance of addressing psychological factors such as cognitive beliefs as well as psychiatric comorbidities. The guidelines for migraine treatment implicate opioid therapy as a second- or third-tier treatment. Guidelines and recommendations for the safe use of opioid medications among patients with chronic pain emphasize the importance of screening prior to prescribing opioid medications. Chronic opioid therapy has been shown to further levels of disability, decrease quality of life, and correlate to psychiatric comorbidities—concerns that are already present in migraine patients. While opioid treatment provides an alternative for persons with contraindications for alternative migraine treatments, it is critical that opioids be used sparingly and exclusively in conjunction with comprehensive assessment and integration of psychological treatment.


Chronic Pain Patients' Impressions of an Emergency Department Opioid Prescribing Guideline Poster

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OBJECTIVE: To determine if an opioid prescribing guideline poster, meant to be posted in an emergency department (ED) triage area, would deter patients with chronic pain from seeking care.

METHODS: We prospectively enrolled patients presenting to a chronic craniofacial pain clinic affiliated with an urban academic Level I trauma center. Patients were surveyed with a close-ended, structured questionnaire. Included patients were aged 18 and older with pain lasting 12 weeks or longer. Patients were shown a sample pain poster. The primary outcome was determination if such a poster would prevent the patient from staying to receive care in the ED.

RESULTS: One hundred patients were surveyed. Most patients (77%) reported having been a patient in the ED in the past, and of these, 23% reported visiting the ED for worsening of chronic pain. After being shown the poster, 97% believed the recommendations in the poster were reasonable and 97% thought that the poster should be displayed in the ED. Seven patients (7%) reported that seeing the poster in the ED waiting room or triage area would intimidate them, and two patients within this group (2% of total sample) reported that it would prevent them from staying to get care.

CONCLUSIONS: The vast majority of patients with chronic pain in this cohort believes that a pain guideline
poster is reasonable and should be posted in the ED. However, a small percentage of patients reported that they would feel intimidated by such a poster and that it would prevent them from staying to get care, a result meant to inform hospitals and policy-makers deciding if such posters should be displayed.

ORAL AND MAXILLOFACIAL SURGERY

Neviod Basal Cell Carcinoma Syndrome and the Keratocystic Odontogenic Tumor

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PURPOSE: To analyze the clinical and radiographic manifestations of nevoid basal cell carcinoma syndrome (NBCCS) with a particular emphasis on the presence, treatment, and outcomes of keratocystic odontogenic tumors (KOTs) in these patients.

PATIENTS AND METHODS: The authors implemented a prospective case series and enrolled a sample of patients with KOTs and NBCCS. The primary study variables were the demographics, treatment, and outcomes of managing KOTs in this sample. Descriptive statistics were computed.

RESULTS: The sample was composed of 16 patients (10 male and six female; mean age, 24 years). These patients presented with 32 previously untreated KOTs. Fifteen patients with 31 KOTs consented to surgery that consisted of a total of 61 procedures during the study period. These procedures included 19 primary enucleation and curettage surgeries and 12 marsupialization procedures followed by secondary enucleation and curettage surgeries. During the course of clinical and radiographic follow-up examinations, 14 new primary and five persistent KOTs (refractory to enucleation and curettage surgeries) were diagnosed, of which 13 new primary KOTs and five persistent KOTs were treated. A total of 51 KOTs (32 primary, 14 new lesions that developed during follow-up, and five persistent lesions) were diagnosed, and 15 patients consented to operative treatment of 49 KOTs. Forty-eight enucleation and curettage surgeries were performed for 49 KOTs that showed effective treatment without persistence in 43 cases (90%) during a follow-up period from two to 20 years (mean, 7 years). One resection was performed for a persistent KOT. The five-year disease-free estimate after primary enucleation and curettage was 86% (95% confidence interval, 74.8–97.4). Other clinical and radiographic stigmata of the syndrome were diagnosed, including calcified falx cerebri, frontal bossing, hypertelorism, multiple basal cell carcinomas, and others.

CONCLUSIONS: The results of this study identify the variable expressivity of this syndrome and the favorable outcomes of marsupialization and enucleation and curettage of syndromic KOTs.


Prevalence of Substance Abuse among Oral and Maxillofacial Surgery Residents from 2006 to 2015

Pasquale Eckert, Matthew Finkelman, and Morton Rosenberg

PURPOSE: Substance abuse in oral and maxillofacial surgery (OMS) training programs is an important and under-represented topic in the literature. This study’s purpose was to assess the prevalence of substance abuse in OMS training programs in the United States during a 10-year period and to determine the substances most abused by OMS residents.

MATERIALS AND METHODS: A cross-sectional survey study was conducted by sending an online
questionnaire to program directors and chairpersons of all OMS graduate training programs accredited by the Commission on Dental Accreditation. The content- and validity-tested survey asked respondents to report on substance abuse cases at their program from 2006 to 2015. Auxiliary questions asked opinions on substance abuse. To analyze the data, percentages were calculated, including the estimated prevalence of abuse; results were presented as bar charts.

RESULTS: Forty-six of the 101 OMS training programs (45.5%) responded. Sixteen of the responding 46 programs (34.8%) reported at least one suspected or encountered incident of substance abuse. The two most abused substances were alcohol and narcotics. During the decade studied, the prevalence of resident substance abuse was estimated to be 1.2%.

CONCLUSION: The estimated prevalence of resident substance abuse has gone unchanged since Rosenberg’s initial study in 1986 (J Oral Maxillofac Surg. 44:458, 1986). With the introduction of new drugs and despite more stringent protocols, substance abuse continues to be a germane issue for OMS requiring ongoing attention clinically and in the literature.

ORTHODONTICS RESEARCH

Three Dimensional Anatomical Exploration of the Anterior Hard Palate at the Level of the Third Ruga for the Placement of Mini-Implants: A Cone-Beam CT Study

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AIM: The aim of this retrospective investigation was to measure vertical bone thickness on the hard palate, determine areas with adequate bone for the insertion of orthodontic mini-implants (MIs), and provide clinical guidelines for identification of those areas.

MATERIALS AND METHODS: Pretreatment records of 1,007 patients were reviewed by a single examiner. A total of 125 records fulfilled the inclusion criteria and were further investigated. Bone measurements were performed on cone-beam computed tomography scans, at a 90° angle to the bone surface, on 28 predetermined and standardized points on the hard palate. Bone thickness at various areas was associated to clinically identifiable areas on the hard palate by means of pretreatment plaster models.

RESULTS: Bone thickness ranged between 1.51 and 13.86 mm (total thickness) and 0.33 and 1.65 mm (cortical bone thickness), respectively. Bone thickness was highest in the anterior palate and decreased significantly towards more posterior areas. Plaster model analysis revealed that bone thickness was highest at the level of the third palatal ruga.

CONCLUSIONS: The areas on the anterior palate with adequate bone thickness for successful insertion of orthodontic MI correspond to the region of the third palatal ruga. These results provide stable and clinically identifiable landmarks for the insertion of palatal MIs.


The Most Distal Palatal Ruga for Placement of Orthodontic Mini-Implants

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OBJECTIVE: To evaluate the stability and bone availability of the most distal (third) palatal ruga, as an anatomical region for safe insertion of orthodontic mini-implants (OMIs) in the anterior palate.

STUDY DESIGN: Orthodontic records of 35 patients were analyzed. Initial (T1) and final (T2) study models were bisected and the outline of the palatal contour was marked on the surface. Models were scanned and the palatal contours were superimposed on the palatal structures on the respective initial and final cephalometric...
images. Cephalometric measurements were used to assess vertical (3rdRug-PP, 2ndRug-PP, and 1stRug-PP), and oblique bone levels (3rdRug-U1, 2ndRug-U1, 1stRug-U1, and 3rdRug-U1(o)). Paired Student’s t-test was used to compare measurements between T1 and T2.

**RESULTS:** The position of the third palatal ruga remained stable during orthodontic treatment (Δ2ndRug-3rdRug p=0.1 mm, p=0.61; and Δ1stRug-3rdRug p=0.2 mm, p=0.39). Bone availability also remained adequate (3rdRug-U1T2(o)=9.9 mm).

**CONCLUSION:** The third palatal ruga is a reliable clinical landmark to evaluate bone availability for the placement of OMIs in the anterior palate.

**PEDIATRIC DENTISTRY RESEARCH**

**Multiple Familial CNS Tumor Syndromes in One Patient: A Case Report**

*Manar AlGhanim and Cheen Loo*

Types of genetically inherited nervous system tumor syndromes, typically the autosomal dominant, may predispose patients to noncentral nervous system oncologic manifestations. Dentists may recognize a number of these manifestations during regular dental recalls, while other manifestations may present themselves in other systems directly affecting patient dental management. It is important for pediatric dentists to be aware of these syndromes and to recognize and manage any craniofacial deformities associated with these syndromes.

The purpose of this report is to describe a case involving a 14-year-old female patient who presented with two familial CNS tumor syndromes (NF-1 and TS). During further radiographic examination, she also presented with signs of a third CNS syndrome. She was referred to the oral surgery department for further management.

*Presented at the American Academy of Pediatric Dentistry’s 69th Annual Session, San Antonio, Texas, May 2016.*

**Comparative and Comprehensive Case Management of Fragile X Syndrome Patients**

*Hesham Alhazmi, Fatima Aziz, and Cheen Loo*

Fragile X syndrome is an X-linked developmental disorder associated with a full mutation of the FMR1 gene, and displays developmental delays, hyperactivity, and characteristic physical features. Males display more severe physical and cognitive symptoms of the syndrome than females since they only have one X chromosome. Due to the special needs of the patient, caretakers are responsible for their oral health care; therefore, the dentist must detail the proper practices regarding oral hygiene and diet to the patients’ caretakers. This case report outlines cases of two brothers who have a fragile X syndrome and are in treatment at Tufts University. The comprehensive treatment hinges on behavior management attuned to individual needs due to varying degrees of developmental delays. The aim is to highlight how fragile X syndrome affects the treatment plan, underscoring the possibility of advanced tooth development and orthodontic problems due to the elongated faces and highly arched palates.

