CELEBRATING EXCELLENCE AND ACHIEVEMENT IN RESEARCH

2013–2014 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 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 2014, a showcase of our predoctoral and postgraduate students’ research activities. This year’s event will be the largest yet, with 78 student poster presentations! We appreciate your attendance and support of our students’ efforts.

We are very pleased to have Dr. Carroll Ann Trotman, professor and chair of Tufts Department of Orthodontics, as our keynote speaker. Her address was on “Restoration of Soft Tissue Dynamics and Form in the Cleft Patient.”

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

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 participation of the 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 in enhancing 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, NIH, and NIDCR to our mission. Working together, we have the means to perform ethical, meaningful research in oral and general health care 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 engaged in developing innovative techniques in tissue engineering, bone remodeling, and Sjögren’s Syndrome. Tufts also provides extensive opportunities for interdisciplinary research with our schools of medicine, 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 work to continually 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 ahead reveal just 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

The following commercial exhibitors and contributors helped to make this year’s Bates-Andrews Day successful:

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Special thanks to the following Tufts faculty and students

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Dr. Addy Alt-Holland
Dr. Jake Chen
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Bates Student Research Group
and Andrews Society Officers

Courtney Michelson, President
Shruti Pore, Vice President
Kelly Kimiko Leong, Secretary
Lindsay Fox, Treasurer
BATES-ANDREWS DAY 2014

Wednesday, March 5, 2014

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

Restoration of Soft Tissue Dynamics and Form in the Cleft Patient

Carroll Ann Trotman, B.D.S., M.A., M.S.
Professor and Chair
Department of Orthodontics

Dr. Trotman received her Bachelor of Dental Surgery from the University of Dundee, Scotland; a certificate in Orthodontics and Masters in Oral Biology from Columbia University, New York; and a Masters in Clinical Research and Statistics from the University of Michigan. She has also completed fellowships in craniofacial anomalies and clinical research design, and is a diplomate of the American Board of Orthodontics. Prior to her position at Tufts, she was an assistant professor at the University of Michigan Ann Arbor, professor and assistant dean for graduate education and academic development at the University of North Carolina, Chapel Hill, and professor and associate dean for academic and student affairs at the University of Maryland. Dr. Trotman has maintained an active research program throughout her career. Her currently NIDCR-funded research efforts are focused on the functional outcomes of cleft lip surgery and decision making for surgeons. She has published extensively and has served on several NIDCR panels and study sections.
BATES-ANDREWS DAY 2014 AWARDS

Best Postgraduate Poster Presentation
Dr. Daniel Coleman — “Accuracy of Periodontal Probing Depth and Calculus Detection through the Use of Kinoshita Nissin Periodontal Dental Model”

Best Scientific Research Presentation by a Senior (Andrews Society Award)
Kyler McEwen — “Shear Bond Strength of Different Dentin and Zirconia Treatments”

First Place ADA/DENTSPLY Student Clinician Award for Best Overall Predoctoral Table Clinic
Elizabeth Bingham — “Dab2 Depletion Modifies E-cadherin Expression in Squamous Cell Carcinoma Cells”

Second Place Award for Predoctoral Table Clinic
Jonathan Bishop — “Effect of Phosphoric Acid on Vitrebond Plus Resin-Modified Glass Ionomer”

Third Place Award for Predoctoral Table Clinic

Research Committee Award for Basic Science Research
Jacqueline Servais — “Anti-VEGF Therapy Inhibits Hypothyroidism Associated with Infantile Hemangioma”

Massachusetts Dental Society and ASDA Public Health Award
Douglas Kim — “Retrospective Study of Oral Health Program in a Rural Zambian Community”

Omicron Kappa Upsilon (OKU) Hilde Tillman Award
Stephanie Brue — “Comparing Microabrasion Techniques for In Vitro White Spot Lesion Removal”

Procter & Gamble Traveling Fellowship Award
Shruti Pore — “Microenvironmental Cues Affect Dab2 Expression in Squamous Cell Carcinoma Development”

Dr. Chad Anderson Family Award for Innovative Methodology and Research Design
Christina Penn — “Thermal Effect Due to Laser and Handpiece Usage on Pulp”

Multicultural Award for the Advancement of Dental Research
Vishavjeet Girn — “Comparison of Mechanical Properties of Dental Restorative Material”

Oral Health Disparities Award
Christina Piacquadio — “Occupational Therapy and Oral Health of Individuals with Developmental/Acquired Disabilities”

Bates Student Research Group “Peer-Reviewed” Award
Taylor Newman — “Assessing the Level of Evidence in Post-Graduate Experience at TUSDM,” with Dr. Irina Dragan

ADEA Student Group Educational Research Award
Lauren Marzouca — “Student Self-Evaluation Versus Faculty Assessment of Operative Competencies: An Analysis of Calibration”
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**STUDENT PRESENTATIONS AND ABSTRACTS**

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**PREDOCCTORAL STUDENT PRESENTATIONS**

### Flexural Loading Strength of Provisional Restorative Material

*Lindsay Kovary, Ivy Ahluwalia,* Stephanie John, Ruby Ghaffari, Masly Harsono, and Ronald Perry*

**OBJECTIVE:** To compare *in vitro* four commercial provisional restorative materials under flexural loading conditions.

**METHODS:** Sixty provisional bridges were made *(n=15 each group)* using: Group 1, Protemp™ Plus (3M ESPE); Group 2, Luxatemp® Solar (DMG); Group 3, Integrity® (DENTSPLY Caulk); and Group 4, Visalys® Temp (Kettenbach). Teeth #19 and #21 were prepared as abutments for the 3-unit bridge on Typodont (Columbia, New York). Approximate reduction amount was 2–2.5 mm on buccal, lingual, and proximal walls, 1–1.5 mm full deep chamfer margin, and 15–20 degrees total occlusal convergence. A metal cast duplicate was made from the Typodont as a template for provisional bridge restorations.

Polyvinyl-siloxane impression material was used as a template for fabricating the provisional bridge. The pontic design for missing tooth #20 was a modified ridge lap. All samples were polished with pumice and cemented using TempBond® (Kerr) on a metal template prior to testing.

The modified 3-point bending test was carried out using a universal testing machine (Instron 5566A, crosshead speed 1.0 mm/min). The initial crack was recorded and testing stopped when it hit a catastrophic failure of the bridge. Data was recorded in Newtons. Statistical analysis was conducted using a one-way ANOVA with post hoc Tukey HSD Test for pairwise comparison. Statistical difference was predetermined at p<0.05.

**RESULTS:**

<table>
<thead>
<tr>
<th>Group (n=15)</th>
<th>Mean Flexural Loading Strength (N)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>573.94</td>
<td>198.11</td>
</tr>
<tr>
<td>2</td>
<td>296.22</td>
<td>92.13</td>
</tr>
<tr>
<td>3</td>
<td>307.38</td>
<td>106.79</td>
</tr>
<tr>
<td>4</td>
<td>458.35</td>
<td>132.71</td>
</tr>
</tbody>
</table>

Groups 2 and 3 were statistically lower than groups 1 and 4. There was no statistical difference between groups 2 and 3 *(p=1)*, nor between groups 1 and 4 *(p=0.11).*

**CONCLUSION:** Strength testing resulted in group 1 being comparable to group 4. Both groups 1 and 4 were significantly higher than groups 2 and 3. Initial mode of failure was observed on the junctions between abutment crowns and pontics. Fracture resistance in provisional bridges may have clinical implications in the success of final restorations.

*Sponsored in part by Kettenbach LP. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #300.*
Survey of Special Education Teachers’ Knowledge of Oral Health Principles

Riley Baldwin,* Wanda Wright, Angel Park, and John Morgan

OBJECTIVE: Adults and children with intellectual and developmental disabilities (IDD) face significant challenges in maintaining good oral health. Little is known of the exposure of special needs children to oral health education and prevention programs while in school. A survey was conducted to investigate the knowledge and attitudes of special education teachers regarding oral health.

METHODS: A 22-item questionnaire was adapted from two existing validated surveys. Qualitative interviews and field-testing among dentists, dental hygienists, and special education teachers were conducted to ascertain a high degree of face and content validity of the questionnaire. The survey included questions regarding the training and education, current curriculum, and knowledge and attitudes about oral health of individuals with disabilities of special education teachers. Likert scales were used for ordinal and count responses.

RESULTS: Preliminary data from 28 teachers who responded to the online survey indicated 76% had received inadequate training and 67% had received no continuing education regarding the teaching of oral health. Of the teachers responding, 44% reported that their current curriculum was already overloaded and did not have room for oral health care education. However, 80% replied that they would like to teach oral health care, with 60% saying it should be formally addressed, similarly to other school subjects.

CONCLUSIONS: Based on preliminary data, special education teachers responding to an online survey were underprepared to teach oral health and, further, did not have enough time to do so in the classroom. However, it was perceived as an important gap in their students’ education and as something that they hope to address in the future.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1493.
Effect of Instruction on Energy Delivered to Simulated Restorations

Sara Samaha,1 Sapan Bhatt,1 Christopher Beninati,1* Ronald Perry,1 Richard Price,2 and Howard Strassler3
1Tufts University School of Dental Medicine, Boston; 2Faculty of Dentistry, Dalhousie University, Halifax, Nova Scotia, Canada; 3University of Maryland School of Dentistry, Baltimore, Maryland

OBJECTIVES: Delivering an adequate amount of energy to resin-based restorations is of critical importance. This study used a simulator to determine if dental students delivered more energy to simulated restorations after they received instructions using the simulator on how to improve their light curing technique.

METHODS: Thirty dental students light-cured two simulated restorations (1-mm deep anterior and 4-mm deep posterior) using three light-curing units (LCUs): VALO® (Ultradent Products, South Jordan, Utah); Bluephase G2® (Ivoclar Vivadent, Amherst, New York), and Optilux 401® (Kerr Corporation, Orange, California). A MARC Patient Simulator® (Bluelight Analytics, Halifax, Nova Scotia, Canada) measured the irradiance (mW/cm²) received by the restorations in real-time to calculate the energy (J/cm²) delivered during a 20-second cure. At first, students were asked to use their own light curing technique. They were then given five minutes of combined verbal instructions and a demonstration on proper curing technique using the MARC-PS, and asked to cure the restorations again. Based on a literature review, 16 J/cm² was considered the minimum amount of energy an average resin-based restoration should receive to be considered adequately cured.

RESULTS: Paired t-tests were used to determine significance in the amount of energy delivered before versus after instruction (Table 1). A McNemar test compared energy delivery before and after instruction in relation to the 16 J/cm² minimum requirement. Eighteen students improved from delivering below 16 J/cm² before instruction to delivering above 16 J/cm² after instruction when using the Optilux 401 (p<0.001). Twenty-seven students delivered above 16 J/cm² both before and after instruction when using both the VALO and Bluephase G2 LCUs; the remaining three students all delivered 16 J/cm² after instruction.

Table 1: Increase in energy delivered after instruction by LCU used

<table>
<thead>
<tr>
<th>LCU</th>
<th>Increase in energy delivered</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALO</td>
<td>5.918 J/cm²</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bluephase G2</td>
<td>3.503 J/cm²</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Optilux 401</td>
<td>4.990 J/cm²</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

CONCLUSION: Using a patient simulator to teach proper curing technique markedly and significantly improved the amount of energy delivered by dental students using three different LCUs.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #350.
Evidence Based Study: The Correlation between Diabetes and Periodontitis and the Importance of Incorporating Blood Glucose Tests in the Dental Setting

Christian Benitez, * Alyssa Benitez, and Aidee Nieto-Herman

BACKGROUND: Diabetes has been demonstrated through investigative research to have multiple deleterious effects on the human body, including its debilitating effect on the body’s natural response to periodontal pathogens and their associated inflammatory mediators. Studies have also established the correlation of a patient’s glycemic and metabolic control to periodontal disease, specifically in terms of the body’s resistance to insulin, in patients who present with periodontal inflammation. Epidemiological data confirms that diabetic patients are at a major risk of periodontal disease. It has recently been suggested that blood glucose testing (BGT) in the dental setting/office may help to improve glycemic and metabolic control in patients with chronic periodontitis (CP) and diabetes mellitus. This systematic review assesses the importance of establishing BGT in the dental setting/office in order to provide dental practitioners with comprehensive health information in their efforts to treat a diabetic patient with periodontal disease.

METHODS: In order to determine the need for glucose testing in the dental setting, a systematic review of the current literature on periodontitis, diabetes, and glycemic control tests was performed. After identifying 90 research articles through both a database and manual search, the scientific papers were screened more closely in order to select articles that cited a relationship between diabetes and periodontitis and/or gingivitis and were published in the United States within the past ten years. The inclusion criteria and research strategy was focused on the hypothesis of whether the inclusion of BGT in the dental setting will influence the success rate of periodontal therapy for patients suffering from diabetes and periodontal disease.

RESULTS: After screening the databases and journals, a total of seven articles were chosen to be included in the study. The results of the systematic review revealed the importance of BGT in the dental setting, which will be effective in improving both diagnosis and treatment of diabetic patients with periodontal disease.