*Presented at the American Academy of Pediatric Dentistry’s 69th Annual Session, San Antonio, Texas, May 2016.*

**Effectiveness of the D-TERMINED Program of Repetitive Tasking for Children with Autism Spectrum Disorder**

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**PURPOSE:** The purpose of this study was to compare the effectiveness of the D-TERMINED Program with standard behavior guidance techniques (SBGTs) used for children with autism spectrum disorder (ASD) in a private dental setting.

**METHODS:** A retrospective data analysis was performed on records of children with ASD who received treatment using either the D-TERMINED program or SBGTs at two private dental practices. Data were
analyzed using chi-squared, Fisher's exact, Wilcoxon Signed Rank, and Mann-Whitney U tests and logistic regression.

**RESULTS:** Forty-four charts (22 in each group) were selected from office visits between 1999 and 2012. Children in the D-TERMInEd group were significantly younger (p=0.01). There were no significant differences between groups regarding gender and dental care characteristics. Patients treated with the D-TERMInEd program showed a significantly greater improvement in behavioral scores compared to the control group (p=0.03). Additionally, children treated with the D-TERMInEd program had significantly lower referrals for dental treatment under general anesthesia (p=0.04).

**CONCLUSION:** The D-TERMInEd program may help children with ASD learn the cooperation skills necessary to receive treatment in a dental practice, which might impact health care cost effectiveness.


**Resin-Infiltration in Inhibiting Proximal Lesions’ Progression in Primary Molars**

*Sara Bagher, Matthew Finkelman, Nour Gowharji, Aruna Ramesh, Gerald Swee, and Cheen Loo*

The goal of this split-mouth, randomized, prospective clinical trial was to evaluate radiographically the effectiveness of resin infiltration as an adjunct to standard-of-care preventative measures (fluoride application, oral hygiene instruction, and diet counseling), compared to standard-of-care preventative measures used alone in controlling the progression of non-adjacent, incipient, proximal enamel carious lesions (E1 and E2) in primary molars after six and 12 months of treatment.

**MATERIALS AND METHODS:** A total of 45 healthy children aged five- and eight-year-olds who had been diagnosed radiographically to have at least two, non-adjacent, incipient, proximal enamel carious lesions in primary molars (total of 90 lesions) were included. The lesions were randomly allocated to either case or control group. Case group lesions were treated using resin infiltration followed by topical fluoride (5% NAF) application vs. only topical fluoride in the control group. All subjects were given oral hygiene instruction, diet counseling, and flossing instructions at the baseline, six and 12-month follow-ups. To provide standardization, individual bite registration was taken during the initial visit and used at the follow-up appointments. The radiographic evaluation was performed by two blinded, trained and calibrated examiners using pairwise reading to determine whether lesions had progressed or not. A p-value of <0.05 was considered statistically significant.

**RESULTS:** After six months, fewer case group lesions (5, 11.4%) showed progression than control group lesions (8, 18.2%) (p=0.453). At the 12-month follow-up, a total of 38 lesion pairs were evaluated radiographically. Six (15.8%) of the case group compared to 13 (34.2%) of the control group lesions showed signs of progression (p=0.092).

**CONCLUSION:** Resin infiltration as an adjunct to standard-of-care preventative measures (fluoride application, oral hygiene instruction, and diet counseling) was not significantly different from the standard-of-care preventative measures alone in terms of radiographic progression when evaluated at six and 12 months after treatment. Data will be collected at 18 and 24 months after treatment for further statistical analysis to compare the effectiveness of these two preventative measures.

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Retrospective Study of Office-Based Frenotomies Performed on Infants with Problematic Ankyloglossia

Alice Chan, Martin Kaplan, Alfred Rich, Sarah Pagni, and Cheen Loo

PURPOSE: The purpose of this retrospective study was to evaluate parental opinion of office-based frenotomy among infants with problematic ankyloglossia.

METHODS: Records from 2013 were reviewed. All relevant patient history including the age at which the frenotomy was performed, infant gender, ankyloglossia classification based on Hazelbaker Assessment Tool for Lingual Frenulum Function (ATLFF) and the frenotomy decision rule for breastfeeding infants (FDRBI), presence or absence of maxillary lip tie, changes in infant’s weight, and breastfeeding characteristics pre- and post-procedure were recorded. Data were analyzed using chi-squared and Mann-Whitney U tests.

RESULTS: Of 132 patient charts reviewed, 130 subjects met the inclusion criteria. Of the 130 subjects, 10 (8%) had anterior ankyloglossia, 98 (75%) had posterior ankyloglossia, nine (7%) had both anterior and posterior ankyloglossia, and 13 (10%) had neither. One hundred and fourteen (88%) had maxillary lip tie, while 16 (12%) did not. All of the subjects identified with anterior ankyloglossia had maxillary lip tie, while 87 (89%) of the 98 subjects with posterior ankyloglossia had maxillary lip tie. There was a low postoperative follow-up rate of 33%. Of those surveyed, 93% reported an improvement to breastfeeding post-treatment regardless of the age of the patient. There was no statistical significance in treatment outcomes whether treatment was performed in neonatal stage vs. post-neonatal stage (p=0.926) or in the association of maxillary lip tie with posterior vs. anterior ankyloglossia (p=0.213).

CONCLUSION: The results showed that the majority of the parents reported improvement to breastfeeding postfrenotomy; however, further studies are needed to confirm these findings.


Interpretation of Bottle Weaning Recommendations among Pediatricians and Pediatric Dentists

Matthew Gillham, Alfred Rich, Matthew Finkelman, and Cheen Loo

PURPOSE: This study aims to determine how pediatricians and pediatric dentists interpret guidelines relating to bottle-fed infants and to assess weaning recommendations.

METHODS: An electronic cross-sectional survey was delivered to a random sample of 11,367 practicing general pediatricians (MDs) and pediatric dentists (PDs) in the United States and Canada. The survey contained one qualifying, three demographic, and eight to eleven practice-based questions.

RESULTS: There were 721 MDs and 1,005 PDs responding, yielding an overall response of 1,726 (15%). MDs (88%) and PDs (87%) responded that weaning is a transitional time period with both a start and a finish. The majority of both MDs (76%) and PDs (62%) selected 12 or 15 months as the age by which weaning should be finished (p<0.001). Both MDs (91%) and PDs (89%) answered that complete bottle unavailability represented weaning cessation. MDs (71%) and PDs (84%) strongly agreed that it is important for a pediatrician to give weaning recommendations, with MDs more frequently giving recommendations (2–3 visits) than PDs (1–2 visits) (p<0.001). We observed a wide array of contrasting responses within the two groups for guideline clarity and understandability.
CONCLUSIONS: Among MDs and PDs, there is widespread agreement that weaning for bottle-fed infants is a transitional period of time with both a start and a finish, occurring at age 12 or 15 months with complete unavailability of bottle. It was more important that MDs give weaning recommendations than PDs. Survey responses indicate bottle weaning guidelines may need clarification.


A Survey of Parents’ Decision When Choosing between General Anesthesia vs. Conscious Sedation during Pediatric Dental Treatment

Sukrit Grewal, Matthew Finkelman, Alfred Rich, and Cheen Loo

PURPOSE: The purpose of this study was to develop a survey to determine the various factors, such as cost, time, amount of work, risk of procedure, number of appointments and attempts and dentist’s recommendation, that influence parents’ decision to choose between general anesthesia (GA) vs. conscious sedation (CS).

METHODS: Thirteen survey questions were developed. The survey was pretested for validity and reliability. Face Validity: Five parents or legal guardians of pediatric patients undergoing either GA or CS were asked to complete the survey. Content Validity: Five pediatric dentists were given the same survey. They were asked to rate each question using the Likert scale and to rate if the question should be included or excluded. A mean of their scores was used to determine if any changes needed to be made to the questionnaire. Test-Retest Reliability: Five other parents or legal guardians took the survey at two separate points in time—once at the beginning and a second at the end of an appointment. The results compare the data for consistency by calculating correlation coefficients. Once validated, the survey will be available for the parents at TUSDM to complete.

RESULTS: The test-retest results showed that there is consistency in the answers. Content validity concluded all questions were to be included.

CONCLUSION: The survey may be useful in assessing various factors involved in the parental decision-making process and help form a causal relationship between the changing attitudes of behavior management.


Factors Related to Sealant Outcome in an Academic Setting

Kare Opaneye, Alfred Rich, Matthew Finkelman, Brian Collins, and Cheen Loo

PURPOSE: The purpose of the study is to review records of sealants placed by pediatric dental residents (PG) vs. undergraduate dental students (UG), and to assess if there was any difference in what happened to the sealants 24 months postplacement. This study also attempted to identify factors that may have contributed to sealant outcomes.

METHODS: Charts were reviewed of patients with first and/or second permanent molar sealant with 24 months follow-up. The age range was six to 18 years. A case-control approach was used with charts divided based on occlusal restoration done (cases) or no occlusal restoration (control) 24 months post-sealant placement.

RESULTS: For the period from 2007 to 2013, there were over 6,687 charts reviewed. Only 193 charts met
inclusion criteria for case group, which were then matched with 764 controls (based on age, sex, tooth, and insurance type). Preliminary trend of results shows a statistically significant difference in sealants placed by PG vs. UG (p-value 0.004). Isolation type comparing rubber dam vs. partial isolation (Isolite, Dri angle or cotton rolls) showed better sealant life span.

CONCLUSION: It appears sealants placed by pediatric dental residents had better outcomes compared to undergraduates 24 months post-sealant placement. Isolation type (non-rubber dam) and frequency of re-care were associated with sealant failures.

PERIODONTOLOGY RESEARCH

Microbiologic Findings in Relation to Risk Assessment for Periodontal Disease: A Cross-Sectional Study

Yong Hur, Seung Kee Choi, Yumi Ogata, Paul Stark, and Paul Levi

BACKGROUND: In this study, an association between a computerized risk calculator and microbiologic testing is examined in patients with periodontitis.

METHODS: Seventy-four patients with moderate and severe periodontitis were selected from patients receiving treatment at Tufts University School of Dental Medicine. Their periodontal risk was analyzed with a periodontitis risk assessment tool, and microbiologic testing was performed. Periodontitis risk assessment and microbiologic testing were examined for a possible association. The data were evaluated by the χ² test at p<0.05 levels.

RESULTS: Forty-six patients scored as having a “very high” risk of periodontitis and 22 patients scored as having a “high” risk of periodontitis by the risk assessment tool. Patients with a risk score of very high risk showed a higher detection of each bacterium except Capnocytophaga species compared to the rest of the study population. Treponema denticola and Prevotella intermedia (p=0.01 and p=0.02, respectively) were two bacteria that showed a statistically significant difference between patients at very high risk and those at high risk.

CONCLUSIONS: Patients with periodontitis were identified as high risk and very high risk compared with the rest of the risk categories by the risk assessment tool. The study population, categorized mostly as very high risk, showed high detection of putative periodontal bacteria.


Periodontal Disease and Risk of All Cancers among Male Never Smokers: An Updated Analysis of the Health Professionals’ Follow-Up Study

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BACKGROUND: Periodontal disease has a direct impact on the immune response and has been linked to several chronic diseases, including atherosclerosis and stroke. Few studies have examined the association between periodontal disease and cancer.

PATIENTS AND METHODS: A total of 19,933 men reported being never smokers (of cigarette, pipes, or cigars) in the Health Professionals Follow-Up Study. Periodontal disease status and teeth number were self-reported at baseline and during follow-up. All cancers were ascertained during 26 years of follow-up. Cox’s proportional hazard models were used to estimate hazard ratios (HRs) and 95% confidence intervals (95% CIs) adjusting for risk factors.
RESULTS: A 13% increase in total cancer was observed among men reporting periodontitis at baseline, and a 45% increase in risk was observed among men with advanced periodontitis (periodontitis with <17 remaining teeth). Periodontitis was not associated with prostate cancer, colorectal cancer, or melanoma, the three most common cancers in this cohort of never smokers, but a 33% increase in risk was observed for smoking-related cancers (lung, bladder, oropharyngeal, esophageal, kidney, stomach, and liver cancers; HR=1.33, 95% CI 1.07–1.65). Men with advanced periodontitis had an HR of 2.57 (95% CI 1.56–4.21; p=0.0002) for smoking-related cancers, compared with men who did not have periodontitis and had 17 teeth or more. Advanced periodontitis was associated with elevated risks of esophageal and head and neck cancers (HR=6.29, 95% CI 2.13–18.6; based on five cases with advanced periodontitis) and bladder cancer (HR=5.06, 95% CI 2.32–11.0; based on nine cases with advanced periodontitis).

CONCLUSIONS: Advanced periodontitis was associated with a 2.5-fold increase in smoking-related cancers among never smokers. Periodontitis may impact cancer risk through systemic immune dysregulation. Further studies need to examine the immune impact of advanced periodontitis on cancer, especially for cancers known to be caused by smoking.

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Is There a Relationship between Periodontal Conditions and Number of Medications among the Elderly?

Zuhair Natto, Majdi Aladmawy, Heba Alshaeri, Mohammed Alasqah, and Athena Papas

OBJECTIVE: To investigate possible correlations of clinical attachment level and pocket depth with number of medications in elderly individuals.

METHODS: Intra-oral examinations for 139 patients visiting Tufts dental clinic were done. Periodontal assessments were performed with a manual UNC-15 periodontal probe to measure probing depth (PD) and clinical attachment level (CAL) at six sites. Complete lists of patients’ medications were obtained during the examinations. Statistical analysis involved Kruskal-Wallis, chi-squared, and multivariate logistic regression analyses.

RESULTS: Age and health status attained statistical significance (p< 0.05) in contingency table analysis with number of medications. Number of medications had an effect on CAL; increased attachment loss was observed when four or more medications were being taken by the patient. Number of medications did not have any effect on periodontal PD. In multivariate logistic regression analysis, six or more medications had a higher risk of attachment loss (>3 mm) when compared to the no-medication group, in crude (OR=1.20, 95% CI: 0.22–6.64) and age adjusted (OR=1.16, 95% CI: 0.21–6.45), but not with the multivariate model (OR=0.71, 95% CI: 0.11–4.39).

CONCLUSION: CAL seems to be more sensitive to the number of medications taken, when compared to PD. However, it is not possible to discriminate at exactly what number of drug combinations the breakdown in CAL will happen. We need to do further analysis, including more subjects, to understand the possible synergistic mechanisms for different drug and periodontal responses.

Effect of Collagen Matrix Seal on Postextraction Ridge Preservation Using Bone Allograft: A Randomized Controlled Clinical Trial and Radiographic Evaluation

Zuhair Natto, Andreas Paraschis, Bjorn Steffensen, Rumpa Ganguly, Matthew Finkelman, and Natalie Jeong

BACKGROUND/OBJECTIVE: One of the serious consequences of single or multiple tooth extraction is the bone resorption that follows, which may create aesthetic problems and compromise future implant placement. Therefore, it is important to preserve as much bone and soft tissue as possible at the time of the extraction to maintain aesthetics, allow the placement of dental implants in a prosthetically ideal position, and prevent future invasive, expensive, and time-consuming procedures. The aim of this prospective, controlled, randomized, parallel arm study was to compare clinically and radiographically the hard and soft tissue remodeling four months following alveolar ridge preservation (ARP) in extraction sockets using a collagen matrix, Mucograft Seal® (MS) or collagen sponge (CS) as barriers, in combination with freeze dried bone allograft (FDBA).

MATERIALS AND METHODS: Participants were assigned to one of the two groups at the day of the extraction and ARP, using a computer-generated randomization scheme. Subjects were blinded to which treatment group they were assigned. Sectional cone beam computed tomographies (CBCTs) were de-identified. The clinical and radiographic measurements for hard and soft tissues were performed with the same stent for standardization and recorded at two different times: 1) before extraction and 2) four months after healing. The flapless technique following atraumatic extraction was used for the two types of barriers. Independent sample t-test, paired t-test, ANCOVA, chi-squared, Fisher exact tests, regression analysis, and intraclass correlation were performed. All statistical analysis was blinded. The groups were exposed after all the analyses were conducted. The report of this clinical trial conforms to the CONSORT statement.

RESULTS: Twenty-eight patients completed the study with no drop-outs, 14 in the MS group and 14 in the CS group. No significant differences between the two groups were detected for demographic characteristics and all soft and hard tissue measurements at baseline, with the exception of distance between Vertical Reference Point and Palatal (Lingual) Crest (VR-PC), which was significantly greater in the CS than the MS group. A slight (0.90 mm) but significantly greater increase from baseline (p=0.01) in gingival thickness at the coronal part was observed in the MC group compared to the CS group (0.50 mm). Horizontal bone loss in the coronal part was less in the MS group (1.21 mm, 14.91%) than in the CS group (1.47 mm, 20.40%). Decrease in bone width of 0.90 and 0.54 mm (10.22 % and 5.94 %) in the MS group and 0.96 and 0.57 mm (11.74% and 6.94%), in the CS group was recorded at the 7- and 10-mm reference points, respectively, in the radiographic measurements with no significant differences between groups. Vertical bone resorption was observed in both groups—0.30 mm in the buccal and 0.27 mm in the palatal in the MS group, and 0.79 and 0.49 mm in the CS group, respectively—with no significant difference between groups. More crestal bone resorption occurred on the buccal than on the palatal aspect in both groups. Radiographic bone quality evaluation indicated that the majority of sites presented type I, II, or III in both groups (57% in the CS and 71% in the MS group) without significant differences between groups. No significant effect on the clinical parameters (probing depth, clinical attachment level, and recession) was detected on the adjacent teeth following extraction and ARP in both groups.

CONCLUSIONS: When combined with FDBA, both collagen matrix and collagen sponge are effective in maintaining soft tissue thickness and minimizing ridge resorption in all dimensions, in sockets with a buccal loss of <2 mm in comparison to previously reported findings recorded after tooth extraction without ARP. The MS was more effective in increasing crestal soft tissue thickness than the CS. Adequate radiographic bone
quality for implant placement was observed in the majority of sites in both groups.


**SOCS-3 Regulates Alveolar Bone Loss in Experimental Periodontitis**

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**ABSTRACT:** The host immune response plays a key role in bacteria-induced alveolar bone resorption. Endogenous control of the magnitude and duration of inflammatory signaling is considered an important determinant of the extent of periodontal pathology. Suppressor of cytokine signaling (SOCS) proteins are inhibitors of cytokine signaling pathways and may play a role in restraining periodontal inflammation. We hypothesized that SOCS-3 regulates alveolar bone loss in experimental periodontitis. Periodontal bone loss was induced in 16-week-old myeloid-specific SOCS-3-knockout and wild-type (WT) C57Bl6-B.129 mice by oral inoculation nine times with 10(9) colony-forming units of _Porphyromonas gingivalis_ A7436 through an oral gavage model for periodontitis. Sham controls for both types of mice received vehicle without bacteria. The mice were euthanized six weeks after the last oral inoculation. Increased bone loss was demonstrated in _P. gingivalis_-infected SOCS-3-knockout mice as compared with _P. gingivalis_-infected WT mice by direct morphologic measurements, micro-computed tomography analyses, and quantitative histology. Loss of SOCS-3 function resulted in an increased number of alveolar bone osteoclasts and increased RANKL expression after _P. gingivalis_ infection. SOCS-3 deficiency in myeloid cells also promotes a higher _P. gingivalis_ lipopolysaccharide-induced inflammatory response with higher secretion of IL-1β, IL-6, and KC (IL-8) by peritoneal macrophages as compared with WT controls. Our data implicate SOCS-3 as a critical negative regulator of alveolar bone loss in periodontitis.


**Prospective Clinical and Radiographic Study of Alveolar Ridge Preservation Combining Freeze-Dried Bone Allograft with Two Xenogeneic Collagen Matrices**

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**BACKGROUND:** Tooth extractions are followed by significant dimensional changes in the alveolar crest that may preclude implant placement. This randomized, controlled prospective compares the preservation of soft and hard tissue dimensional changes after alveolar ridge preservation (ARP), using two membranes consisting of collagen matrix (CM) or extracellular matrix (ECM) as barriers over freeze-dried bone allograft (FDBA).