CONCLUSION: The systematic review of the articles supports the relationship between glycemic and metabolic control to the severity of periodontal disease. Although the mechanism of this link is still not completely understood, it has been demonstrated that the severity of both periodontitis and diabetes, more specifically Type 2 diabetes, is bidirectional. As a result, the implementation of BGT in the dental setting/office may assist in treating patients with diabetes and periodontal disease. However, future studies are needed to demonstrate the overall results of BGT in the dental setting/office. As a consequence of the silent progression of diabetes, which now encompasses over 25.8 million Americans, approximately 7 million of these individuals with diabetes are currently unaware of their current condition. Due to the outstanding number of people afflicted with diabetes in the United States, whether clinically detected or undiagnosed, the relationship between the two diseases is a paramount public health concern and may also have considerable economic implications.
Dab2 Depletion Modifies E-cadherin Expression in Squamous Cell Carcinoma Cells

Elizabeth Bingham,* Shruti Pore, A. Chau, James Baleja, and Addy Alt-Holland

OBJECTIVE: Loss of E-cadherin-mediated cell-cell adhesion is associated with squamous cell carcinoma (SCC) progression, but the molecular mechanisms that direct E-cadherin loss and regulate SCC cell motility and invasion are only partially known. Disabled-2 (Dab2) is an adaptor protein that is involved in endocytosis of cell surface proteins, cell adhesion, and migration. Here we determined the effect of Dab2 depletion, under different small interfering RNA (si-RNA) transfection conditions, on SCC cell morphology and E-cadherin expression level.

METHODS: E-cadherin and Dab2 protein expression levels were determined in lysates of E-cadherin competent (II-4) and E-cadherin suppressed (II-4-Ecad-) skin SCC cells by Western blotting. Cultures were transfected with si-Dab2 under serum-starved and non-starved conditions, and imaged by bright field and fluorescent microscopy.

RESULTS: Under non-starved transfection conditions, Dab2 depletion resulted in reduced E-cadherin expression and increased cell spread within compact II-4 cell colonies, similarly to the spread of II-4-Ecad- cells. However, under serum-starved transfection conditions, while less cell spread was observed, si-Dab2-mediated depletion resulted in an opposing, marked increase in E-cadherin level. Whereas in II-4-Ecad- SCC cells the endogenous E-cadherin level is initially low, under non-starved transfection conditions Dab2 depletion decreased E-cadherin expression even further. Under serum-starved transfection conditions, similarly to Dab2 depleted II-4 cultures, Dab2 loss increased E-cadherin expression level in II-4-Ecad- SCC cells.

CONCLUSIONS: Dab2 depletion in SCC cells is associated with E-cadherin down regulation and consequent abrogation of cell-cell adhesion. Using short-term stress conditions revealed the existence of a compensatory mechanism that enables SCC cells to overcome the effect of Dab2 depletion on cell-cell contact by increasing E-cadherin protein levels. Thus, Dab2 plays a key role in the behavior of SCC cells, and may serve as a potential biomarker for epithelial cancers, such as skin and oral cancers.

“Tufts Collaborates!” grant awarded to Drs. Alt-Holland and Baleja funded this study. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #748.
Effect of Phosphoric Acid on Vitrebond Plus Resin-Modified Glass Ionomer

Jonathan Bishop,* William Chao, Melissa Ing, Steven Eisen, and Gerard Kugel

OBJECTIVE: Despite numerous tests assessing phosphoric acid pre-treatment on dental materials, there is little research testing the positive/negative effects of phosphoric acid on resin-modified glass ionomer (RMGI) surface and its influence on shear bond strength of the RMGI-composite resin interface. This study sought to determine whether phosphoric acid etching of the RMGI surface affects the shear bond strength between Vitrebond™ Plus RMGI and Filtek™ Supreme Ultra nanocomposite when using the closed sandwich technique.

METHODS: Cylindrical molds sized 3 mm x 6 mm were filled with Vitrebond Plus RMGI. Samples were then treated in one of two ways: 1) RMGI surfaces were treated with 35% phosphoric acid (N=27); or 2) RMGI surfaces were not treated with phosphoric acid (N=26). Within each category, all samples were treated with ExciTE® F total-etch bonding agent. Separate cylindrical molds (8 mm x 3 mm) were then placed over the RMGI samples and 3 mm of Filtek Supreme Ultra was added to each sample. The composite resin side of the buttons were embedded in acrylic molds and these molds were kept at room temperature for 24 hours. All experimental samples were created following manufacturers’ instructions. The shear bond strength of each button was determined using a universal testing machine (Instron® 5566A) at a crosshead speed of 1.0 mm/min. Data was analyzed via the independent-samples t-test. A p-value <0.05 was considered statistically significant.

RESULTS: Group statistics

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean (MPa)</th>
<th>SD (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Etched</td>
<td>27</td>
<td>3.17</td>
<td>1.97</td>
</tr>
<tr>
<td>Non-etched</td>
<td>26</td>
<td>3.22</td>
<td>1.84</td>
</tr>
</tbody>
</table>

No statistically significant difference was observed between the acid-etched and non-etched groups (p=0.918).

CONCLUSIONS: Literature review shows some clinicians selectively etch RMGI, and this study shows there is no statistically significant effect on the bond strength between Vitrebond Plus and Filtek Supreme Ultra. Further research is warranted to ensure etching RMGI does not increase microleakage when using these two products.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #249.
Measuring the Dimensional Accuracy of Ceramic Orthodontic Brackets

William Brown, * Gerard Kugel, Matthew Finkelman, Kane Ramsey, and Georgios Kanavakis

OBJECTIVES: To measure internal slot-dimensions of ceramic/esthetic orthodontic brackets of three different manufacturers and compare them to each other and to nominal stated manufacturing value (0.018 inches).

METHODS: American Orthodontics (Radiance model, n=60), Ormco (Ice model, n=60), and 3M Unitek (Clarity model, n=60) were included. Bracket slots were imaged from the distal using an Olympus SZX16 (Olympus Corporation; Tokyo, Japan) microscope with mounted camera. Digital images were imported and all measurements were made with the Buehler Omninet 9.0 software program (Buehler, Lake Bluff, Illinois). Bracket measurements were taken from gingival and occlusal sides at two points equidistant between slot base and top. Mean slot-dimension for each tooth/manufacturer combination was recorded. Six teeth per manufacturer were examined and results compared between companies using a set of 6 one-way ANOVAs. Mean of each bracket set (18 total sets) was compared to the manufacturing standard of 0.018, using a set of 18 one-way ANOVAs. Bonferroni correction adjusted for multiple comparisons.

RESULTS: For all teeth, there were statistically significant differences in slot-dimensions between the three companies (p<.001). American brackets were statistically insignificant when compared to the manufacturing standard (p-values ranging between 0.026 and 0.441). The majority of Ormco and 3M Unitek brackets were statistically significant when compared to the manufacturing standard (all p-values <.001), with the exception of the Ormco left central incisor (p=0.003). Significance was indicated when p-value is <0.0028 after application of Bonferroni correction.

<table>
<thead>
<tr>
<th>Company</th>
<th>Tooth</th>
<th>N (number of samples)</th>
<th>Min.</th>
<th>Max.</th>
<th>Mean</th>
<th>Standard Dev.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>American</td>
<td>Right Cuspid</td>
<td>10</td>
<td>0.0173</td>
<td>0.0181</td>
<td>0.0177</td>
<td>0.00031</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>Right Lateral</td>
<td>10</td>
<td>0.0175</td>
<td>0.0189</td>
<td>0.0179</td>
<td>0.00043</td>
<td>0.441</td>
</tr>
<tr>
<td></td>
<td>Right Central</td>
<td>10</td>
<td>0.0175</td>
<td>0.0183</td>
<td>0.0178</td>
<td>0.00027</td>
<td>0.046</td>
</tr>
<tr>
<td></td>
<td>Left Central</td>
<td>10</td>
<td>0.0176</td>
<td>0.0183</td>
<td>0.0179</td>
<td>0.00021</td>
<td>0.264</td>
</tr>
<tr>
<td></td>
<td>Left Lateral</td>
<td>10</td>
<td>0.0172</td>
<td>0.0184</td>
<td>0.0177</td>
<td>0.00041</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>Left Cuspid</td>
<td>10</td>
<td>0.0172</td>
<td>0.0185</td>
<td>0.0177</td>
<td>0.00043</td>
<td>0.038</td>
</tr>
<tr>
<td>Ormco</td>
<td>Right Cuspid</td>
<td>10</td>
<td>0.0174</td>
<td>0.0177</td>
<td>0.0175</td>
<td>0.00009</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Right Lateral</td>
<td>10</td>
<td>0.0170</td>
<td>0.0179</td>
<td>0.0176</td>
<td>0.00025</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Right Central</td>
<td>10</td>
<td>0.0175</td>
<td>0.0177</td>
<td>0.0176</td>
<td>0.00007</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Left Central</td>
<td>10</td>
<td>0.0166</td>
<td>0.0179</td>
<td>0.0175</td>
<td>0.00037</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>Left Lateral</td>
<td>10</td>
<td>0.0170</td>
<td>0.0177</td>
<td>0.0175</td>
<td>0.00019</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Left Cuspid</td>
<td>10</td>
<td>0.0173</td>
<td>0.0179</td>
<td>0.0177</td>
<td>0.00017</td>
<td>0.001</td>
</tr>
<tr>
<td>3M</td>
<td>Right Cuspid</td>
<td>10</td>
<td>0.0190</td>
<td>0.0195</td>
<td>0.0193</td>
<td>0.00015</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Right Lateral</td>
<td>10</td>
<td>0.0196</td>
<td>0.0203</td>
<td>0.0200</td>
<td>0.00023</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Right Central</td>
<td>10</td>
<td>0.0189</td>
<td>0.1092</td>
<td>0.0190</td>
<td>0.00009</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Left Central</td>
<td>10</td>
<td>0.0187</td>
<td>0.0192</td>
<td>0.0189</td>
<td>0.00015</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Left Lateral</td>
<td>10</td>
<td>0.0198</td>
<td>0.021</td>
<td>0.0204</td>
<td>0.00041</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Left Cuspid</td>
<td>10</td>
<td>0.0191</td>
<td>0.0195</td>
<td>0.0193</td>
<td>0.00013</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

CONCLUSION: Results revealed that three tested bracket manufacturing companies consistently manufacture brackets with undersized or oversized slot-dimensions. Slot sizes varied from 0.0166 (7.78%) undersized to
0.021 (16.67%) oversized. Variations of this magnitude directly impact fit of the wire and amount of contact surface between wire and bracket slot resulting in unintended treatment effects. Products supplied by American Orthodontics andOrmco.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #499.
Comparing Microabrasion Techniques for *In Vitro* White Spot Lesion Removal

**Stephanie Brue,* Angel Park, and Gerard Kugel**

**OBJECTIVE:** This study serves to analyze the effect of technique variations for enamel depth removed on normal and early demineralization of enamel (white spots). It is hypothesized that microabrasion with rotary and greater time will remove a greater depth of enamel.

**METHODS:** Intact non-carious human teeth were obtained. Teeth were sectioned into approximately 3 mm x 3 mm squares and embedded in resin. Samples were polished using 600-grit SiC paper to obtain a flattened enamel surface (Ecomet®, Buehler). Samples were randomly assigned to two groups (n=20): normal enamel (NE) and demineralized enamel (DE). The DE group was immersed in a demineralizing solution (Queiroz, et al., 2008) for 32 hrs at 37°C to create artificial demineralized lesions. Each group was randomly divided into four subgroups (n=5) and treated with microabrasion material (Opalustre®, Ultradent) with variation of techniques: cotton swab for 30 or 60 sec or rotary prophy cup for 30 or 60 sec. All samples were abraded using a light pressure determined by a digital scale. Samples were cross-sectioned (Isomet®, Buehler). The removal depths were measured under stereo microscope (Olympus SZX16®) with analysis software (Omninet 9.0, Buehler). Statistical analysis was done using independent samples t-test.

**RESULTS:**

<table>
<thead>
<tr>
<th></th>
<th>Time=30</th>
<th>Time=60</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rotary (n=5)</td>
<td>Swab (n=5)</td>
<td>p-value</td>
</tr>
<tr>
<td></td>
<td>Mean (95% CL mean (µm))</td>
<td>Mean (95% CL mean (µm))</td>
<td></td>
</tr>
<tr>
<td>DE</td>
<td>105.9 (28.8–183.1)</td>
<td>41.2 (34.4–47.9)</td>
<td>0.049</td>
</tr>
<tr>
<td>NE</td>
<td>53.6 (47.9–59.2)</td>
<td>35.7 (27.1–44.3)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

**CONCLUSION:** Results from all groups were normally distributed (Shapiro-Wilk test). On DE, the focus of treatment, at t=30, enamel removal using swab had a mean (95% CL) of 41.2 µm (34.3–47.9), and rotary was greater at 105.9 µm (28.8–183.1) (p=0.049). DE depth at t=60 using swab had a mean (95% CL) of 74.1 µm (59.0–89.1), and rotary was again greater at 216.5 µm (153.2–279.7) (p=0.003). Small sample size limited comparison between time points. Greatest enamel removal was observed using rotary and after greater time (t=60). By referencing these techniques based on time and instrument used, a more efficient and accurate microabrasion procedure can be clinically accomplished.

*Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #891.*
Gluma Antimicrobial Effect on Five Strains of Cariogenic Bacteria

Minh Bui,1* Brian Klein,2 and Ronald Perry1
1Tufts University School of Dental Medicine, Boston; 2Tufts University Sackler School of Graduate Biomedical Sciences, Boston

OBJECTIVES: Gluma® desensitizer is one of many topical agents used to prevent post-operative hypersensitivity. This project aimed to see if Gluma could have an additional antimicrobial effect on five strains of common bacteria associated with caries by assessing the zone of inhibition.

METHODS: Three experiments were conducted using prepared plates (either MRS or blood agar) with strains of Streptococcus mutans (ATCC 25175 [S. mutans]), Porphyromonas gingivalis (BAA-308 [PG W83]), Porphyromonas gingivalis (ATCC 33277 [PG 33277]), Lactobacillus rhamnosus GG (ATCC 53103 [LGG]), and Lactococcus lactis (CMB8). In the first test, Gluma was pipetted directly onto plates; in the second test, Whatman and Fisher filter paper discs were impregnated with Gluma then placed on plates; in the third test, 1 µl and 0.5 µl Gluma was filled into wells punched out using tips of a micropipette and a Pasteur pipette. Plates were packaged in pouches, incubated anaerobically at 37°C for at least 48 hours, then retrieved. Zones of inhibitions were assessed and measured. Statistics were not done because the aim was to verify the presence or absence of the zones of inhibition.

RESULTS:

<table>
<thead>
<tr>
<th>Strains</th>
<th>Zones of Inhibition (mm) for Gluma pipetted onto plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. mutans</td>
<td>10 11 12 13</td>
</tr>
<tr>
<td>CMB8</td>
<td>9 11 12 12</td>
</tr>
<tr>
<td>LGG</td>
<td>8 10 10 11</td>
</tr>
<tr>
<td>PG W83</td>
<td>12 13 14 16</td>
</tr>
<tr>
<td>PG 33277</td>
<td>5 6 10</td>
</tr>
</tbody>
</table>

All five strains demonstrated susceptibility by having the zones of inhibition with clear borders of antimicrobial capability up to a certain point where the Gluma could not diffuse out. Results were listed from smallest to largest values.

<table>
<thead>
<tr>
<th>Strains</th>
<th>Zones of inhibition (mm) for Fisher filter paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. mutans</td>
<td>9 10 10 10 11</td>
</tr>
<tr>
<td>CMB8</td>
<td>8 9 9 10 10</td>
</tr>
<tr>
<td>LGG</td>
<td>7 9 9 10 11</td>
</tr>
<tr>
<td>PG W83</td>
<td>9 9 10 10 11</td>
</tr>
<tr>
<td>PG 33277</td>
<td>9 9 10 10 12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strains</th>
<th>Zones of inhibition (mm) for Whatman filter paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. mutans</td>
<td>8 9 10 10 10</td>
</tr>
<tr>
<td>CMB8</td>
<td>5* 10 10 11 13</td>
</tr>
<tr>
<td>LGG</td>
<td>7 9 9 9 10</td>
</tr>
<tr>
<td>PG W83</td>
<td>5* 9 9 10 10</td>
</tr>
<tr>
<td>PG 33277</td>
<td>9 10 12 12 14</td>
</tr>
</tbody>
</table>
All discs but two (noted with an asterisk) demonstrated clear inhibition zones. Fisher filter paper discs created zones of similar diameters, whereas Whatman discs had a larger range.

<table>
<thead>
<tr>
<th>Strains</th>
<th>Micropipette tip well + 1 µl</th>
<th>Micropipette tip well + 0.5 µl</th>
<th>Pasteur tip well + 1 µl</th>
<th>Pasteur tip well + 0.5 µl</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMB8</td>
<td>19</td>
<td>20</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>LGG</td>
<td>15</td>
<td>15</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>S. mutans</td>
<td>15</td>
<td>17</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

Plates yielded results with distinct borders only for three species. Zones were bigger for the wells created by the micropipette than the Pasteur pipette.

**CONCLUSIONS:** From the results of all three experiments, Gluma demonstrated an antimicrobial effect on the bacteria tested regardless of the approach used to introduce the desensitizer.

*Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #269.*
Microleakage of Dental Bulk Fill, Conventional, and Self-Adhesive Composites

Matthew Cannavo,* Masly Harsono, Matthew Finkelman, and Gerard Kugel

OBJECTIVE: To compare microleakage among bulk fill (BF) composite, a conventional (CV) composite, and bioactive self-adhesive (SAC) restorative material.

METHOD: One-hundred forty standard Class II preparations were prepared on sound extracted human third molar teeth by the same operator. Preparations were approximately 2.0 mm deep at the occlusal floor and 4.0 mm deep at the gingival floor. Samples were randomly assigned into seven groups (n=20). Four composite systems were tested: Filtek™ Supreme Ultra (3M, ESPE/CV), SonicFill™ (Kerr/BF), Tetric EvoCeram® (Ivoclar/BF), and ACTIVA (Pulpdent Corporation/SAC). Scotchbond™ universal adhesive (3M, ESPE) was used as a bonding agent in groups 1–6. In three groups the bonding agent was used as total etch (TE) and in three groups it was used as self-etch (SE). ACTIVA is a self-adhesive bioactive restorative with 5 second etch. All materials were used according to manufacturer’s instructions. Samples were cured for 40 seconds with LED lights (DEMI, Kerr) and thermocycled for 5,000 cycles between 5°C and 50°C with a dwell time of 30 seconds. Samples were immersed in a 50% ammoniacal silver nitrate solution for three hours and exposed to a photodeveloping solution for six hours. Samples were embedded into acrylic and sectioned in the mesio-distal direction (Isomet, Buehler). Microleakage was evaluated with analyzer software (Omnimet 9.0, Buehler). A penetration score was used on the Axial (A) and Gingival (G) walls; 0=no microleakage, 1= microleakage less than half-way to axial/pulpal wall, 2=more than half-way to axial/pulpal wall, 3=at or beyond the axial/pulpal wall. Statistical analysis completed using generalized estimating equations (GEE) comparing the 7 groups in terms of microleakage; p-value=0.1492.

RESULT:

<table>
<thead>
<tr>
<th>Group n=20</th>
<th>Microleakage=0 (G/A)</th>
<th>Microleakage=1 (G/A)</th>
<th>Microleakage=2 (G/A)</th>
<th>Microleakage=3 (G/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (CV TE)</td>
<td>14/17</td>
<td>3/0</td>
<td>0/0</td>
<td>3/3</td>
</tr>
<tr>
<td>2 (CV SE)</td>
<td>11/15</td>
<td>1/2</td>
<td>2/1</td>
<td>6/2</td>
</tr>
<tr>
<td>3 (BF TE)</td>
<td>16/17</td>
<td>2/0</td>
<td>0/0</td>
<td>2/3</td>
</tr>
<tr>
<td>4 (BF SE)</td>
<td>13/14</td>
<td>1/0</td>
<td>0/0</td>
<td>6/6</td>
</tr>
<tr>
<td>5 (BF TE)</td>
<td>16/17</td>
<td>4/1</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>6 (BF SE)</td>
<td>15/18</td>
<td>1/0</td>
<td>0/0</td>
<td>4/2</td>
</tr>
<tr>
<td>7 (SAC)</td>
<td>16/18</td>
<td>0/0</td>
<td>0/0</td>
<td>4/2</td>
</tr>
</tbody>
</table>

CONCLUSION: Microleakage difference was not statistically significant between CV, BF, and SAC groups tested (p-value=0.1492).

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #847.
Effects of Storage Conditions on the Hardness of Nanocomposite

William Chao,* Jonathan Bishop, Melissa Ing, Matthew Finkelman, Angel Park, and Gerard Kugel

OBJECTIVE: The aim of this study is to evaluate the effects of air, distilled water, and artificial saliva storage conditions on the hardness of nanocomposite.

METHODS: Cylindrical molds of 2 mm x 6 mm were filled with 3M Filtek Supreme Ultra® nanocomposite and light cured from the top for 20 seconds (per manufacturer’s instructions). Thirty-six samples were made for each of the four time intervals (n=144): 15 minute, 1 hour, 12 hours, and 24 hours. Samples were randomly divided into three groups: air, distilled water, and artificial saliva. Using an Instron® testing machine, three indentations were made on the bottom side of each sample with a 1000 g pre-load, and a mean Vicker’s Hardness Number (VHN) was calculated. One-way ANOVA was used to assess statistical significance between the groups at each time interval, with Tukey’s HSD as post-hoc tests (SPSS, v.19). Using the Bonferroni correction, a p-value of 0.0125 was considered statistically significant for the ANOVA.

RESULTS: At 15 minutes, saliva had the lowest mean (SD) VHN, 58.3(2.6), and air the highest, 63.9(3.1). At 24-hours, saliva had the highest value at 86.3(3.7).

Table 1. Comparison of mean Vickers Hardness Number for nanocomposite in three storage conditions

<table>
<thead>
<tr>
<th></th>
<th>Air (N=12)</th>
<th>Distilled water (N=12)</th>
<th>Artificial saliva (N=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>15 min</td>
<td>63.9a,b</td>
<td>3.1</td>
<td>60.2a</td>
</tr>
<tr>
<td>1 hour</td>
<td>68.2c</td>
<td>2.2</td>
<td>65.1c</td>
</tr>
<tr>
<td>12 hour</td>
<td>75.0d,e</td>
<td>2.8</td>
<td>72.1d</td>
</tr>
<tr>
<td>24 hour</td>
<td>83.9</td>
<td>5.5</td>
<td>81.4</td>
</tr>
</tbody>
</table>

*Similar letters denote statistical significance between the two groups

At the 15-minute and 12-hour time intervals, there was significance between air and water and air and saliva. Moreover, at the 1-hour interval, there was significance between all three conditions. At the 24-hour interval, all groups had results at the p-value (0.0125).

CONCLUSIONS: Storage conditions appear to have an effect on hardness of nanocomposite at 15-minute, 1-hour, and 12-hour time intervals. However, this effect is less pronounced at the 24-hour time interval where the nanocomposite may be approaching its maximum hardness. Further research is suggested to explore the effects of storage conditions on hardness between time intervals.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1460.
Characterization of the Novel Zebrafish Helicase Craniofacial Mutant

Jimmy Chen,* David Cheng, Viktoria Andreeva, and Pamela Yelick

OBJECTIVES: Our goal was to characterize the developmental expression of the 9N helicase gene and define 9N craniofacial cartilage defects.

METHODS: An Alcian blue/Alizarin Red developmental staging series was generated to characterize cartilage and bone, respectively, in age-matched 9N mutant and wild-type sibling zebrafish. We used in situ hybridization (ISH) to examine the tissue specific developmental expression of the 9N helicase gene.

RESULTS: The 9N mutant neurocranium presented with an underdeveloped notochord, an expanded otic capsule, a malformed Trabeculae Cranii, and a trilobed Ethmoid plate. In humans, these deformities can be associated with possible vertebral disc, otic capsule, and sella turcica dysplasia, and bilateral cleft palate, respectively. The 9N mutant pharyngeal skeleton presented with underdeveloped dentition, inverted Ceratohyal and underdeveloped Basihyal, shortened Meckel’s cartilage, and fused joints between the Meckel’s cartilage and the Palatoquadrate. In humans, these defects correspond to an under-calcified dentition, hyoid arch dysplasia, a shortened mandible, and a possible fusion between the mandible and temporo-mandibular joint. ISH revealed that the 9N helicase mRNA is expressed in 16 cell stage zebrafish on the cell surface, in 14 somite stage zebrafish along the neurocranium, and from 1–5 days post fertilization in the notochord, otic capsule, ceratohyal, basihyal, and Meckel’s cartilage. The 9N helicase mRNA expression pattern is consistent with the deformities observed in 9N mutant zebrafish.

CONCLUSIONS: Our data suggest an important role for the 9N helicase in craniofacial development. Future functional characterizations of the 9N helicase mutant will be used to improve our understanding of human craniofacial development, and provide new inroads for more effective therapies for the prevention and repair of craniofacial defects.

These studies were supported by NIH/ NIDCR R01 DE and Tufts University School of Dental Medicine, Boston. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1043.
Student and Faculty Perception on Use of Objective Clinical Structured Examination in Preclinical Removable Partial Denture Course

Dave Cho,* Paul Stark, and Yun Saksena

OBJECTIVES: The aim of this research is to determine the usefulness of objective structured clinical examination (OSCE) as perceived by students and faculty in a pre-clinical removable partial denture (RPD) course compared to a practical exam that is currently used.

METHODS: Students from the 2015 Class at Tufts University School of Dental Medicine and the faculty involved in teaching the course were surveyed. The survey was anonymous and on paper and asked the students and faculty about their perception of the value of OSCE and the practical. The questions on the surveys were answered on a Likert Scale. Utilizing SPSS software, perceptions of OSCE and the practical exam were compared using the Wilcoxon Signed Rank Test.

RESULTS: There were strong correlations for each pair of questions that compared student perception of the OSCE and the practical. The practical scored higher in each category of the student survey. Due to the low number of total faculty surveys completed, analysis was not performed for faculty perception.

<table>
<thead>
<tr>
<th></th>
<th>Q12 – Q1</th>
<th>Q13 – Q2</th>
<th>Q14 – Q3</th>
<th>Q15 – Q4</th>
<th>Q16 – Q5</th>
<th>Q17 – Q6</th>
<th>Q18 – Q8</th>
<th>Q19 – Q9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

CONCLUSION: Compared to the practical, students found the OSCE to be a more negative experience. The students thought that the OSCE was not as relevant to the course material; the OSCE was not as well organized; they received less feedback; it did not motivate them to study harder; the experience was more stressful; and the exam was less fair. Comments from the survey showed that students thought the OSCE was a good idea, but time per station was limited. Student perceptions may have been affected by scheduling conflicts and changes, cancellation of the debriefing, and students tampering with the stations (the tampered station scores were adjusted). When the scores were combined with the practical, the OSCE helped some students pass the course, while no one failed the course because of the OSCE. Further research may involve investigating how students actually scored on the OSCE given the negative perception. It may also involve changing the OSCE in order to turn the exam into a positive learning experience.

Also presented at the 2014 ADEA Annual Session in San Antonio, Texas.
Comparing Immediate Tear Strength of Elastomeric Impression Materials

Elena Ciciolla,* Jesse Small, Masly Harsono, and Ronald Perry

OBJECTIVES: This study examines the immediate tear strengths (MPa) of elastomeric impression materials using the Boghosian and Lautenschlager Tear Strength Test Method and following the manufacturer minimum recommended setting time (MRST).