**METHODS:** Standardized clinical and radiographic measurements of soft and hard tissues were recorded by means of a stent before and four months after ARP. The surgery entailed sulcular incisions with minimal flap elevation and repositioning without advancement.
RESULTS: Of 11 patients in the CM group and 12 in the ECM group who completed the study, gingival thickness (GT) increased from 0.1 to 0.2 mm for both groups along with a 0.5-mm decrease in the width of keratinized tissue after healing. Reductions in ridge width were most pronounced on the coronal aspect, 1.8 mm for CM and 2.0 mm for ECM, whereas vertical reduction was most pronounced on the buccal aspect, 0.7 to 1.0 mm. Differences between groups were not statistically significant. However, significant correlation for changes in GT (p=0.001) and crestal bone width (p=0.002) with preoperative buccal plate thickness (BPT) was observed.

CONCLUSIONS: Both xenogeneic collagen matrices combined with FDBA were effective in maintaining soft tissues and minimizing ridge resorption in all dimensions after ARP. BPT was an important determinant for amount of change in crestal GT and ridge width.


Usage of Bone Replacement Grafts in Periodontics and Oral Implantology and Their Current Levels of Clinical Evidence: A Systematic Assessment

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OBJECTIVES: The aim of this review is to evaluate the levels of clinical evidence for bone replacement grafts available in the United States, for periodontics and oral implantology purposes.

METHODS: A search was performed using PubMed, the Cochrane Library, and Google Scholar for articles relating to the use of bone replacement grafts in implant and/or periodontics by two independent reviewers. Articles unrelated to the topic, not involving patients, not including abstracts, or in languages other than English were excluded. Selected articles were graded according to “levels of evidence” based on guidelines originally introduced by Wright et al. (2003).

RESULTS: There was limited published peer-reviewed clinical literature available regarding U.S. commercially available bone replacement grafts in periodontics and oral implantology. Of 144 bone replacement grafts available in the United States according to Avila-Ortiz et al. (2013), only 52 met the inclusion criteria. The majority of materials used were allografts (26 out 93 available in United States), followed by alloplasts (15 of 30) and xenografts (11 of 21).

CONCLUSIONS: Dental providers should be aware of the limited evidence that qualified for a strong rating supporting the clinical efficacy of these materials for periodontics and oral implantology purposes using the inclusion criteria selected in this study.

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Epigenetic Modulation in Periodontitis: Interaction of Adiponectin and JMJD3-IRF4 Axis in Macrophages

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ABSTRACT: Emerging evidence suggests an important role for epigenetic mechanisms in modulating signals during macrophage polarization and inflammation. JMJD3, a JmjC family histone demethylase necessary for M2 polarization, is also required for effective induction of multiple M1 genes by lipopolysaccharide (LPS). However, the effects of JMJD3 on inflammation in the context of obesity remains unknown. To address this deficiency, we first examined the expression of JMJD3 in macrophage isolated from bone marrow and adipose tissue of diet induced obesity (DIO) mice. The results indicated that JMJD3 was downregulated in obesity. Adiponectin (APN), a factor secreted by adipose tissue which is downregulated in obesity, functions to switch macrophage polarization from M1 to M2, thereby attenuating chronic inflammation. Intriguingly, our results indicated that APN contributed to JMJD3 upregulation, reduced macrophage infiltration in obese adipose tissue, and abolished the upregulation of JMJD3 in peritoneal macrophages isolated from DIO mice when challenged with Porphyromonas gingivalis LPS (pg.lps). To elucidate the interaction of APN and JMJD3 involved in macrophage transformation in the context of inflammation, we designed the loss and gain-function experiments of APN in vivo with APN−/− mice with experimental periodontitis and in vitro with macrophage isolated from APN−/− mice. For the first time, we found that APN can help to reduce periodontitis-related bone loss, modulate JMJD3 and IRF4 expression, and macrophage infiltration. Therefore, it can be inferred that APN may contribute to anti-inflammation macrophage polarization by regulating JMJD3 expression, which provides a basis for macrophage-centered epigenetic therapeutic strategies.


Lack of P47phox in Akita Diabetic Mice Is Associated with Interstitial Pneumonia, Fibrosis, and Oral Inflammation

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OBJECTIVES: Excess reactive oxygen species production is central to the development of diabetic complications. The contribution of leukocyte reactive oxygen species produced by the NADPH oxidase to altered inflammatory responses associated with uncontrolled hyperglycemia is poorly understood.

METHODS: To get insight into the role of phagocytic superoxide in the onset of diabetic complications, we used a model of periodontitis in mice with chronic hyperglycemia and lack of leukocyte p47phox (Akita/Ncf1) bred from C57BL/6-Ins2Akita/J (Akita) and neutrophil cytosolic factor 1 knock-out (Ncf1) mice.
RESULTS: Akita/Ncf1 mice showed progressive cachexia starting at early age and increased mortality by six months. Their lungs developed infiltrative interstitial lesions that obliterated air spaces as early as 12 weeks when fungal colonization of lungs also was observed. Neutrophils of Akita/Ncf1 mice had normal degranulation and phagocytic efficiency when compared with wild-type mice. Although Akita/Ncf1 mice had increased prevalence of oral infections and more severe periodontitis compared with wild-type mice, bone loss was only marginally higher compared with Akita and Ncf1 null mice.

CONCLUSIONS: Altogether, these results indicate that lack of leukocyte superoxide production in mice with chronic hyperglycemia results in interstitial pneumonia and increased susceptibility to infections.

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PHARMACOLOGY, THERAPEUTICS, AND TOXICOLOGY

Oral Tolerance of an Experimental Mouthwash Formulation

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OBJECTIVES: To evaluate oral tolerance of an “Experimental Mouthwash with Experimental Flavor” compared to Biotène® Plaque-Biofilm-Loosening Formula mouthwash in a dry mouth population after 14 days of usage.

METHODS: This was a single center, examiner/subject blind, randomized, parallel group study. Subjects’ response to a dry mouth screening (DMS) questionnaire and comprehensive oral examination were used to determine eligibility. Eligible subjects were stratified according to their Sjögren’s syndrome status (present/absent) and DMS score (mild/moderate/severe). Subjects used their assigned product under supervision and completed the post-product use sensory questionnaire (PPUSQ) within two minutes of use, then continued with home use 2–5 times a day and were reassessed at days 8 and 15.

RESULTS: Of 243 screened subjects, 220 were randomized (safety and ITT population, 110 per group; Sjögren’s syndrome: experimental N=35, Biotène® n=34), and 213 completed the study. Average age: 57.6 (SD±12.96) years; 69.1% were female. By day 15, there were 87 treatment-emergent adverse events (TEAEs) in 53 subjects; 73 were oral TEAEs. There were five mild treatment-related TEAEs: with the experimental mouthwash there was one report each of coated tongue, rash pruritus, and subject-reported oral discomfort (“burning sensation in mouth after rinsing”); with the Biotène® mouthwash there was one report each of gingival ulceration and subject-reported gingival pruritus. There were two non-study-related serious TEAEs. Analysis of question one of the PPUSQ using a generalized linear model for the top two categories (“liked it extremely” and “liked it very much”) showed noninferiority of the experimental mouthwash when compared to Biotène® after 15 days.

CONCLUSION: Both treatments were generally well-tolerated. Interestingly, most participants did not complain about burning; this may be because they expected mint flavored products to sting/burn/tingle and did not report it. The subjects used in this research were involved in a clinical trial.


Clinical Trial Comparing Strip and Paint-On Oxalates for Dentinal Hypersensitivity

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OBJECTIVES: A randomized positively-controlled trial was conducted to evaluate the durable effects of a single treatment with 1.5% oxalate strips on dentinal hypersensitivity.

METHODS: One hundred and thirty-one adult volunteers were screened to identify a general population with air-related cervical dentinal hypersensitivity. Sixty eligible subjects were randomized to one of two oxalate
groups, balancing for baseline air sensitivity and age. Oxalate treatment consisted of either: 1) 1.5% oxalate gel strips (Crest® Sensi-Stop™ Strips, Procter & Gamble Co.), or 2) 3% oxalate acid potassium salt solution (Super Seal® Dental Desensitizing Liner, Phoenix Dental). All oxalate test products were professionally applied at test sites following manufacturer’s instructions. Subsequent oral hygiene was standardized with a blinded anticavity paste and manual brush. For efficacy, dentinal hypersensitivity was assessed before/after treatment and at 30 days using a 1-second cool air stimulus. Responses were measured by a treatment-blinded clinician using a standard four-point scale (Schiff) and by subjects via a tablet-based pain-ranking scale (VAS). Safety was assessed by clinical examination.

RESULTS: The study population was diverse with respect to gender, ethnicity, and age, the latter of which ranged from 26 to 67 years. Overall mean (SD) sensitivity was 1.3 (0.4) for Schiff and 61.1 (17.7) for VAS. The single treatment with oxalate (strip or paint-on) yielded significant (p<0.0001) improvements in both immediate and durable sensitivity for both the clinical and subjective endpoints. The 1-month post-treatment responses were evident across measures. Adjusted Schiff means were 0.31 and 0.31 for the strip and paint-on oxalates, respectively, compared to adjusted VAS means of 23.9 and 27.4. Groups did not differ significantly (p>0.48) on clinical or subjective response after 1-month. Both treatments were well-tolerated.

CONCLUSIONS: In randomized clinical trial, a single application of oxalate via strip or paint-on yielded 75–76% reductions in clinical sensitivity and 54–61% reductions in perceptual sensitivity one month after treatment.


Age Comparisons in an RCT of Peri-Implantitis Treatment with Minocycline Microspheres

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OBJECTIVES: The objective of the study is to evaluate the relation of age to the efficacy of minocycline HCl 1-mg microspheres for the treatment of peri-implantitis used as an adjunct to mechanical debridement, when compared to debridement alone.

METHODS: Two hundred and eight patients with implants diagnosed with peri-implantitis were enrolled in a multicenter trial and randomized to either mechanical debridement alone or mechanical debridement with the local administration of minocycline HCl 1-mg microspheres. The primary outcome measure was probing depth reduction of qualifying implant sites at six months. Clinical assessments were performed at baseline, three and six months. Age subgroups (over 50 and below 50) were analyzed for the primary outcome. Mixed model repeated measures were used to investigate the interaction of treatment by subgroup factor.