METHODS: Seven sample groups (n=20 each group) were created using a stainless steel mold (101.6 mm long, 19.05 mm wide, and 2.7 mm thick) and different elastomeric impression materials. A notch was created in the central region of each sample using a stainless steel insert that created either a 0.30 mm (n=10) or 0.50 mm thick (n=10) notch. Each mold was immersed in a water bath of 35±1°C for five minutes and removed. The elastomeric impression materials were loaded into the mold and immersed after 20 seconds for the manufacturer minimum recommended setting time. Specimen was removed from water bath, immediately placed into universal testing machine (Instron® 5582), and subjected to tensile force at a crosshead speed of 500 mm/min until failure.

Statistical analysis was conducted using one-way ANOVA with a post hoc Tukey HSD for pair wise analysis among groups. Statistical differences were predetermined at p<0.05.

RESULTS:

<table>
<thead>
<tr>
<th>Groups</th>
<th>Material</th>
<th>Average Stress MPa (Psi/mean±SD)</th>
<th>Average Stress MPa (Psi/mean±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mold 338 (0.50 mm thickness)</td>
<td>Mold 348 (0.30 mm thickness)</td>
</tr>
<tr>
<td>1</td>
<td>Aquasil™ Monophase (DENTSPLY Caulk)</td>
<td>607.541±39.013A</td>
<td>462.585±49.221F</td>
</tr>
<tr>
<td>2</td>
<td>Tissue Management Impression Material (DENTSPLY Caulk)</td>
<td>534.072±28.980B</td>
<td>493.367±28.320F</td>
</tr>
<tr>
<td>3</td>
<td>Tissue Management Impression Material Tray (DENTSPLY Caulk)</td>
<td>533.654±55.597B</td>
<td>497.955±58.582F</td>
</tr>
<tr>
<td>4</td>
<td>Imprint™ 4 Light (3M ESPE)</td>
<td>349.668±31.245C</td>
<td>287.535±55.853G</td>
</tr>
<tr>
<td>5</td>
<td>Take 1® Advanced (Kerr)</td>
<td>288.123±37.414D</td>
<td>253.665±22.578G</td>
</tr>
<tr>
<td>6</td>
<td>Flexitime® (Heraeus)</td>
<td>268.576±33.100D</td>
<td>256.620±9.212G</td>
</tr>
<tr>
<td>7</td>
<td>Impregum™ Soft Lightbody (3M ESPE)</td>
<td>175.791±21.673E</td>
<td>183.210±34.355H</td>
</tr>
</tbody>
</table>

Groups with the same letter superscript are not statistically different from one another.
Group 1 yielded statistically higher tensile strength compared to the other groups in the 0.5 mm thickness. For the 0.3 mm thickness, group 3 showed statistically higher tear strengths compared to groups 4, 5, 6, and 7.

**CONCLUSION:** Capturing crown and bridge margins accurately is critical for a well-fitting prosthesis. Impression materials should exhibit high tear strengths to avoid tearing in thin areas, such as those within the sulcus, when impression trays are removed from the mouth.

*Sponsored in part by DENTSPLY Caulk. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #501.*
Endodontic Treatment Outcomes in Patients with Sjögren’s Syndrome

Rachel Cohen,* Angel Park, Mabi Singh, and Athena Papas

OBJECTIVE: In patients with Sjögren’s Syndrome (SSP), hyposalivation has severe implications due to loss of the protective effects of saliva. Xerostomia promotes cariogenic bacteria, which attack tooth structure, often leading to root canal therapy (RCT). SSP report having 2.2 restorations/yr. vs. 0.8 restorations/yr. in peer controls despite spending on average $1,335.16/yr. vs. $503.57/yr. on dental work annually. We investigated the failure rate and factors associated with RCT in female SSP treated at Tufts University School of Dental Medicine in an effort to determine how best to manage treatment of SSP, all of whom have salivary hypofunction (<1.5 ml/min) and use preventive fluoride therapy.

METHODS: This retrospective study reviewed dental records from 115 SSP with radiographic evidence of RCT. RCT success and failure were assessed by evaluating radiographs and clinical notes. Failure was defined as missing RCT tooth on follow-up radiograph, periapical radiolucency, or documented pain on percussion. Salivary flow rates (SFR) and treatment information were collected from patient charts and activity status was determined. Association between SFR and endodontic failure was assessed using the Wilcoxon-Mann-Whitney test (SAS 9.2).

RESULTS: We were able to assess treatment outcomes in 79/115 active subjects with regular follow-up visits. Within these 79, 37.97% had at least one failure. Both unstimulated and stimulated SFRs between the success and failure groups were not statistically significantly different.

Table 1: Stimulated Salivary Flow (ml/min) Values by RCT Success or Failure

<table>
<thead>
<tr>
<th></th>
<th>RCT Success</th>
<th>RCT Failure</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>49</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>IQR</td>
<td>0.147–1.676</td>
<td>0.024–1.128</td>
<td>0.276</td>
</tr>
<tr>
<td>Median</td>
<td>0.632</td>
<td>0.385</td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td>0.000</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSIONS: A higher rate of endodontic failure in SSP compared to the general population was found. The SSP failure rate was almost double that reported in the literature for the general population, which ranges from 3.0–19.1%. Though not statistically significant, SSP with lower SFR have increased rates of RCT failure, despite prevention. Study limitations include small sample size due to missing follow-up radiographs where we were unable to determine RCT outcome. This high rate of RCT failure warrants further study.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1597.
Properties of Silk Electrogels: Functional Vehicles for Drug Delivery

John Constantine,1* Tyler Brady,1 Roberto Elia,2 Gerard Kugel,1 and David Kaplan2
1Tufts University School of Dental Medicine, Boston; 2Tufts University Department of Biomedical Engineering, Medford, Massachusetts

OBJECTIVE: To verify that dental implants coated with silk-based electrogels are capable of delivering therapeutic pharmaceuticals.

METHODS: Silk-based electrogels were grown directly on titanium studs for 20 seconds, generating a uniform coating. The silk solution was laced with pharmaceuticals prior to electrogelation. Pharmaceuticals included BMP-2, Streptomycin, and penicillin in differing combinations and concentrations. The resulting implants were tested for antibiotic release, BMP-2 release, and strength of attachment. For antibiotic release testing, electrogels were placed on fully prepared bacterial lawns of E. coli. The zone of inhibition was measured after 3 days. For measurement of BMP-2 release, BMP-2-treated electrogels were placed in phosphate buffered saline (PBS) and samples were taken at 0, 1, 3, and 6 hours. BMP-2 was also introduced directly onto mesenchymal stem cells (MSCs). Changes to MSCs were determined using ALP staining (a sign of osteogenic differentiation). The tensile strength of the electrogel adhesion was measured using an Instron®.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Zone of Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silk/Titanium</td>
<td>0.0±0.0</td>
</tr>
<tr>
<td>Penicillin</td>
<td>1 µg/ml 4.8 mm±0.79</td>
</tr>
<tr>
<td>Penicillin/3 µg/ml</td>
<td>6.5 mm±1.51</td>
</tr>
<tr>
<td>Penicillin/Streptomycin 3 µg/ml</td>
<td>8.2 mm±0.86</td>
</tr>
<tr>
<td>Penicillin/Streptomycin 1 µg/ml</td>
<td>10.4 mm±0.77</td>
</tr>
<tr>
<td>Penicillin/Streptomycin 2 µg/ml</td>
<td>11.5 mm±1.04</td>
</tr>
<tr>
<td>Penicillin/Streptomycin 3 µg/ml</td>
<td>11.7 mm±1.91</td>
</tr>
</tbody>
</table>

RESULTS: Penicillin Streptomycin created a larger zone of inhibition than did penicillin alone at all concentrations tested.

BMP-2 was released from electrogels and measured at 1 hour, 3 hours, and 6 hours.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>BMP Cumulative Concentration (ng/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 hr</td>
</tr>
<tr>
<td>Silk/Titanium</td>
<td>0</td>
</tr>
<tr>
<td>BMP-2 (1.5 µg/ml)</td>
<td>0</td>
</tr>
<tr>
<td>BMP-2 (3.0 µg/ml)</td>
<td>0</td>
</tr>
<tr>
<td>BMP-2 (6.0 µg/ml)</td>
<td>0.54</td>
</tr>
<tr>
<td>BMP-2 + Pen/Streptomycin (6.0 µg &amp; 6% Pen/Strep/ml)</td>
<td>0.57</td>
</tr>
<tr>
<td>BMP-2 Alone (6.0 µg/ml PBS)</td>
<td>0.54</td>
</tr>
<tr>
<td>BMP-2 Silk (no gel) (6.0 µg/ml)</td>
<td>0.88</td>
</tr>
</tbody>
</table>

There was no significant difference in adhesive strength between the different treatments (p 0.566).
CONCLUSIONS: Silk electrogels are capable of absorbing, storing, and releasing therapeutic drugs. Adhesion testing found incorporation of pharmaceuticals does not compromise strength. The results show promise for dental implants.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #489.
**Adiponectin Attenuates Inflammation by Regulating the Jmjd3-Irf4 Axis in Macrophages**

Donying Xuan,1 Matthew Devine,1* Lan Zhang,1 Qianqian Han,1 Yin Tang,1 Qisheng Tu,1 and Jake Chen1,2

1Division of Oral Biology, Tufts University School of Dental Medicine, Boston; 2Department of Anatomy and Cell Biology, Tufts University School of Medicine and Sackler School of Biomedical Sciences, Boston

**OBJECTIVE:** Polarization of macrophages between inflammatory (M1) and anti-inflammatory (M2) phenotypes plays a crucial role in wound healing and the systemic inflammatory state. Adiponectin, a factor secreted by adipose tissue (AT) and down-regulated in obesity, functions to switch macrophage polarization from M1 to M2, thereby attenuating chronic inflammation. However, little is known about the epigenetic mechanism underlying how adiponectin affects the macrophage state. In this study, we aimed to examine the relationship between adiponectin and the H3K27 demethylase Jmjd3 in regards to the Jmjd3-Irf4 axis, which is required for M2 polarization in macrophages.

**METHODS:** An established *P. gingivalis*-induced periodontal bone loss model was utilized with wild-type mice and adiponectin knockout (APN−/−) mice, then exogenous adiponectin was administrated to APN−/− mice. Jmjd3 and Irf4 expression was analyzed by RT-PCR and immunohistochemistry from collected gingival and AT (n=5). To analyze the possible molecular mechanism *in vitro*, bone marrow-derived macrophages were isolated from wild-type and APN−/− mice, then challenged with *Porphyromonas gingivalis* lipopolysaccharide (Pg-LPS) ± adiponectin. Jmjd3 and Irf4 expression was determined by RT-PCR (n=3).

**RESULTS:** The results exhibited that exogenous administration of adiponectin can abrogate periodontal bone loss, and cause reduction of macrophage infiltration into AT. RT-PCR results demonstrated that adiponectin can rescue the up-regulation of Jmjd3 and Irf4 expression *in vivo* in gingiva tissue and AT. Also, upregulation of Jmjd3 and RNA expression was mitigated in bone marrow-derived macrophages from APN−/− mice upon challenge with Pg-LPS. Moreover, this reduction in expression could be restored by pretreatment with adiponectin.
Bone marrow-derived macrophage mRNA expression

<table>
<thead>
<tr>
<th></th>
<th>APN&lt;sup&gt;-/-&lt;/sup&gt;</th>
<th>APN&lt;sup&gt;-/-&lt;/sup&gt; + adiponectin</th>
<th>APN&lt;sup&gt;-/-&lt;/sup&gt; + Pg-LPS</th>
<th>APN&lt;sup&gt;-/-&lt;/sup&gt; + Pg-LPS + adiponectin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jmjd3/GAPDH</td>
<td>1.31±0.662</td>
<td>5.92±1.75*</td>
<td>0.833±0.202</td>
<td>2.56±0.194***</td>
</tr>
<tr>
<td>IRF4/GAPDH</td>
<td>1.21±0.370</td>
<td>3.10±0.500**</td>
<td>1.08±0.186</td>
<td>2.78±0.437**</td>
</tr>
</tbody>
</table>

Asterisk indicates significance over APN<sup>-/-</sup> group. *p<0.05; **p<0.005
Asterisk indicates significance over APN<sup>-/-</sup> + Pg-LPS group. **p<0.005; ***p<0.0005

**CONCLUSIONS:** Our results demonstrate by gain- and loss-of-function approaches that adiponectin abrogates periodontal bone loss by regulating the Jmjd3-Irf4 axis to M2 polarization in macrophages. Understanding of epigenetic changes underlying the effect of adiponectin on macrophages may provide the basis for macrophage-centered epigenetic therapeutic strategies to control inflammation and promote wound healing.

Supported by NIH/NIDCR grant DE21464 and National Natural Science Foundation of China (grant 81271160) and an award from IADR/Academy of Osseointegration (AO) to JC. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1262.
Depth of Cure and Radiopacity of Select Composites

Sapan Bhatt, Michael Kreitzer, Daniel Dooley,* Ronald Perry, and Gerard Kugel

OBJECTIVES: To investigate the relationship between depth of cure and radiopacity for select composite materials.