RESULTS: In the total population, the subjects’ mean age was 61.4 years and 82.2% of the subjects were >50 years old. Of the subjects, 50.5 % were male, 78.8% Caucasian, 16.8% Black, 2.9% Asian, and 1% other, while 9.6% were smokers. The mean (SD) number of years since implant placement was 6.7 (4.05) years. Minocycline microspheres plus mechanical debridement provided more probing depth reduction than mechanical debridement alone in both subgroups (p=0.0244). Although minocycline microspheres plus mechanical debridement provided more probing depth reduction than mechanical debridement alone in subjects ≤50 years than in subjects >50 years at six months, no evidence of interaction between the age subgroup and PD reduction was found (p=0.8711).
CONCLUSIONS: The adjunctive use of minocycline microspheres to the mechanical debridement of implants with peri-implantitis appears to provide an additional effect on the reduction of probing depths compared to mechanical debridement alone without any relation to the subjects’ age. Further studies including a bigger sample size of the young cohort are recommended.

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Colony-Forming Units of Candida in Sjögren’s and Non-Sjögren’s Xerostomic Population

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OBJECTIVES: The objective of the study is to compare the colony forming units (CFU) of candida (C. albicans) in Sjögren’s and non-Sjögren’s population.

METHODS: One hundred and fifty-seven patients screened, with an average age of 58.19, were enrolled who attended the Oral Medicine Clinic, Tufts University School of Dental Medicine. The candida tests were done as part of standard clinical protocol. One hundred and twenty-eight xerostomics, 34 patients with diagnosed Sjögren’s syndrome, and 94 patients with xerostomia (non-Sjögren’s) were included in the study. Candidiasis was determined by taking a swab and cultured in a testing kit from Dentocult™ for two days at room temperature. The colony-forming units were compared according to the manufacturer’s instruction.

RESULTS: Of the subjects, 51.4% with Sjögren’s and 57.4% without (non) Sjögren’s were found to have positive candida tests. Pearson chi-squared tests between the groups were not statistically significant. The median unstimulated (US) and stimulated (SS) flow for the Sjögren’s were 0.008 and 0.44 ml/min while US and SS for non-Sjögren were 0.03 and 0.81 ml/min. The difference between the CFUs of candida was not statistically significant between the groups (p=0.421). There was an inverse relationship between the higher number of CFU and prevalence in both of the groups.

CONCLUSIONS: More that 50% of xerostomic population, irrespective of the cause of xerostomia, experienced prevalence of candidiasis, and stimulated saliva may play a larger role in controlling the candidiasis. Larger studies are required to determine the possible association of xerostomia and candidiasis.

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Fibronectin-Binding Protein TDE1579 Affects Cytotoxicity of Treponema denticola

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ABSTRACT: While FbpA, a family of bacterial fibronectin (FN) binding proteins, has been studied in several gram-positive bacteria, the gram-negative Treponema denticola, an anaerobic periodontal pathogen, also has an overlooked fbp gene (tde1579). In this research, we confirm that recombinant Fbp protein (rFbp) of T. denticola binds human FN with a Kdapp of 1.5 × 10⁻⁷ M and blocks the binding of T. denticola to FN in a concentration-dependent manner to a level of 42%. The fbp gene was expressed in T. denticola. To reveal the roles of fbp in
T. denticola pathogenesis, an fbp isogenic mutant was constructed. The fbp mutant had 51% reduced binding ability to human gingival fibroblasts (hGF). When hGF were challenged with T. denticola, the fbp mutant caused less cell morphology change, had 50% reduced cytotoxicity to hGF, and had less influence on the growth of hGF cells.

PROSTHODONTICS RESEARCH

Probability of Survival of Implant-Supported Metal Ceramic and CAD/CAM Resin Nanoceramic Crowns

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OBJECTIVES: To evaluate the probability of survival and failure modes of implant-supported resin nanoceramic relative to metal-ceramic crowns.

METHODS: Resin nanoceramic molar crowns (LU) (Lava Ultimate, 3M ESPE) were milled and metal-ceramic (MC) (Co-Cr alloy, Wirobond C+, Bego) with identical anatomy were fabricated (N=21). The metal coping and a burnout-resin veneer were created by CAD/CAM, using an abutment (Stealth-abutment, Bicon LLC) and a milled crown from the LU group as models for porcelain hot-pressing (GC-Initial IQ-Press, GC). Crowns were cemented, the implants (N=42, Bicon) embedded in acrylic-resin for mechanical testing, and subjected to single-load to fracture (SLF, N=3 each) for determination of step-stress profiles for accelerated-life testing in water (N=18 each). Weibull curves (50,000 cycles at 200N, 90% CI) were plotted. Weibull modulus (m) and characteristic strength (η) were calculated and a contour plot used (m vs. η) for determining differences between groups. Fractography was performed in SEM and polarized-light microscopy.

RESULTS: SLF mean values were 1871N (±54.03) for MC and 1748N (±50.71) for LU. Beta values were 0.11 for MC and 0.49 for LU. Weibull modulus was 9.56 and η=1038.8 N for LU, and m=4.57 and η=945.42N for MC (p>0.10). Probability of survival (50,000 and 100,000 cycles at 200 and 300 N) was 100% for LU and 99% for MC. Failures were cohesive within LU. In MC crowns, porcelain veneer fractures frequently extended to the supporting metal coping.

CONCLUSION: Probability of survival was not different between crown materials, but failure modes differed.

SIGNIFICANCE: In load-bearing regions, similar reliability should be expected for metal ceramics, known as the gold standard, and resin nanoceramic crowns over implants. Failure modes involving porcelain veneer fracture and delamination in MC crowns are less likely to be successfully repaired compared to cohesive failures in resin nanoceramic material.

Periodontal Response to Two Different Subgingival Restorative Margin Designs: A 12-Month Randomized Clinical Trial

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OBJECTIVES: Subgingival margin placement is sometimes required for different reasons and is often associated with adverse periodontal reactions. The purpose of this study was to determine if a single restoration with subgingival margin on a tooth, in the maxillary anterior zone, would affect its periodontal soft tissue parameters, and whether or not a deep chamfer preparation has a different influence in the periodontium when compared to a feather-edge preparation.

MATERIAL AND METHODS: Plaque and gingival indexes, periodontal probing depth, bleeding on probing, and patient's biotype were registered. One hundred and six teeth were prepared with a deep chamfer, while 94 were prepared with a feather-edge finishing line. Twelve months after the restoration delivery, the same parameters were evaluated. Repeated measure one-way analysis of variance (ANOVA) (α=0.05) was used.

RESULTS: A statistically significant difference between the baseline and the 12-month follow-up is present in regard to plaque index, gingival index, and periodontal probing depth, but no statistically significant difference is found between chamfer and feather-edge finishing lines. There is a statistically significant difference between the baseline and the 12-month follow-up in regard to bleeding on probing. Feather-edge preparation presents significantly more bleeding on probing and less gingival recession than the chamfer.

CONCLUSIONS: Subgingival margins do influence the periodontal soft tissue response. A statistically significant difference exists between feather-edge and chamfer finishing lines in regard to bleeding on probing and gingival recession.

CLINICAL RELEVANCE: Subgingival margins should be carefully selected, especially when feather-edge finishing line is utilized.


Technique to Match Gingival Shade When Using Pink Ceramics for Anterior Fixed Implant Prostheses

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ABSTRACT: Use of pink gingival ceramics can reduce the necessity for extensive surgical procedures attempting to restore missing soft and hard tissues in the maxillary esthetic zone. Selecting the appropriate shade for pink porcelain poses a challenge, especially when the patient presents with a high smile line. This paper describes a simple and effective technique to facilitate shade selection for gingival ceramics to match the patient's existing gingival shade.

Effect of Different Dental Ceramic Systems on the Wear of Human Enamel: An In Vitro Study

Roya Zandparsa, Rabie El Huni, Hiroshi Hirayama, and Marc Johnson

STATEMENT OF PROBLEM: The wear of tooth structure opposing different advanced dental ceramic systems requires investigation.

PURPOSE: The purpose of this in vitro study was to compare the wear of advanced ceramic systems against human enamel antagonists.

MATERIALS AND METHODS: Four ceramic systems (IPS e.max Press, IPS e.max CAD, Noritake Super Porcelain EX-3, and LAVA Plus Zirconia) and one control group containing human enamel specimens were used in this study (N=12). All specimens were fabricated as disks 11 mm in diameter and three mm thick. The mesiopalatal cusps of the maxillary third molars were prepared to serve as the enamel styluses. All specimens were embedded individually in 25 mm³ autopolymerizing acrylic resin blocks. Wear was measured with a cyclic loading machine and a newly designed wear simulator. All enamel styluses (cusps) were scanned using the Activity 880 digital scanner (SmartOptics). Data from the base line and follow-up scans were collected and compared with Qualify 2012 3D and 2D digital inspection software (Geomagic), which aligned the models and detected the geometric changes and the wear caused by the antagonist specimen. One-way ANOVA was used to analyze the collected data.

RESULTS: After 125,000 bidirectional loading cycles, the mean loss of opposing enamel volume for the enamel disks in the control group was 37.08 μm³; the lowest mean value for IPS e.max Press system was 39.75 μm³; 40.58 μm³ for IPS e.max CAD; 45.08 μm³ for Noritake Super Porcelain EX-3 system; and 48.66 μm³ for the Lava Plus Zirconia system. No statically significant differences were found among the groups in opposing enamel volume loss (p=0.225) or opposing enamel height loss (p=0.149). In terms of opposing enamel height loss, Lava Plus Zirconia system showed the lowest mean value of 27.5 μm. The mean value for the IPS e.max CAD system was 27.91 μm; 29.08 μm for the control enamel; 33.25 μm for the IPS e.max Press system; and 34.75 μm for the Noritake Super Porcelain EX-3 system.

CONCLUSIONS: Within the limitations of this in vitro study, no differences were found in the linear and volumetric reduction of enamel cusps abraded against enamel disks and all other ceramic specimens. All ceramic systems exhibited high durability and were wear-friendly to opposing enamel.

PULP BIOLOGY AND REGENERATION RESEARCH

GelMA Encapsulated HDPSCs and HUVECs for Dental Pulp Regeneration

Arwa Khayat, Nelson Monteiro, Elizabeth Smith, Shantel Angstadt, and Pamela Yelick

OBJECTIVES: The concept of pulpal regeneration has been used in dental clinics to obtain apical closure of immature permanent teeth with thin dentinal walls. Although sometimes successful, stimulating bleeding from the periapical area of the tooth can be challenging and in turn may deleteriously affect tooth root maturation. The method described in this study could help the clinician to overcome these challenges. Our objective was to regenerate dentin-pulp complex in tooth root segments (RS) injected with human dental pulp stem cells (hDPSCs) and human umbilical vein endothelial cells (HUVECs) encapsulated in gelatin methacrylate (GelMA).

METHODS: HDPSCs and HUVECs were used from passage two and five respectively. Both cell types were encapsulated in 5% GelMA and injected into RS of 6 mm length and 2–3 mm orifice wide. White mineral trioxide aggregate (WMTA) was used to seal one of the orifices, while the other was left open. Samples were cultured in vitro in osteogenic media for 10 days, and subsequently implanted subcutaneously in the back of nude rats for four and eight weeks. RS injected with acellular GelMA alone and empty RS were used as controls. At least five sample replicates were used for each experimental and control group.

RESULTS: H&E, IHC, and confocal analyses are being conducted on all experimental groups to investigate mineralized tissue formation and possible formation of dentin-pulp complex and vascularization.

CONCLUSIONS: Preliminary bright field light microscopic analyses revealed vascularization of in vivo implanted cell-seeded TR segments. Ongoing analysis of histology, IHC, and confocal analyses for in vitro and in vivo samples are currently being performed.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #0274.

Dental Epithelial-Mesenchymal Cell Sheets for 3D Tooth Regeneration: An In Vitro and In Vivo Study

Nelson Monteiro, Elizabeth Smith, Shantel Angstadt, and Pamela Yelick

OBJECTIVES: Dental epithelial-mesenchymal (DE-DM) cell interactions provide critical functions in tooth development. Our objective was to create biomimetic, 3D tooth buds consisting of DE-DM cell sheets, layered over dental cell encapsulated gelatin methacrylate (GelMA) hydrogel scaffolds.

METHODS: Pig DE or DM cells were seeded on temperature-responsive plates at various cell densities (0.02, 0.114, and 0.228 cell 106/cm²) for 7, 14, and 21 days to obtain DE and DM cell sheets, respectively. Biomimetic tooth buds consisting of harvested and stacked DE-DM cell sheets layered over DM and DE seeded GelMA constructs and cultured in vitro for 24 hours and 4, 7, and 12 days, also in vivo for three weeks. Histological evaluations of paraffin-embedded and serial-sectioned 3D biomimetic tooth bud constructs were performed with H&E staining, immunofluorescent (IF), and immunohistochemical analyses. In vivo mineralization was assessed and quantified using micro CT (Bruker). Collagen deposition was assessed using polarized light microscopy.
RESULTS: DM cell sheets were readily harvested after 21, 14 and 11 days at cell seeding densities of 0.02, 0.114, and 0.228 × 10⁶ cells/cm², respectively. DE cell sheets were obtained only at the highest cell seeding density after 14 days in culture. H&E and IF analyses of paraffin-embedded and sectioned in vitro cultured biomimetic tooth bud specimens revealed organized multilayered cell sheet formation. In vivo implanted tooth bud constructs exhibited mineralized tissue formation and dental cell differentiation marker expression. No mineralized tissue formation was observed in acellular in vivo implanted GelMA constructs.

CONCLUSIONS: Our biomimetic 3D dental cell sheet + GelMA tooth bud model can be used to study DE-DM cell interactions in vitro, and mineralized bone and dental tissue formation in vivo. We propose our biomimetic tooth bud as a model to optimize DE-DM cell interactions leading to functional biomimetic tooth formation.

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Alveolar Jaw Bone Formation by Human Dental Pulp Cells and E1001(1k)/β-TCP Scaffolds

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OBJECTIVES: The long-term goal of this research is to provide functional repair of jaws and teeth. This study will characterize alveolar bone formation by neural crest cell derived human dental pulp cells (hDPCs) seeded onto porous scaffolds made of E1001(1k), a member of a large combinatorial library of tyrosine-derived polycarbonates, and β-tricalcium phosphate (β-TCP).

METHODS: Cylindrical E1001(1k)/β-TCP scaffolds were prepared by a combination of porogen leaching and freeze drying to fit into a 5-mm critical-sized rat mandible defect. Five groups were examined: 1) scaffolds seeded with 2.5 × 10⁵ hDPCs/scaffold; 2) scaffolds seeded with 5.0 × 10⁵ hDPCs/scaffold; 3) acellular scaffolds loaded with 4 mg BMP-2; 4) acellular scaffolds alone; and 5) empty defect. Cell-seeded and acellular scaffolds were cultured in osteogenic media for one week before implantation. BMP-2 was loaded onto prewetted scaffolds 30 minutes before implantation. Micro-CT was performed on live animals at three and six weeks postimplantation, prior to jaw harvest. Harvested jaws were embedded for cryosection, and histological and immunohistochemical analyses of alveolar bone formation are currently being performed.

RESULTS: Micro-CT indicated that scaffolds loaded with BMP-2 showed the most bone formation. The hDPC seeded and acellular scaffold alone groups exhibited variable levels of new bone formation, as compared to the empty defect group.

SIGNIFICANCE: E1001(1k)/β-TCP scaffolds support the formation of hDPC-derived bone formation. Ongoing studies include qualitative and quantitative assessment of alveolar jaw bone formation.

These studies were supported by DoD/AFIRM II Award #W81XWH-14-2-0004 and NIH/NIDCR R01 DE016132 (PCY). Presented at the 4th Annual TERMIS World Congress, Boston, September 8–11, 2015.
Salivary and Lacrimal Gland Research

Salivary Characteristics of Self-Reported Xerostomias with Active Caries

Joseph Cimmino,* Mabi Singh, Athena Papas, Elizabeth Tzavaras, Britta Magnuson, Pamela Corrado, Susan Cutler, and Matthew Finkelman

OBJECTIVES: The objective of this study was to analyze the salivary characteristics in self-reported xerostomias with one or two active carious lesions.

METHODS: Thirty-one self-reported xerostomias (subjective perception of dryness in the oral cavity) from the Oral Medicine Clinic of Tufts University School of Dental were included in the study. The unstimulated saliva (US) and paraffin wax stimulated saliva (SS) were measured. The viscosity, pH, buffering capacity of saliva, and Visual analog scale (VAS) for dryness (0=no dryness, 100=extreme dryness) were done.

RESULTS: There were 7 males and 24 females (N=31) with at least one active caries who were included in the study. The average age was 53–55 (±15.05). The US was 0.08 (0.05) ml/min and the SS was 0.71 (0.65) ml/min. The mean VAS score was 68.7 (2.03) with a mean pH of 6.8 (484). A saliva consistency check was performed and showed 38.7% had increased viscosity, 29% mild increased (frothy, bubbly), and 32.3% had healthy saliva. The saliva check buffer test indicated 0% in the highly acidic range (5.0–5.5), 48% with the moderately acidic range (6.0–6.6), and 52% in the healthy range (6.8–7.8). The buffering capacity test showed 22.6% had very low buffering ability of saliva, 41.9% had low buffering ability, and 35.5% had normal buffering ability.

CONCLUSIONS: Our data showed from self-reported xerostomias with one or two active carious lesions that there is a wide range of salivary characteristics in unstimulated and stimulated saliva. The salivary consistency, pH, buffering capacity, and visual analogue scale differed widely. Studies with larger sample sizes are needed to establish characteristics of saliva on xerostomias and the other factors that may contribute to the characteristic variance.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #0793.

Severity of Hyposalivation in the Polypharmacy Patient Population

Arwa Farag,* Mabi Singh, Matthew Finkelman, and Athena Papas

OBJECTIVES: Hyposalivation due to polypharmacy is among the most common complaints. It receives less attention, compared to Sjögren's syndrome (SJS), despite its major effect on the patient’s quality of life. The aim of this study was to evaluate the severity of hyposalivation in patients with polypharmacy compared to those with SJS.

METHODS: Adult subjects with reported xerostomia due to SJS, medication (MED), and healthy controls were recruited to the Oral Medicine Clinic at Tufts University School of Dental Medicine. Demographic data, medical history, and information about medications were collected. A five-point questionnaire (DMQ) was given to subjectively evaluate the severity of xerostomia. Oral examination and the Challancomb scale (10-point scale) were used to objectively determine the severity of hyposalivation. Unstimulated and stimulated saliva were collected.

RESULTS: A total of 217 subjects were enrolled, of which 45% were SJS, 36% were MED, and 19% were healthy controls. Subjects in the SJS and MED groups were found to have significantly higher Challancomb scores.
Salivary and Lacrimal Gland Research

compared to controls (p<0.001), with no significant difference between the SJS and MED groups (p=0.458). Unstimulated saliva was significantly diminished in both SJS and MED compared to controls (p<0.001 and p=0.013, respectively) with no significant difference between the SJS and MED patients (p=0.179). Stimulated saliva was significantly diminished in the SJS group compared to controls (p=0.002), with no significant difference between the SJS and MED groups (p=0.134), or between the MED and control groups (p=0.046) when using the Bonferroni correction for multiple comparisons.

CONCLUSIONS: Although the subjective reporting of xerostomia may vary, patients with polypharmacy can encounter severe hyposalivation that is comparable to what Sjögren’s syndrome patients have. More attention should be directed to polypharmacy patient population in terms of frequent dental follow-ups, fluoride application, salivary substitute, and salivogue prescription.

The subjects used in this research were involved in another clinical trial sponsored by GlaxoSmithKline. Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #1546.