METHODS: Four composite materials were tested: group 1, Aura™ (SDI, Australia); group 2, Luna™ (SDI); group 3, Llis™ (FGM, Brazil); and group 4, Opallis™ (FGM). Samples (n=6 for each group) were prepared in stainless steel tubular molds (8 mm x 4 mm internal diameter) according to the depth of cure protocol specified in ISO 4049. Half of the samples were cured for 10 seconds with a Radii Plus (SDI) curing light and the other half were cured for 20 seconds. Uncured composite was removed from the bottom of the sample, and the remaining composite height was measured with a caliper. Sample heights were then divided by two according to ISO 4049. Mean depth of cure and standard deviation were calculated for each sample. To measure radiopacity, one 1 mm x 15 mm diameter disc was prepared for each composite material and radiographs were taken using a 2200 digital radiograph machine set at 70kV, 4mA, 0.09s exposure time connected to a RVG6100™ digital imaging sensor. Radiopacity levels were determined from a 0.5 mm stepped aluminum wedge. One-way ANOVA and Tukey tests were conducted on depths of cure for each composite for both cure time (p<0.05, CI=95%).

RESULTS:

<table>
<thead>
<tr>
<th>Composite</th>
<th>Avg. Depth of Cure (mm)</th>
<th>10 sec</th>
<th>20 sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>2.38A</td>
<td>2.76A</td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td>2.76B</td>
<td>3.16B</td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td>1.67C</td>
<td>2.06C</td>
<td></td>
</tr>
<tr>
<td>Group 4</td>
<td>2.29A</td>
<td>2.94A,B</td>
<td></td>
</tr>
</tbody>
</table>

Materials with the same letter are not significantly different from each other.

<table>
<thead>
<tr>
<th>Composite</th>
<th>Radiopacity (mm Al)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>3.00</td>
</tr>
<tr>
<td>Group 2</td>
<td>1.84</td>
</tr>
<tr>
<td>Group 3</td>
<td>2.73</td>
</tr>
<tr>
<td>Group 4</td>
<td>3.12</td>
</tr>
</tbody>
</table>

CONCLUSION: While no relationship exists between radiopacity and depth of cure, the composites did vary significantly in depth of cure. For both the 10- and 20-second cure times, group 3 was the shallowest depth of cure and group 2 was the deepest. Group 1 and group 4 had similar cure depths.

Supported in part by SDI. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1160.
Elastic Recovery of Light-Bodied Impression Materials at Different Working Times

Lindsay Fox,* Ronald Perry, and Gerard Kugel

OBJECTIVE: To compare the elastic recovery behavior of five commercially available quick setting impression materials with a newly introduced Super-Quick vinylpolysiloxane (VPS) material Imprint 4™ (3M ESPE) and evaluate the effect of varied working times.

METHOD: Six groups (n=10 each group) of quick setting light body materials were analyzed for elastic recovery according to ISO4823:2000 standards (ADA No.19, 2004). Materials: 3M-ESPE-Imprint4™ (IP4), DENTSPLY-AquasilUltraXLV® (XLV), Heraeus-Flexitime®XtremeCorrectFlow (FTX), Kerr-Take1Advanced™ (T1A), Panasil-Initial-X-lightFast® (XLF), and GC-America-EXA'lence-LightBody™ (EXA). After a working time of 1:00 minute (according to ISO), the mold was placed into a 35°C water bath and allowed to set according to manufacturer’s directions; total set time (XLV, T1A, XLF, EXA) or fixed intraoral set time (IP4, FTX). A second experiment was performed with a shortened working time of 30 seconds (non-ISO standard).

RESULTS:

One-way ANOVA and Tukey tests were performed on percent recovery (p≤0.05).

<table>
<thead>
<tr>
<th>Working time</th>
<th>1:00 min</th>
<th>0:30 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP4</td>
<td>99.65 ±0.033</td>
<td>AB</td>
</tr>
<tr>
<td>XLV</td>
<td>99.41 ±0.064</td>
<td>D</td>
</tr>
<tr>
<td>T1A</td>
<td>99.70 ±0.081</td>
<td>AB</td>
</tr>
<tr>
<td>XLF</td>
<td>99.61 ±0.077</td>
<td>ABC</td>
</tr>
<tr>
<td>EXA</td>
<td>99.11 ±0.140</td>
<td>E</td>
</tr>
<tr>
<td>FTX</td>
<td>99.40 ±0.160</td>
<td>D</td>
</tr>
</tbody>
</table>

CONCLUSION: All materials performed above the minimum (96.5%) ISO standards for recovery. At 1:00 min, IP4 showed similar elastic recovery to T1A and XLF. At 30 seconds, IP4 showed similar recovery to only T1A. Within the materials with fixed intraoral set time, IP4 showed no significant difference between the two working times, while FTX was immeasurable at reduced working time. Within the materials with total set time, XLV showed a statistical improvement of elastic recovery with shorter working time while all other groups showed no significant difference.

Supported in part by 3M ESPE. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #280.
Pilot Study Analysis of Four Types of Digitally Processed Models

Ryan George,*1 Judyth Lee,1 M. Beyari,2 H. Lamfon,2 John Orfanidis,1 Matthew Finkelman,1 Masly Harsono,1 and Ronald Perry1

1Tufts University School of Dental Medicine, Boston; 2Umm Al-Qura University, Makkah, Saudi Arabia

OBJECTIVE: To perform a pilot study to test efficacy of using a three-dimensional (3D) evaluation of digitally-processed models to compare accuracy in fabrication methods using a conventional model as a control.

METHODS: A die of Tooth #3 was fabricated using four methods (N=3 each group): conventional analog model (CAM) (Impression: Heraeus Flextime; Die: GC America, Fuji Rock); scanned impression material (SIM) (Impression: Heraeus Flextime; Die: inverted using MeshLab software); extracted die from scanned impression material (EXSIM) (Heraeus Flextime); intraoral digitally-processed model (IO) (MHT). A typodont (Kilgore) was used as the master comparison model/control. The master model and all models from each group were scanned using Smart Optics 880 to create a digital sample. The scanner was calibrated according to manufacturer’s specifications before each use. Using Exocad software, each digital sample was digitally matched to the master model digital sample at the highest and lowest points on each, creating superimposed test samples (N=12). All superimposed test samples were imported into Geomagic Qualify 2012 software and analyzed using 3D analysis to collect data about size/shape differences (in the overall models and specifically in each upper and lower arch) between the digitally-processed models and the conventional model. Average maximum deviation and average minimum deviation were analyzed using Geomagic.

RESULTS:

<table>
<thead>
<tr>
<th>Group</th>
<th>3D Maximum Deviation</th>
<th>3D Minimum Deviation (µ)</th>
<th>3D Standard Deviation (µ)</th>
<th>Maximum Upper Deviation (µ)</th>
<th>Maximum Lower Deviation (µ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAM</td>
<td>0.0293</td>
<td>−0.0196</td>
<td>0.0480</td>
<td>0.4867</td>
<td>−0.4220</td>
</tr>
<tr>
<td>SIM</td>
<td>0.0267</td>
<td>−0.0236</td>
<td>0.0390</td>
<td>0.4930</td>
<td>−0.4990</td>
</tr>
<tr>
<td>EXSIM</td>
<td>0.1076</td>
<td>−0.0236</td>
<td>0.1513</td>
<td>0.6600</td>
<td>−0.1180</td>
</tr>
<tr>
<td>IO</td>
<td>0.0433</td>
<td>−0.0326</td>
<td>0.0796</td>
<td>0.6570</td>
<td>−0.6563</td>
</tr>
</tbody>
</table>

CONCLUSION: 3D analysis of all superimposed test samples resulted in comparable results. Further testing is necessary to determine if this method of evaluation is effective in testing accuracy of digitally processed models.

Comparison of Mechanical Properties of Dental Restorative Material

Vishavjeet Girn,* William Chao, Masly Harsono, Angel Park, and Gerard Kugel

OBJECTIVE: This study aims to evaluate and compare the compressive strength, diametric tensile strength, and flexural strength of four commercial tooth-colored restorative materials.

METHODS: Four groups (n=10 each) of restorative materials were tested. Samples were prepared according to DIN 53454 (ISO 9917 2001) and ISO Standard 4049 for compressive testing (CS), flexural strength (FS) and diametric tensile strength (DTS): a 4 x 8-mm² mold for CS; a 6 x 3.5-mm² mold for diametric tensile strength (DTS); a 2 x 2 x 2-mm³ mold for FS. The samples in groups 1 to 3 were cured with a halogen light from top and bottom surfaces for 40 seconds. Group 4 was self-polymerized according to manufacturer’s directions. Samples were then stored in distilled water for 24 hours to ensure polymerization of the material. All tests were performed using a universal testing machine (UTM) with 1 K load cell (Instron 5566A, Norwood, Massachusetts). For CS and DTS testing, a 4 mm/min cross head speed was used, while FS testing used a three-point bending fixture attach on a UTM machine at a 0.5 mm/min cross head. The distance between the two supports was set at 20 mm. The radius of each support was 1 mm. Differences among groups was tested with one way ANOVA and post hoc tests using Tukey’s HSD. Statistical significance was predetermined at level p<0.05.

RESULTS:

Mean values of four measurements of strength in four restorative materials

<table>
<thead>
<tr>
<th>Group</th>
<th>Material</th>
<th>Compressive Strength (MPa±SD)</th>
<th>Diametric Tensile Strength (MPa±SD)</th>
<th>Flexural Strength (MPa±SD)</th>
<th>Modulus of Elasticity (GPa±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Filtek™ Supreme Ultra (3M ESPE) Resin</td>
<td>286.89±63.72a</td>
<td>48.97±10.78d</td>
<td>126.67±12.73f</td>
<td>9.53±1.00i</td>
</tr>
<tr>
<td>2</td>
<td>ACTIVA BioActive Restorative (Pulpdent)</td>
<td>270.71±14.67a</td>
<td>44.44±4.43d</td>
<td>108.41±14.73g</td>
<td>4.45±0.29j</td>
</tr>
<tr>
<td>3</td>
<td>Ketac™ Nano (3M ESPE) RMGI</td>
<td>201.89±46.61b</td>
<td>12.85±5.71c</td>
<td>16.84±2.66h</td>
<td>2.89±0.54k</td>
</tr>
<tr>
<td>4</td>
<td>Fuji IX™ (GC America) GI</td>
<td>73.74±24.36c</td>
<td>6.00±1.49e</td>
<td>8.58±4.61h</td>
<td>2.57±1.40k</td>
</tr>
</tbody>
</table>

Means with the same superscript letter are not statistically different from one another.

CONCLUSION: Bioactive restorative group 2 demonstrates mechanical properties similar to a composite resin restorative material group 1. This study suggests that this new bioactive material has promising attributes as a dental restorative material comparable to resin composites and superior to RMGIs and GIs.

Association between Cumulative Grade Percent and Dental Licensure Exam Results

Jasmine Jenkins,* Paul Stark, and Yun Saksena

Many factors, some unrelated to academic performance, can impact whether a student passes a licensure examination. Considering the importance of these examinations on the careers of future dentists, it is valuable to study the relationships between performance in educational programs and the outcomes of such examinations. Thus, the purpose of this study was to compare the relationship between selected measures of academic performance and the outcomes on the North East Regional Board of Dental Examiners (NERB) and Western Regional Examining Board (WREB) licensing examinations. The dental students’ cumulative grade percentage served as the primary predictor when evaluating this relationship. Data were collected on three graduating classes at Tufts University School of Dental Medicine (2010–2012). Mean grades were compared between those who passed and those who failed their licensure examinations using t-tests. All analyses were performed using SPSS, Version 19. The Tufts Medical Center/Tufts University Health Sciences institutional Review Board approved this study. There were 416 students in the combined group who took one of the exams: 280 took the NERB and 136 took the WREB. Of the 416, the 112 failures had a mean (SD) GPA of 86.04 (3.93), and the 304 who passed had a mean (SD) GPA of 87.66 (3.80), p<0.001, indicating a statistically significant difference in GPA depending on licensure exam results.

CONCLUSION: The study found that students who passed the licensure examination had a statistically significantly higher cumulative GPA than those who did not, although the difference was only 1.6 percentage points. Though statistically significant, this is a very small difference practically. Such differences may not be discernable when grades are converted to a 4-point GPA. Further work needs to be conducted to determine whether academic performance is a good predictor of passing the licensure examinations.

Also presented at the 2014 ADEA Annual Session in San Antonio, Texas.
Paracrine Effects of Diabetic-Foot Ulcer Fibroblasts on Keratinocytes In Vitro

Rajvir Jutla,1* Anna Maione,1 Avi Smith,1 Behzad Gerami-Naini,1 A. Veves,2 L. Pradhans,2 Marjana Tomic-Canic,3 and Jonathan Garlick1

1Department of Oral and Maxillofacial Pathology, Tufts University School of Dental Medicine, Boston; 2Beth Israel Deaconess Medical Center, Boston; 3University of Miami, Miami, Florida

OBJECTIVES: Signaling between fibroblasts and keratinocytes is essential for proper wound healing but is thought to be dysregulated in the diabetic foot ulcer (DFU) environment. An engineered 3D human skin model was used to examine differences in the ability of DFU fibroblasts to support the differentiation and proliferation of human keratinocytes. The long-term goal is to develop improved therapeutic approaches for DFU repair.

METHODS: Fibroblasts were harvested from diabetic foot ulcers (DFU) and non-ulcerated diabetic feet (DFF) from Type II diabetic patients as well as from site-matched non-diabetic feet (NFF). DFU, DFF, or NFF fibroblasts were embedded in collagen gels, normal human keratinocytes (NHKs) were seeded on them, and tissues grown at air-liquid interface. Tissues were pulsed with BrdU for 6 hours, formalin-fixed, and paraffin embedded. Sections of these tissues were stained by H&E to visualize tissue development and for BrdU to identify proliferating cells. The number of BrdU-positive, basal keratinocytes were counted and expressed as a percentage of the total number of basal keratinocytes per 20x image.