Oral Health Related Quality of Life and Salivary Flow Rates in Sjögren’s Syndrome

Kristina Hatzipetrou,* Samantha Keck, Matthew Finkelman, and Mabi Singh

OBJECTIVES: The purpose of this study is to determine the oral health related quality of life in patients with Sjögren’s syndrome (SS), primary and secondary, using a questionnaire and to determine a correlation to salivary flow rates.

METHODS: A survey was distributed to patients with primary and secondary SS from Tufts University School of Dental Medicine. After IRB approval, potential subjects were approached about participation at a normal clinical appointment. After the survey was distributed, the unstimulated (USF) and stimulated salivary flow (SSF) rates for each participant were obtained. There were 14 questions, which dealt with oral health impacted profile (OHIP). The answers to the questions were coded: never=0, hardly ever=1, occasionally=2, fairly often=3, and very often=4. A higher value indicates a worse quality of life. Table 1 reports the correlation between each question and the USF and SSF rates. The Spearman correlation between salivary flow rates and OHIP-14 items was calculated using SPSS 22.

Table 1.

<table>
<thead>
<tr>
<th></th>
<th>USF Correlation Coefficient (n=21)</th>
<th>USF p-value</th>
<th>SSF Correlation Coefficient (n=21)</th>
<th>SSF p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>-0.077</td>
<td>0.739</td>
<td>-0.260</td>
<td>0.254</td>
</tr>
<tr>
<td>Q2</td>
<td>-0.162</td>
<td>0.495</td>
<td>-0.174</td>
<td>0.462</td>
</tr>
<tr>
<td>Q3</td>
<td>0.282</td>
<td>0.228</td>
<td>0.229</td>
<td>0.332</td>
</tr>
<tr>
<td>Q4</td>
<td>-0.376</td>
<td>0.093</td>
<td>-0.546</td>
<td>0.010</td>
</tr>
<tr>
<td>Q5</td>
<td>-0.268</td>
<td>0.241</td>
<td>-0.227</td>
<td>0.322</td>
</tr>
<tr>
<td>Q6</td>
<td>-0.199</td>
<td>0.386</td>
<td>-0.257</td>
<td>0.260</td>
</tr>
<tr>
<td>Q7</td>
<td>-0.200</td>
<td>0.398</td>
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<td>0.228</td>
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<tr>
<td>Q8</td>
<td>0.032</td>
<td>0.892</td>
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<tr>
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<td>0.625</td>
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<td>0.458</td>
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<tr>
<td>Q10</td>
<td>-0.194</td>
<td>0.400</td>
<td>-0.088</td>
<td>0.704</td>
</tr>
</tbody>
</table>

RESULTS: Preliminary analysis contained 21 participants. All the participants were females and the median age was 60 (inter-quartile range=18). Only 10 of the 14 OHIP-14 questions were analyzed due to missing responses.
The only significant correlation was reported for Q4, which asked, “How often have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or denture?” and SSF. The correlation coefficient was −0.546 (p=0.010); the negative correlation indicates that lower SSF was associated with a worse quality of life for this item.

CONCLUSIONS: Primary and secondary Sjögren's patients in this study showed an association between decreased quality of life when eating and decreased stimulated salivary flow. The lack of statistical significance in most analyses may be due to limited data at this time; therefore, more data will be collected to further examine the association between additive OHIP-14 score and salivary flow.

Presented at the 2016 AADR/CADR Annual Meeting in Los Angeles. Abstract #1215.

Lacrimal Gland Inflammation Deregulates Extracellular Matrix Remodeling and Alters Molecular Signature of Epithelial Stem/Progenitor Cells
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PURPOSE: The adult lacrimal gland (LG) is highly regenerative and able to repair itself even after substantial damage; however, this ability to regenerate is lost with the development of dry eye conditions in chronically inflamed LGs. This study compares changes in the cell adhesion and cell matrix molecules and stem cell transcription factors in the LGs of healthy mice and of two mouse models of Sjögren's syndrome: non-obese diabetic (NOD) and MRL-lpr/lpr (MRL/lpr) mice during the early stage of inflammation.

METHODS: The LGs from 12- to 13-week-old female MRL/lpr and male NOD mice along with their respective control strains were harvested and divided into three pieces and processed for quantitative (q) RT-PCR and qRT-PCR Arrays, histology, immunohistochemistry, and Western blotting.

RESULTS: The extracellular matrix (ECM) and adhesion molecules RT2-PCR array combined with protein expression data revealed changes in the expression of integrins, matrix metalloproteinases, and other molecules, which are associated largely with invasion, attachment, and expansion of the lymphocytic cells, whereas changes in the stem cell transcription factors revealed substantial decrease in expression of transcription factors associated with epithelial stem/progenitor cell lineage.

CONCLUSIONS: We concluded that the expression of several important ECM components is significantly deregulated in the LG of two murine models of Sjögren's syndrome, suggesting an alteration of the epithelial stem/progenitor cell niche. This may result in profound effects on localization, activation, proliferation, and differentiation of the LG stem/progenitor cells and, therefore, LG regeneration.

STEM CELL RESEARCH

Stepwise Differentiation of Dental Pulp Stem Cells toward Retinal-Pigmented Epithelium Cells

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ABSTRACT: Age-related macular degeneration (AMD) is the leading cause of blindness in the aging American population. Stem cells hold promise for personalized cell replacement therapy, as the affected cell type, retinal pigment epithelial cells (RPE), can be efficiently generated from human embryonic stem cells (hESCs) and induced pluripotent stem cells (iPSCs). Clinical studies are underway using hESC-derived RPE; however, the required immunosuppressive therapy is a significant obstacle for many patients. iPSC-derived RPE may overcome some of these concerns, but present distinct technical challenges. We propose here using human dental pulp stem cells (DPSCs) as a potential source for patient-matched RPE cells. DPSCs are neuroectodermal-derived cells that can be easily obtained from a patient’s extracted tooth. DPSCs express many stem cell markers, and their ability to differentiate toward numerous cell types without requiring viral transduction is well-established. Directed differentiation of DPSCs toward RPE was attempted using a characterized protocol with Noggin, Dkk1, and Activin; however, DPSCs were not viable under these conditions. To establish a rational stepwise differentiation protocol, we screened for culture and differentiation conditions to induce neuroectodermal stem cell fate by modulating media, serum, growth factor, and small molecules. Two conditions showed early neural stem cell differentiation. These cells were characterized as expressing SOX2, PAX6, SIX3, and NESTIN. In addition, they expressed NANOG and/or OCT4 pluripotency markers. In order for stem cell-derived RPE cells to be utilized clinically, they need to be engineered into a functional 3D polarized tissue that can be transplanted into a patient. We established a 3D polarized tissue model using iPSC-derived RPE and bioengineered silk fibroin as a bio-mimetic membrane. Silk fibroin is nonimmunogenic and its degradation, mechanical properties, and surface patterning are easily tunable. We will compare the function of 3D tissue engineered DPSC-derived RPE vs. iPSC-derived RPE to ensure that our cells mimic the properties of normal RPE tissue that we will eventually use to replace diseased RPE seen in AMD. We propose that DPSC-derived RPE cells could offer safe and autologous cells for tissue replacement therapies.


Generation of Induced Pluripotent Stem Cells from Diabetic Foot Ulcer Fibroblasts Using a Nonintegrative Sendai Virus

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ABSTRACT: Diabetic foot ulcers (DFUs) are nonhealing chronic wounds that are a serious complication of diabetes. Since induced pluripotent stem cells (iPSCs) may offer a potent source of autologous cells to heal these wounds, we studied if repair-deficient fibroblasts, derived from DFU patients and age- and site-matched control fibroblasts, could be reprogrammed to iPSCs. To establish this, we used Sendai virus to successfully
reprogram six primary fibroblast cell lines derived from ulcerated skin of two DFU patients (DFU8 and DFU25), nonulcerated foot skin from two diabetic patients (DFF24 and DFF9), and healthy foot skin from two nondiabetic patients (NFF12 and NFF14). We confirmed reprogramming to a pluripotent state through three independent criteria: immunofluorescent staining for SSEA-4 and TRA-1-81, formation of embryoid bodies with differentiation potential to all three embryonic germ layers in vitro, and formation of teratomas in vivo. All iPSC lines showed normal karyotypes and typical, nonmethylated CpG sites for OCT4 and NANOG. iPSCs derived from DFUs were similar to those derived from site-matched nonulcerated skin from both diabetic and nondiabetic patients. These results have established for the first time that multiple, DFU-derived fibroblast cell lines can be reprogrammed with efficiencies similar to control fibroblasts, thus demonstrating their utility for future regenerative therapy of DFUs.


Altered ECM Deposition by Diabetic Foot Ulcer-Derived Fibroblasts Implicates Fibronectin in Chronic Wound Repair

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ABSTRACT: Current chronic wound treatments often fail to promote healing of diabetic foot ulcers (DFU), leading to amputation and increased patient morbidity. A critical mediator of proper wound healing is the production, assembly, and remodeling of the extracellular matrix (ECM) by fibroblasts. However, little is known about how these processes are altered in fibroblasts within the DFU microenvironment. Thus, we investigated the capacity of multiple, primary DFU-derived fibroblast strains to express, produce, and assemble ECM proteins compared to diabetic patient-derived fibroblasts and healthy donor-derived fibroblasts. Gene expression microarray analysis showed differential expression of ECM and ECM-regulatory genes by DFU-derived fibroblasts, which translated to functional differences in a 3D in vitro ECM tissue model. DFU-derived fibroblasts produced thin, fibronectin-rich matrices, and responded abnormally when challenged with transforming growth factor-beta, a key regulator of matrix production during healing. These results provide novel evidence that DFU-derived fibroblasts contribute to the defective matrices of DFUs and chronic wound pathogenesis.