RESULTS: H&E staining showed that all three fibroblast types (DFU, DFF, and NFF) were able to support keratinocyte development into a fully differentiated epidermal layer. However, keratinocytes grown on DFU fibroblasts were more proliferative than those grown on DFF fibroblasts (p<0.05). The number of proliferating keratinocytes grown on NFF fibroblasts was less than DFUs and greater than DFFs, although not statistically significant.

CONCLUSIONS: Our findings indicate that DFU fibroblasts stimulated increased keratinocyte proliferation in 3D tissues when compared with DFF fibroblasts, suggesting that the ulcer environment may direct paracrine signaling between fibroblasts and keratinocytes. This suggests a possible mechanism for the hyperproliferative keratinocytes found in the callus surrounding DFUs. This marks an important step towards understanding mechanisms that will help develop future regenerative therapies to treat oral and cutaneous wounds.

Supported by NIH Grant #RO1 DK98055-06A1 and the TUSDM Dean’s Scholars Program. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1038.
A Comparison of Conventional Intraoral Radiography and Sectional CBCT Imaging

Elaina Kazes,* Angel Park, Aruna Ramesh, and Virginia Karapanou

OBJECTIVES: This study measured agreement between conventional periapical (PA) radiographic images versus sectional CBCT images in identifying the position of maxillary molar root tips relative to maxillary sinus floor.

METHODS: The primary observer (OB1) categorized 130 tooth roots of posterior maxillary teeth into 4 groups based on the relationship of root tips to the maxillary sinus floor using CBCT images (Planmeca Romexis® Viewer) and corresponding PA images (MiPACS®). A second observer (OB2) categorized 40 random roots from the same sample as OB1 in both image modalities for observer comparison.

The images were classified as follows:

A: Root tips below the sinus floor
B: Root tips in contact with the sinus floor without sinus floor elevation
BB: Root tips in contact with the sinus floor in a lateral position, without sinus floor elevation
C: Root tips protruding within the sinus

RESULTS: Bowker’s test of symmetry and Cohen’s kappa tests were used to determine the level of agreement between the observers (OB1 and OB2), and between PA and CBCT.

Table 1: Level of Agreement between Observers

<table>
<thead>
<tr>
<th>Image Type</th>
<th>Sample Size</th>
<th>Bowker’s Test of Symmetry</th>
<th>Cohen’s Kappa Test</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>OB1 PA + OB2 PA</td>
<td>40</td>
<td>S=5.3, p=0.50</td>
<td>K=0.70</td>
<td>Strong agreement</td>
</tr>
<tr>
<td>OB1 CBCT + OB2 CBCT</td>
<td>40</td>
<td>S=3.3, p=0.77</td>
<td>K=0.53</td>
<td>Moderate agreement</td>
</tr>
</tbody>
</table>

Table 2: Level of Agreement between CBCT and PA

<table>
<thead>
<tr>
<th>Image Type</th>
<th>Sample Size</th>
<th>Bowker’s Test of Symmetry</th>
<th>Cohen’s Kappa Test</th>
<th>Notes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>OB1 PA + OB1 CBCT</td>
<td>130</td>
<td>S=69.3, p&lt;0.01</td>
<td>K=0.23</td>
<td>Weak agreement</td>
</tr>
<tr>
<td>OB2 PA + OB2 CBCT</td>
<td>40</td>
<td>S=22.0, p≤0.01</td>
<td>K=0.21</td>
<td>Weak agreement</td>
</tr>
</tbody>
</table>
Table 3: Percentage of Agreement between CBCT and PA

<table>
<thead>
<tr>
<th>Group</th>
<th>% Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (Root tips below the sinus floor)</td>
<td>68.6</td>
</tr>
<tr>
<td>B (Root tips in contact with the sinus floor without sinus floor elevation)</td>
<td>23.6</td>
</tr>
<tr>
<td>BB (Root tips in contact with the sinus floor in a lateral position, without sinus floor elevation)</td>
<td>12.1</td>
</tr>
<tr>
<td>C (Root tips protruding within the sinus)</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**CONCLUSIONS:** Statistical analysis shows agreement between the two observers in categorizing the PA and CBCT. As expected, the Kappa statistic was in low agreement when comparing PA and CBCT, the percentage of agreement being highest in group A (when the root tips are below the sinus floor) and lowest in group C (when the root tips protrude within the sinus).

*Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1420.*
**Oral Health Related Quality of Life in Primary Sjögren’s Syndrome**

*Samantha Keck,* Athena Papas, Matthew Finkelman, Britta Magnuson, and Mabi Singh

**OBJECTIVE:** This study investigated oral health related quality of life (OHRQoL) in patients with primary Sjögren’s Syndrome (PSS) using a web-based questionnaire.

**METHODS:** A comprehensive web-based questionnaire (Qualtrics) was created using the OHIP-14 Questionnaire and questions from the Harrison Interactive Survey on Sjögren’s Syndrome. After IRB review, the questionnaire was sent out by the Sjögren’s Syndrome Foundation (SSF) to their email list. Members of SSF were asked to forward the questionnaire to someone of similar age and same gender that had not been diagnosed with Sjögren’s Syndrome, which served as the comparison population. All data were de-identified.

**RESULTS:** There were 1,336 PSS and 165 comparison responses. All participants did not respond to every question. Demographics were: PSS, average age (range) 59.2 years (17–89), 96% female; comparison, average age (range) 58.4 years (18–83); 95.6% female. OHIP-14 responses were on a coded scale: never=0, hardly ever=1, occasionally=2, fairly often=3, and very often=4. The maximum additive OHIP-14 score was 56. A lower score indicated better OHRQoL. Each of the 14 questions of OHIP-14 was compared between the PSS population and the non-Sjögren’s Syndrome comparison population using Mann-Whitney U tests with the Bonferroni Correction for multiple testing. For each question, a higher frequency of “never” was reported in the comparison population, and a higher frequency of “very often” was reported in PSS. All 14 tests had a p-value of <0.001. The results were statistically significant. The additive OHIP-14 was also analyzed for PSS and the comparison population (Table 1). The p-value was <0.001, and the results were statistically significant.

**CONCLUSIONS:** The OHRQoL in PSS population was significantly decreased in all measures in comparison to a non-Sjögren’s population. PSS patients are reported to have poor oral health measures, and the results of this study may be a result of poor oral health affecting oral quality of life.

*Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1599.*
Retrospective Study of Oral Health Program in a Rural Zambian Community

Douglas Kim, * Wanda Wright, Alice Ko, Maryam Mahdavi, Angel Park, and John Morgan

OBJECTIVE: Oral health interventions and services in developing nations often focus on curative and emergency procedures. The aim of this study was to describe and assess the impact of an oral health program provided in a rural Zambian community. Elements of the program included oral health education, screening examinations, fluoride application and pain relieving extractions.

METHODS: Data was collected from screening examinations and treatment records during annual visits to a rural health center in Zambia from 2007–2012. Screening examinations were performed by qualified oral health providers and included treatment urgency scores (TU) as defined by the Association of State and Territorial Dental Directors (0=no obvious problem; 1=early dental problem; 2=urgent dental care required). Patient information was de-identified, entered into an Access database, and analyses completed in SAS (Version 9.2).

RESULTS: Preliminary results indicated that 2,375 individual patients were screened from 2007–2012. The least number of screening visits (192) was in 2007, the most (720) in 2012. Of the patients who were recommended curative treatments each year, an average of 42.7% required extractions. The percentage of patient visits with TU=0 was 27.8% in 2007 and 52.1% in 2012. From 2007 to 2011, the percentage of TU=2 visits was consistently about 1/2 of the total visits. The lowest percentage of TU=2 visits (32.1%) was reported in 2012.

CONCLUSION: Although most oral health intervention programs in developing nations focus on curative and emergency procedures such as extractions, the oral health program in this study also focused on prevention and education. In 2012, although the percentage for TU=2 was the lowest compared to previous years, the number of patients was greatest. These results are consistent with the program’s focus on prevention with an increase over time in the utilization of the program for preventive services.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1076.
Microleakage Evaluation of Beveling Cavosurface Margins in Composite Class-II Restorations

Julia Kim,* Stephanie John, Matthew Finkelman, Gerard Kugel, and Masly Harsono

OBJECTIVE: To observe the microleakage of Class-II composite restorations with or without beveled enamel cavosurface margins.

METHODS: A total of eighty Class-II preparations were prepared on caries-free extracted human molars by a single operator. All preparations were approximately 1.5 mm in depth at the pulpal floor and 2.5 mm at the gingival floor. Samples were randomly assigned into four groups, n=20 each, two groups with bevel (B), two groups without bevel (WB). Beveled groups had cavosurface margins of the occlusal and proximal walls of the preparations beveled approximately 1 mm at 45° angle. Two adhesive systems were used: Adper™ Scotchbond™ Multi-Purpose Plus Adhesive total etch-system (TE, 3M ESPE) and Adper™ Easy Bond Self-Etch Adhesive (SE, 3M ESPE). Adhesives were applied according to manufacturer’s instructions. Samples were filled with Filtek Supreme Ultra (3M ESPE) and cured for 30 seconds with an LED light (DEMI, Kerr).

After restorations were completed, samples were thermocycled for 10,000 cycles between 5°C and 50°C with a dwell time of 15 seconds and immersed in 50% ammoniacal silver nitrate solution for 3 hours and in a photo developing solution for 24 hours. Samples were embedded into acrylic and sectioned in the mesio-distal direction (Isomet, Buehler). Microleakage scores towards pulpal floor (P) and axial wall (A) were recorded under a light microscope (Olympus SZX16). Statistical analysis was conducted using an ordinal regression test. Statistical significance was predetermined at p<0.05.

RESULTS: The following table shows the number of samples in each scoring group.

<table>
<thead>
<tr>
<th>Microleakage score towards Pulpal Floor (P) / Axial wall (A)</th>
<th>Group 1 WB, TE</th>
<th>Group 2 WB, SE</th>
<th>Group 3 B, TE</th>
<th>Group 4 B, SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = no microleakage</td>
<td>4/6</td>
<td>1/1</td>
<td>13/11</td>
<td>4/4</td>
</tr>
<tr>
<td>1 = 25% towards (P)/(A)</td>
<td>13/11</td>
<td>11/7</td>
<td>5/8</td>
<td>12/6</td>
</tr>
<tr>
<td>2 = 50% towards (P)/(A)</td>
<td>1/2</td>
<td>6/8</td>
<td>2/1</td>
<td>3/8</td>
</tr>
<tr>
<td>3 = 75% towards (P)/(A)</td>
<td>2/1</td>
<td>0/1</td>
<td>0/0</td>
<td>1/1</td>
</tr>
<tr>
<td>4 = 100% towards (P)/(A)</td>
<td>0/0</td>
<td>2/3</td>
<td>0/0</td>
<td>0/1</td>
</tr>
</tbody>
</table>

WB=without bevel, B=bevel, TE=total etch, SE=self-etch.

CONCLUSIONS: Effect of beveling enamel cavosurface margins and using total etch adhesive systems on microleakage was statistically significant, and group 3 had the lowest microleakage in Class II composite restorations.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #841.
Assessment of Participants in Oral Health Project in Rural Zambia

Alice Ko,* Wanda Wright, Douglas Kim, Maryam Mahdavi, Angel Park, and John Morgan

OBJECTIVE: Effective design and implementation of preventive oral health programs in developing nations is challenging. Based on the proposed strategy of the World Health Organization (WHO), a prevention-focused oral health program has been implemented at a health center in a rural Zambian community. The aim of this study was to assess whether patients who had visits in successive years had less oral health urgency than those who attended only an initial visit.

METHODS: Data was collected from screening forms of yearly visits to the program from 2007–2012. All records were de-identified, exported to Access, and double entered, and crude bivariate analyses were completed in SAS. Treatment urgency (TU) of each patient visit was recorded as 0=no obvious problem; 1=early dental problem (restoration); 2=urgent care (toothache, infection). A total of 2,375 patients were screened. Of those, 212 were patients with multiple visits.

RESULTS: The number of patients seen in multiple years was 212, attending 479 visits. Of the 212 subjects, 81.1% visited twice, 12.7% three times, 5.2% four times, and 0.9% five times. Preliminary data analysis of the total visits indicates 174 (36.9%) were TU=0, 101 (21.4%) were TU=1, and 196 (41.6%) were TU=2. In 2007 the proportion of TU=0 was 25.0% and in 2012 it was 55.7%. The TU=2 decreased from 46.9% in 2007 to 25.5% in 2012.

CONCLUSION: Preliminary results indicate that the proportion of visits with TU=0 increased, while that of TU=2 scores decreased over the six-year period. This is consistent with a population seeking preventive oral health and not returning solely for urgent care. Although further investigation is needed, this evaluation suggests a promising method to determine if the oral health program implemented in a rural community of Zambia is working toward and supports WHO’s proposed strategy.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1077.
Strength Testing of Various Cements and Restorative Materials

Michael Kreitzer,* Sapan Bhatt, Ronald Perry, and Gerard Kugel

OBJECTIVES: Evaluate shear-bond-strength (SBS), compressive-strength (CS) and flexural-strength (FS) for select glass-ionomer (GI) cements and restorative-materials; CS and FS for select composites.