Multipotent Differentiation of Human Dental Pulp Stem Cells: A Literature Review

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ABSTRACT: The advent of regenerative medicine has brought us the opportunity to regenerate, modify, and restore human organ function. Stem cells, a key resource in regenerative medicine, are defined as clonogenic, self-renewing, progenitor cells that can generate into one or more specialized cell types. Stem cells have been classified into three main groups: embryonic stem cells (ESCs), induced pluripotent stem cells (iPSCs), and
Stem Cell Research

adult/postnatal stem cells (ASCs). The present review focused the attention on ASCs, which have been identified in many perioral tissues such as dental pulp, periodontal ligament, follicle, gingival, alveolar bone, and papilla. Human dental pulp stem cells (hDPSCs) are ectodermal-derived stem cells, originating from migrating neural crest cells, and possess mesenchymal stem cell properties. During the last decade, hDPSCs have received extensive attention in the field of tissue engineering and regenerative medicine due to their accessibility and ability to differentiate in several cell phenotypes. In this review, we have carefully described the potential of hDPSCs to differentiate into odontoblasts, osteocytes/osteoblasts, adipocytes, chondrocytes, and neural cells. Stem Cell Rev. 2016. doi: 10.1007/s12015-016-9661-9. PubMed PMID: 27240827.
TISSUE ENGINEERING

Epigenetically Modified Bone Marrow Stromal Cells in Silk Scaffolds Promote Craniofacial Bone Repair and Wound Healing

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ABSTRACT: Epigenetic regulation of gene expression is a central mechanism that governs cell stemness, determination, commitment, and differentiation. It has been recently found that PHF8, a major H4K20/H3K9 demethylase, plays a critical role in craniofacial and bone development. In this study, we hypothesize that PHF8 promotes osteoblastogenesis by epigenetically regulating the expression of a nuclear matrix protein, special AT-rich sequence-binding protein 2 (SATB2) that plays pivotal roles in skeletal patterning and osteoblast differentiation. Our results showed that expression levels of PHF8 and SATB2 in preosteoblasts and bone marrow stromal cells (BMSCs) increased simultaneously during osteogenic induction. Overexpressing PHF8 in these cells upregulated the expression of SATB2, Runx2, osterix, and bone matrix proteins. Conversely, knockdown of PHF8 reduced the expression of these genes. Furthermore, ChIP assays confirmed that PHF8 specifically bound to the transcription start site (TSS) of the SATB2 promoter, and the expression of H3K9me1 at the TSS region of SATB2 decreased in PHF8 overexpressed group. Implantation of the BMSCs overexpressing PHF8 with silk protein scaffolds promoted bone regeneration in critical-sized defects in mouse calvaria. Taken together, our results demonstrated that PHF8 epigenetically modulates SATB2 activity, triggering BMSCs osteogenic differentiation and facilitating bone formation and regeneration in biodegradable silk scaffolds.


Advances and Perspectives in Tooth Tissue Engineering

Nelson Monteiro and Pamela Yelick

ABSTRACT: Bioengineered teeth that can grow and remodel in a manner similar to that of natural teeth have the potential to serve as permanent replacements to the currently used prosthetic teeth, such as dental implants. A major challenge in designing functional bioengineered teeth is to mimic both the structural and anisotropic mechanical characteristics of the native tooth. Therefore, the field of dental and whole tooth regeneration has advanced towards the molecular and nanoscale design of bioactive, biomimetic systems, using biomaterials, drug delivery systems, and stem cells. The focus of this review is to discuss recent advances in tooth tissue engineering, using biomimetic scaffolds that provide proper architectural cues, exhibit the capacity to support dental stem cell proliferation and differentiation, and sequester and release bioactive agents, such as growth factors and nucleic acids, in a spatiotemporal controlled manner. Although many in vitro and in vivo studies on tooth regeneration appear promising, before tooth tissue engineering becomes a reality for humans, additional research is needed to perfect methods that use adult human dental stem cells, as opposed to embryonic dental
stem cells, and to devise the means to generate bioengineered teeth of predetermined size and shape.


Tooth Tissue Engineering: The Importance of Blood Products as a Supplement in Tissue Culture Medium for Human Pulp Dental Stem Cells

Ricardo Pisciolaro,1 Monica Duailibi,1,2 Neil Novo,1,3 Yara Juliano,1,3 Debora Pallos,3 Pamela Yelick,4 Joseph Vacanti,5 Lydia Ferreira,1 and Silvio Duailibi1,2

ABSTRACT: One of the goals in using cells for tissue engineering (TE) and cell therapy consists of optimizing the medium for cell culture. The present study compares three different blood product supplements for improved cell proliferation and protection against DNA damage in cultured human dental pulp stem cells for tooth TE applications. Human cells from dental pulp were first characterized as adult stem cells (ectomesenchymal mixed origin) by flow cytometry. Next, four different cell culture conditions were tested: I) supplement-free; II) supplemented with fetal bovine serum; III) allogeneic human serum; and IV) autologous human serum. Cultured cells were then characterized for cell proliferation, mineralized nodule formation, and colony-forming units (CFU) capability. After 28 days in culture, the comet assay was performed to assess possible damage in cellular DNA. Our results revealed that protocol IV achieved higher cell proliferation than protocol I (p=0.0112). Protocols II and III resulted in higher cell proliferation than protocol I, but no statistical differences were found relative to protocol IV. The comet assay revealed less cell damage in cells cultured using protocol IV as compared to protocols II and III. The damage percentage observed on protocol II was significantly higher than all other protocols. CFUs capability was highest using protocol IV (p=0.0018) and III, respectively, and the highest degree of mineralization was observed using protocol IV as compared to protocols II and III. Protocol IV resulted in significantly improved cell proliferation, and no cell damage was observed. These results demonstrate that human blood product supplements can be used as feasible supplements for culturing adult human dental stem cells.


Mandibular Jaw Bone Regeneration Using Human Dental Cell-Seeded Tyrosine-Derived Polycarbonate Scaffolds

Weibo Zhang,1 Zheng Zhang,2 Shuang Chen,2 Lauren Macri,2 Joachim Kohn,2 and Pamela Yelick1

ABSTRACT: Here we present a new model for alveolar jaw bone regeneration, which uses human dental pulp cells (hDPCs) combined with tyrosine-derived polycarbonate polymer scaffolds [E1001(1k)] containing beta-tricalcium phosphate (β-TCP) [E1001(1k)/β-TCP]. E1001(1k)/β-TCP scaffolds (5 mm diameter × 1 mm thickness) were fabricated to fit a 5-mm rat mandibular ramus critical bone defect. Five experimental groups were examined in this study: 1) E1001(1k)/β-TCP scaffolds seeded with a high density of hDPCs, 5.0 × 10(5) hDPCs/scaffold (CH); 2) E1001(1k)/β-TCP scaffolds seeded with a lower density of hDPCs, 2.5 × 10(5)
hDPCs/scaffold (CL); 3) acellular E1001(1k)/β-TCP scaffolds (SA); 4) acellular E1001(1k)/β-TCP scaffolds supplemented with 4-μg recombinant human bone morphogenetic protein-2 (BMP); and 5) empty defects (EDs). Replicate hDPC-seeded and acellular E1001(1k)/β-TCP scaffolds were cultured \textit{in vitro} in osteogenic media for one week before implantation for three and six weeks. Live microcomputed tomography (μCT) imaging at three and six weeks postimplantation revealed robust bone regeneration in the BMP implant group. CH and CL groups exhibited similar uniformly distributed mineralized tissue coverage throughout the defects, but less than the BMP implants. In contrast, SA-treated defects exhibited sparse areas of mineralized tissue regeneration. The ED group exhibited slightly reduced defect size. Histological analyses revealed no indication of an immune response. In addition, robust expression of dentin and bone differentiation marker expression was observed in hDPC-seeded scaffolds, whereas, in contrast, BMP and SA implants exhibited only bone and not dentin differentiation marker expression. HDPCs were detected in three-week but not in six-week hDPC-seeded scaffold groups, indicating their survival for at least three weeks. Together, these results show that hDPC-seeded E1001(1k)/β-TCP scaffolds support the rapid regeneration of osteodentin-like mineralized jaw tissue, suggesting a promising new therapy for alveolar jaw bone repair and regeneration.


**Runx2/DICER/miRNA Pathway in Regulating Osteogenesis**

Leilei Zheng,1,2 Qisheng Tu,1 Shi Meng,1 Lan Zhang,1 Liming Yu,1 Jinlin Song,2 Yun Hu,2 Lei Sui,1 Jin Zhang,1,3 Michel Dard,4 Jessica Cheng,1 Dana Murray,1 Yin Tang,1 Jane Lian,5 Gary Stein,5 and Jake Chen1

1Tufts University School of Dental Medicine, Boston; 2Chongqing Medical University, Chongqing, China; 3Guangzhou University of Chinese Medicine, Guangzhou, China; 4New York University College of Dentistry, New York; 5University of Vermont College of Medicine, Burlington, Vermont

**ABSTRACT:** DICER is the central enzyme that cleaves precursor microRNAs (miRNAs) into 21–25 nucleotide duplex in cell lineage differentiation, identity, and survival. In the current study, we characterized the specific bone metabolism genes and corresponding miRNAs and found that DICER and runt-related transcription factor 2 (Runx2) expressions increased simultaneously during osteogenic differentiation. Luciferase assay showed that Runx2 significantly increased the expression levels of DICER luciferase promoter reporter. Our analysis also revealed weaker DICER expression in embryos of Runx2 knock out mice (Runx2 −/−) compared with that of Runx2 ± and Runx2 +/+ mice. We further established the calvarial bone critical-size defect (CSD) mouse model. The bone marrow stromal cells (BMSCs) transfected with siRNA targeting DICER were combined with silk scaffolds and transplanted into calvarial bone CSDs. Five weeks postsurgery, micro-CT analysis revealed impaired bone formation and repairing in calvarial defects with the siRNA targeting DICER group. In conclusion, our results suggest that DICER is specifically regulated by osteogenic master gene Runx2 that binds to the DICER promoter. Consequently, DICER cleaves precursors of miR-335-5p and miR-17-92 cluster to form mature miRNAs, which target and decrease the Dickkopf-related protein 1 (DKK1) and proapoptotic factor BIM levels, respectively, leading to an enhanced Wnt/β-catenin signaling pathway. These intriguing results reveal a central mechanism underlying lineage-specific regulation by a Runx2/DICER/miRNAs cascade during osteogenic differentiation and bone development. Our study also suggests a potential application of modulating DICER expression for bone tissue repair and regeneration.

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