METHODS: Six GI-cements, five GI-restorative-materials, and four composites were tested (n=5). To test SBS, extracted human teeth embedded in epoxy-resin were sectioned with a diamond saw to remove enamel on the occlusal surface. After conditioning the dentin surface per manufacturer’s instructions (MI), a 6-mm plastic ring was centered over the bonding area and filled with test GI material. SBS was measured using a universal testing machine (Instron®, crosshead-speed: 0.75 mm/min), and results (MPa) were analyzed. CS samples were mixed per MI and placed into (3 x 5 mm) metal cylindrical molds on top of a Mylar strip resting on a glass slab. The mold was filled, all excess removed, and another Mylar strip on a glass slab was placed on top and secured with a paperclip. Samples were stored for 24 hours, removed from molds and broken using an Instron-machine (crosshead speed: 1.0 mm/min), and results analyzed. FS samples were mixed per MI and placed into metal rectangular molds (2 x 2 x 30 mm) on top of a Mylar strip resting on a glass slab. Samples were secured, stored for 24-hours, removed from molds, then broken using a 4-point bending ring with an Instron machine (crosshead speed: 1.0 mm/min), and results analyzed. Upon completion of all preparations, each sample was stored for 1 hour at 37°C (100%RH), removed, and immersed in deionized-water at 37°C for 23 hours before testing.

Group GI Cements
1. riva luting (SDI)
2. Ionomaster C (Wilcos)
3. Ionomaster F (Wilcos)
4. Maxxion C (FGM)
5. Vidrion C (SS White)
6. Vitro Cem (Nova DFL)

Group GI Restorative Materials
1. riva self-cure (SDI)
2. Maxxion R (FGM)
3. Vitro Fil (Nova DFL)
4. Vitro Molar (Nova DFL)
5. Ionomaster R (Wilcos)

Group Composites
1. Aura MC (SDI)
2. Luna (SDI)
3. Llis (FGM)
4. Opallis (FGM)

RESULTS: One-way ANOVA test and Tukey-post-hoc tests were used to find significant difference for each individual strength by material (p<0.05, CI=95%). All tests for GI cements, GI restorative materials, and composites showed statistical significance.
<table>
<thead>
<tr>
<th>GI Cements (n=5)</th>
<th>Avg. SBS (MPa±Std Dev)</th>
<th>Avg. CS (MPa±Std Dev)</th>
<th>Avg. FS (MPa±Std Dev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>riva luting</td>
<td>4.13±0.77*</td>
<td>100.1±7.11*</td>
<td>5.93±1.09*</td>
</tr>
<tr>
<td>Ionomaster C</td>
<td>3.87±1.35*</td>
<td>62.5±5.28*</td>
<td>5.63±0.96*</td>
</tr>
<tr>
<td>Ionomaster F</td>
<td>5.49±0.55*</td>
<td>96.1±11.5*</td>
<td>7.80±0.76*</td>
</tr>
<tr>
<td>Maxxion C</td>
<td>4.25±0.89*</td>
<td>56.1±5.18*</td>
<td>7.96±1.67</td>
</tr>
<tr>
<td>Vidrion C</td>
<td>10.2±3.10*</td>
<td>136.6±14.5*</td>
<td>11.7±2.90*</td>
</tr>
<tr>
<td>Vitro Cem</td>
<td>4.53±2.32*</td>
<td>61.3±8.99*</td>
<td>5.60±1.55*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GI Restorative (n=5)</th>
<th>Avg. SBS (MPa±Std Dev)</th>
<th>Avg. CS (MPa±Std Dev)</th>
<th>Avg. FS (MPa±Std Dev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>riva self cure</td>
<td>6.79±1.38*</td>
<td>158.1±18.8*</td>
<td>13.1±1.85*</td>
</tr>
<tr>
<td>Maxxion R</td>
<td>5.72±0.52*</td>
<td>82.2±2.06*</td>
<td>7.84±1.01*</td>
</tr>
<tr>
<td>Vitro Fil</td>
<td>3.49±1.55*</td>
<td>62.5±2.68*</td>
<td>8.57±1.63*</td>
</tr>
<tr>
<td>Vitro Molar</td>
<td>5.58±2.69*</td>
<td>103.2±19.3*</td>
<td>6.76±0.88*</td>
</tr>
<tr>
<td>Ionomaster R</td>
<td>1.48±0.87*</td>
<td>30.2±3.43*</td>
<td>*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Composites (n=5)</th>
<th>Avg. CS (MPa±Std Dev)</th>
<th>Avg. FS (MPa±Std Dev)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aura MC</td>
<td>354.7±25.5</td>
<td>103.9±8.1*</td>
</tr>
<tr>
<td>Luna</td>
<td>360.6±23.9</td>
<td>128.6±12.3*</td>
</tr>
<tr>
<td>Llis</td>
<td>313.2±28.9*</td>
<td>87.5±6.7*</td>
</tr>
<tr>
<td>Opallis</td>
<td>369.1±28.8*</td>
<td>102.9±10.9*</td>
</tr>
</tbody>
</table>

*Results with an asterisk (*) are statistically different (p<0.05).

**CONCLUSIONS:** Riva self-cure GI restorative material showed the highest SBS, CS, and FS, while Vidrion C had the highest SBS, CS, and FS for a GI cement. Luna composite had the highest FS value and Llis was significantly different from Opallis for CS testing.

*Sponsored in part by SDI. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1124.*
Effect of Mold Type on Depth of Cure

Hemanth Kunduru,1* Richard Price,2 and Ronald Perry1

1Tufts University School of Dental Medicine, Boston; 2Dalhousie University, Halifax, Nova Scotia, Canada

OBJECTIVES: The ISO 4049 standard for determining depth of cure uses a metal mold with a 4-mm diameter internal round hole. This mold design may not be clinically relevant (Flury et al. 2012). This study evaluated the effect of three different mold designs on the depth of cure of dental resin.

METHODS: Three resin composites from Ivoclar-Vivadent were measured: Tetric® Bulk fill IVA (A); Tetric Evoceram® A2 (B); and Heliomolar A2 (C). These composites were packed into a 10-mm deep metal or semi-transparent white Delrin mold with a 4-mm internal diameter circular hole, or a 10-mm deep metal mold with a 2-mm radius semi-circular hole. The top and bottom surfaces were covered with Mylar strips and pressed flat using a glass slide, which was then removed. Composites A and B were exposed to a Bluephase® G2 curing light for 10 s on high, and C was exposed for 15 s. Immediately after light curing, the specimens were removed from the molds and the soft composite scraped away with a plastic spatula. The remaining hard composite was measured with a digital micrometer and divided by two. Ten specimens of each composite were made in each mold. ANOVA and Fishers post-hoc multiple comparison tests were used to compare the mold effect on the depth of cure.

RESULTS: The depth of cure ranged from 1.3 to 4.9 mm depending on the composite and mold used.

<table>
<thead>
<tr>
<th>Mold</th>
<th>Composite</th>
<th>Depth of Cure (mm)</th>
<th>S.D. mm</th>
<th>Difference from ISO Mold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular Semi-Transparent Delrin</td>
<td>A</td>
<td>4.9</td>
<td>0.1</td>
<td>+81%</td>
</tr>
<tr>
<td>Circular Semi-Transparent Delrin</td>
<td>B</td>
<td>4.2</td>
<td>0.2</td>
<td>+83%</td>
</tr>
<tr>
<td>Circular Semi-Transparent Delrin</td>
<td>C</td>
<td>3.4</td>
<td>0.2</td>
<td>+127%</td>
</tr>
<tr>
<td>Circular Metal</td>
<td>A</td>
<td>2.7</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Circular Metal</td>
<td>B</td>
<td>2.3</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Semi-Circular Metal</td>
<td>A</td>
<td>2.2</td>
<td>0.1</td>
<td>−19%</td>
</tr>
<tr>
<td>Semi-Circular Metal</td>
<td>B</td>
<td>1.9</td>
<td>0.2</td>
<td>−17%</td>
</tr>
<tr>
<td>Circular Metal</td>
<td>C</td>
<td>1.5</td>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>Semi-Circular Metal</td>
<td>C</td>
<td>1.3</td>
<td>0.1</td>
<td>−13%</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Mold design had a significant effect on the depth of cure for all three composites. Composite A cured to a greater depth compared to B or C (p<0.05). Composite A did not achieve a 4 mm depth of cure in either metal mold when the Bluephase G2 was used for 10 seconds. Composite B did achieve a 2 mm depth of cure in the circular metal mold.

This study was supported by Ivoclar-Vivadent and by Tufts and Dalhousie Universities. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1152.
All Ceramic Restorations: A Clinical Case

Chase Larsen,* Guilherme Valverde, William Lobel, Nopsaran Chaimattayompol, and Hans-Peter Weber

Over the past few decades, ceramic materials have been widely used in prosthetic dentistry because of their excellent esthetics and biocompatibility. Associated with improved microstructure and physical properties, all-ceramic crowns and their use have expanded in the field of dentistry as an alternative treatment for dental defects. Clinical data and years of experience suggest that they may be as reliable as metal-ceramic crowns in appropriate situations. The present work depicts a clinical case where six anterior IPS e.max® crowns (Ivoclar Vivadent) were fabricated for a patient in the pre-doctoral clinic at Tufts University. A 46-year-old woman presented in July 2012 with a desire to enhance the esthetics of her smile. A clinical and radiographic examination revealed extensive composite restorations on her maxillary incisors with poor contour, inconsistent color, and recurrent decay. Overhanging margins and inadequate plaque removal had contributed to periodontal inflammation with moderate loss of attachment but limited mobility in the maxillary anterior sextant. The treatment plan included periodontal therapy, endodontic therapy, the placement of direct restorations for carious lesions in posterior teeth, and the placement of six all-ceramic full-coverage crowns on the maxillary anterior teeth. Upon completion of the first two phases of treatment, the maxillary anterior teeth were prepared for all-ceramic crowns. As an alternative to a traditional wax mock-up, the desired position and contour of the crowns was determined by fabricating provisional crowns directly on the tooth preparations using BlueLine® DCL denture teeth (Ivoclar Vivadent) and acrylic. The occlusion, profile of emergence, crown length, and lip support could all be adjusted and verified intraorally using this technique. A stone model of the provisional restorations was sent, along with the final impression, to aid the lab technician in the fabrication of the final crowns. All-ceramic restorations are designed to provide clinicians with a reliable option for treating dental defects in areas of esthetic concerns while maintaining the advantages of indirect restorations. This case provides interested clinicians with one technique by which to begin integrating all-ceramic restorations into their routine practice.
Effect of Curing Light on Depth of Cure

Hemanth Kunduru,1 Richard Price,2 Judyth Lee,1* and Ronald Perry1
1Tufts University School of Dental Medicine, Boston; 2Dalhousie University, Halifax, Nova Scotia, Canada

OBJECTIVES: To evaluate the effect of three different curing lights on the depth of cure of one bulk fill resin composite.

METHODS: One Ivoclar-Vivadent resin composite Tetric® bulk fill IVA (TBF) was light cured for 10 seconds in a 10-mm deep metal mold with a 2-mm radius semi-circular hole. The top and bottom surfaces were covered with Mylar strips and pressed flat using a glass slide, which was then removed. Three different curing lights were used for 10 seconds each: Bluephase® G2 (BP), Demi Plus (DP), and Woodpecker® LED D (WP). Immediately after light curing, the specimens were removed from the molds and the remaining soft composite scraped away with a plastic spatula. The length of the remaining hard composite was measured with a digital micrometer. This number was then divided by two. Ten specimens of composite were made for use with each curing light. An ANOVA and Fisher post-hoc multiple comparison test was used to compare the effect of the curing lights on the depth of cure.

RESULTS: The depth of cure ranged from 2.5 mm to 2.6 mm depending on the curing light used.

<table>
<thead>
<tr>
<th>Curing Light</th>
<th>Depth of Cure (mm)</th>
<th>S.D. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP</td>
<td>2.6</td>
<td>0.07</td>
</tr>
<tr>
<td>BP</td>
<td>2.5</td>
<td>0.60</td>
</tr>
<tr>
<td>WP</td>
<td>2.5</td>
<td>0.10</td>
</tr>
</tbody>
</table>

No significant difference between curing lights (p<0.01)

CONCLUSIONS: When tested immediately after light curing, the choice of curing light had no effect on the depth of cure (p<0.01). In this metal mold, the bulk filling resin composite TBF did not achieve the 4-mm depth of cure stated by the manufacturer when these lights were used for 10 s.

This study was supported by Ivoclar-Vivadent and by Tufts and Dalhousie Universities. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #313.
Tufts University School of Dental Medicine Geriatric Patients Oral Quality of Life

Jennie Leikin,* Matthew Finkelman, Britta Magnuson

OBJECTIVE: To take a sample of geriatric patients at Tufts University School of Dental Medicine (TUSDM) to examine geriatric patient’s quality of life (as measured by the Geriatric Oral Health Assessment Index (GOHAI)) and oral health status (as measured by periodontal status, number of missing teeth, presence of decay, and presence of restorations).

METHODS: IRB approval was obtained and 35 geriatric patients (aged ≥65) at TUSDM were consented for participation in this study. They were each surveyed using the GOHAI questionnaire, demographic information was collected, and periodontal status was recorded. AxiUm records were reviewed for dental status information. Descriptive statistics were reported. The Kruskal-Wallis test was used to assess the statistical significance of the association between periodontal status and GOHAI score. P-values less than 0.05 were considered significant. SPSS Version 19 was used.

RESULTS: The patients surveyed included 19 females and 16 males. They included 33 white subjects, 1 black/African American subject, and 1 Asian subject. Of these, 24 subjects were aged 65–74 years, 9 subjects were aged 75–84 years, and 2 subjects were aged 85–94 years. Scoring of GOHAI was on a scale of 0–60. The GOHAI median for this population was 18, with a range of 9 to 34. Five subjects were diagnosed with clinical periodontal health; 13 subjects were diagnosed with gingivitis; and 17 subjects were diagnosed with periodontitis. The healthy subjects had a median GOHAI score of 18.00, with an interquartile range of 2.00. The gingivitis subjects had a median GOHAI score of 16.00, with an interquartile range of 9.00. The periodontitis subjects had a median GOHAI score of 19.00, with an interquartile range of 8.00. The p-value was 0.163.

CONCLUSION: This study showed insufficient evidence that periodontal status is associated with the GOHAI score in geriatric patients at TUSDM. Further analysis of the number of missing teeth, the presence of decay, and the presence of restorations is necessary to qualify oral health status of geriatric patients and its association with the GOHAI score at TUSDM.
The Relationship between Learning Modality and Academic Performance

*Heather Leung, Paul Stark, and Yun Saksena*

**BACKGROUND:** A majority of dental faculty teach in a single mode, the lecture. However, the mode by which students assimilate information varies depending on age, gender, experience, and personality. This study aimed to explore the possible relationship between the dominant learning sensory modalities of undergraduate dental students at Tufts University School of Dental Medicine (TUSDM) and their academic performance in the following three first-year didactic courses: Biochemistry, Gross Anatomy, and Operative Dentistry (practical component).

**MATERIALS AND METHODS:** Student preferences in learning were assessed by a learning preferences instrument called the VARK (visual, aural, read/write, kinesthetic) survey. Following approval from the Institutional Review Board, the sixteen-item questionnaire was emailed via Qualtrics to 380 pre-doctoral students of the 2015 and 2016 classes at TUSDM. An overall 15.3% response rate was obtained. Due to a relatively small sample size (n=58), the non-parametric Kruskal-Wallis test was used to compare the grades of three courses (Gross Anatomy, Biochemistry, and Operative Dentistry) across the four sensory modality groups (V, A, R, K). Pairs of modalities were compared using Mann-Whitney U tests. All statistical analyses were performed using SPSS Version 21.

**RESULTS:** Biochemistry grades differed across the learning modalities (p=0.017). The read/write modality had the highest median (range) GPA, 3.7 (1.0), followed by kinesthetic, 3.3 (1.7), then visual, 3.2 (1.3), and aural, 3.0 (1.7). There was a statistically significant difference between modality groups A and R (p=0.003) and modality groups R and K (p=0.020). No statistically significant differences were found in Gross Anatomy (p=0.071) or Operative Dentistry (p=0.495) between the four learning modalities.

**CONCLUSIONS:** This study found that median grades differed across learning modalities for Biochemistry, but not Gross Anatomy or Operative Dentistry. This might suggest that different learning styles process information differently. However, due to our low response rate, more work needs to be done before meaningful conclusions can be drawn.

*Also presented at the 2014 ADEA Annual Session in San Antonio, Texas.*
Penetration Depths of Different Retraction Pastes
Wei Liu,* Masly Harsono, Ronald Perry, and Gerard Kugel

OBJECTIVE: To measure the depth of gingival penetration for three retraction paste materials.

METHODS: In a polystyrene mold (30 mm x 30 mm x 12 mm), Post-It® Index Notes (3M™) were used as placeholders to create a simulated gingival sulcus 8 mm deep with widths of 0.06 mm, 0.13 mm, and 0.19 mm. The mold was filled with Permadyne™ (3M ESPE™) automixed polyether impression material (Pentamix™ 3M) to simulate the gingiva. After setting, the elastomeric block was removed from the mold and the upper edge cut at 45°, replaced in the mold, and mass measured. Three retraction pastes were added to the sulci according to manufacturer’s instructions. Depth measurements were taken. Each material was measured 8 times at each sulcus width. Statistical analysis was done by one-way ANOVA with post-hoc analysis conducted via Tukey’s HSD. Significance differences were predetermined at p<0.05.

RESULTS: The average and standard deviation of three retraction pastes with three different sulcus widths were calculated.

<table>
<thead>
<tr>
<th>Sulcus Width</th>
<th>Experimental Product 1</th>
<th>Experimental Product 2</th>
<th>Experimental Product 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.06</td>
<td>2.291±0.825</td>
<td>3.553±0.853</td>
<td>3.493±0.584</td>
</tr>
<tr>
<td>0.13</td>
<td>6.657±1.248</td>
<td>6.055±0.799</td>
<td>6.931±1.162</td>
</tr>
<tr>
<td>0.19</td>
<td>7.350±1.017</td>
<td>6.702±0.789</td>
<td>7.685±1.096</td>
</tr>
</tbody>
</table>

CONCLUSION: At all sulcus width (0.06 mm, 0.13 mm), Experimental Product 1 paste was inserted to deeper depths than Experimental Product 2 paste. At two narrower sulcus widths (0.06 mm and 0.13 mm), Experimental Product 1 paste was able to penetrate deeper than Experimental Product 3 paste. Yet at those sulcus widths, Experimental Product 2 paste did not penetrate significantly deeper than Experimental Product 3 paste. However, at the widest sulcus width (0.19 mm), Experimental Product 2 paste demonstrated better penetration comparing to Experimental Product 3 paste. In addition, Experimental Product 1 paste is not significantly better in 0.19 mm sulcus width than Experimental Product 3 paste.

Sponsored in part by DENTSPLY Caulk. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1175.
Demographic/Utilization Information for an Oral Health Program in Rural Zambia

Maryam Mahdavi,* Wanda Wright, Douglas Kim, Alice Ko, Angel Park, and John Morgan

OBJECTIVE: According to the World Health Organization, limited literature exists on outcomes of dental aid organizations (DAOs). This study provided demographic and utilization information regarding participants for a preventive focused oral health project in rural Zambia.

METHODS: From 2007 to 2012, oral health personnel screened 2,375 individuals attending an oral health program based at a rural Zambian health center. Program elements included dental education, prevention including fluoride application, and pain relieving extractions. A screening instrument based on the Association of State and Territorial Dental Directors was used. Age, gender, untreated caries (UCs), and pain were recorded for each visit. Data were de-identified, entered into an Access database, and analyzed using SAS (Version 9.2).

RESULTS: Preliminary results indicated participants ranged in age from 2 to 92 [mean age (SD) = 26.4 (17)] and 62.1% were female. Of the study population, 41.3% were aged 19 or younger, 54.3% were between 20 and 59 years, and 4.3% were over 60 years. At the first recorded visit, pain was reported by 51.7% of participants and UCs identified in 64.2%. For those ≤19 years, 22.0% reported pain and 34.3% had UCs. In the 20- to 59-year age range, 72.6% reported pain and 84.9% had UCs. For those ≥60 years, 68.9% reported pain and 94.2% had UCs. Pain was reported by 56.2% of the females and 44.8% of the males respectively (p<0.01).

CONCLUSIONS: High disease prevalence was reported in the study population. Over half of the participants were aged 20–59. Prevalence of pain and UCs was highest in the older age groups. Less pain was reported by men than women, with men underrepresented in the study population. This study demonstrated a method of program outcomes assessment. Project enhancement strategies include improved recruitment for those under 20, community mobilization to reach those over 60, and outreach activities to achieve more participation by men.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1078.
Microleakage Evaluation of Restorations Sealed with a CO₂ Laser

Alissa Mariano,* Christopher Beninati, Christina Penn, Daniel Dooley, Ronald Perry, Gerard Kugel, and Masly Harsono

OBJECTIVE: To evaluate microleakage of restorations sealed with the 9.3 µm Solea™ Dental Laser System (Convergent Dental) at 3 outputs.

METHODS: Thirty-six non-carious extracted human molars were prepared with Class V restorations on the buccal and lingual surfaces. The preparations were completed in the cervical 1/3 using a Midwest Tradition L Hand Piece (DENTSPLY) with a #330 bur. The restorations were approximately 1.5 mm deep and trapezoid shaped, with flat/straight occlusal and gingival outlines and axial walls following the tooth contours. Both buccal and lingual restorations were total etched and coated with Peak® LC Bond (Ultradent Products) and filled with FilkTek™ shade A4 (3M ESPE) according to manufacturers’ instructions. The samples were randomly assigned to three treatment groups:

<table>
<thead>
<tr>
<th>Sample Group</th>
<th>Sample Size</th>
<th>Solea Laser System</th>
<th>Soft Tissue Setting</th>
<th>Power Output</th>
<th>Water Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1: High Power</td>
<td>12</td>
<td>1.00 mm</td>
<td>100%</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Group 2: Medium Power</td>
<td>12</td>
<td>1.00 mm</td>
<td>100%</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Group 3: Low Power</td>
<td>12</td>
<td>1.00 mm</td>
<td>50%</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

The lingual margins were laser-irradiated with a single pass along the margin with the laser 4–7 mm from the lingual/cervical surface. Restorations were finished and polished using Super-Snap® Finishing and Polishing (Shofu). Microleakage evaluation was completed after 2,000 thermocycles followed by immersion in 50% ammoniacal silver nitrate and photo developing solutions. Samples were sectioned longitudinally and silver dye penetration was observed with a stereo microscope (Olympus SZX 16). Two independent readers recorded microleakage scores on the cervical margin of both restorations based on a whole number scale from 0 to 4:

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>No evidence of dye penetration at the tooth/restoration interface.</td>
</tr>
<tr>
<td>25%</td>
<td>Dye penetration less than half the length of the cervical floor.</td>
</tr>
<tr>
<td>50%</td>
<td>Dye penetration up to the full length of the cervical floor.</td>
</tr>
<tr>
<td>75%</td>
<td>Dye penetration up to half the length of the axial wall.</td>
</tr>
<tr>
<td>100%</td>
<td>Dye penetration greater than half the length of the axial wall.</td>
</tr>
</tbody>
</table>

Analysis was conducted using Wilcoxon Signed Rank test (p<0.05).

RESULTS: Group 1 demonstrated the lowest mean score on the lingual surface. Group 3 demonstrated the highest mean score on the lingual surface. Group 3 resulted in a statistically higher microleakage score on the lingual surface.
<table>
<thead>
<tr>
<th>Group</th>
<th>Microleakage Score of Lingual Lased Surface Mean±Std Dev (n=24)</th>
<th>Microleakage Score of Buccal Control Surface Mean±Std Dev (n=24)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>0.54167±0.64415</td>
<td>0.66667±0.94281</td>
<td>0.7188</td>
</tr>
<tr>
<td>Group 2</td>
<td>0.58333±0.86201</td>
<td>0.95833±1.05984</td>
<td>0.2189</td>
</tr>
<tr>
<td>Group 3</td>
<td>1.29167±1.27407</td>
<td>0.25000±0.82916</td>
<td>0.0015</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Varying the power at higher intensity demonstrates lower average microleakage scores and appears to show marginal sealing; however, the laser may etch or discolor the margin as it seals at high powers. Other studies are required to determine optimal power outputs.

*Sponsored in part by Convergent Dental. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #855.*
Student Self-Evaluation vs. Faculty Assessment of Operative Competencies: An Analysis of Calibration

Lauren Marzouca,* Bradley Belous,* Christopher Paolino, Steven Eisen, Gerard Kugel, and Matthew Finkelman

OBJECTIVE: Practicing dentists rely heavily on their ability to self-evaluate their work in order to provide the highest level of oral health care. Accordingly, a comprehensive goal of dental education is to foster a self-critiquing mind. Although many academic research studies have examined clinical aptitude, few studies have examined the effectiveness of student self-evaluation in the preclinical setting. We aim to determine if students truly comprehend how to objectively assess their own operative dentistry preparations and restorations by comparing and contrasting calibrated professor scoring and first-year dental student self-evaluation.

METHODS AND RESULTS: The Tufts University School of Dental Medicine (TUSDM) class of 2016 took their regularly scheduled operative dentistry preclinical practical examination on April 20, 2013, and May 2, 2013 (half of the class at a time). The class was told about the study prior to the practical examination, IRB approval was achieved, and the students were shown an information sheet describing the study. Upon completion of the #3 MO amalgam restoration practical examination, students self-evaluated their own work. The students left their self-assessment forms at their simulation clinic seats, and the forms were collected after all students left the examination room. Finally, the professors evaluated the amalgam restorations using normal grading procedures. Two randomized and calibrated instructors collaboratively scored each student’s practical on a 10-point scale, with the lowest passing score being a 7. The scale also included half-points (e.g. 7.5, 9.5, etc.). All students and faculty used identical grading forms. The student score and the professor score were linked using only the simulation clinic chair number. The study data were not linked to any identifiable information.

CONCLUSION: Based on a #3 amalgam MO restorative operative dentistry practical whereby the entire TUSDM class of 2016 was asked to volunteer in a self-assessment, it was found that there was a significant difference between student self-evaluation and professor generated scores. One hundred fifty-eight (n=158) students chose to participate: roughly 85% of the class. Twenty-three point four percent (23.45%) of students graded themselves exactly the same as the professors. Of the student grades that differed from the professors’ grades, 53.1% scored themselves higher; the largest percentage of students scored themselves higher by only 0.5 points (21.5%). Of the remaining students’ scores that differed from the professors’ scores, 23.4% of students graded themselves lower. Of this 23.4%, the majority of students graded themselves lower by only 0.5 points (14.6%). These data demonstrate that students tended to score themselves higher, rather than lower, by a ratio of 25:11. A paired samples t-test also revealed that students (M=8.38, SD=0.92) scored themselves higher than...
Predoctoral Student Presentations

professors (M=8.04, SD=1.06) overall (p<0.001). A Spearman correlation revealed a statistically significant weak negative correlation of −0.304 (p<0.001), when students’ grades and the absolute difference between students’ grades and professor grades were compared. Hence, as a student scored himself or herself higher, the numerical absolute difference between the student grade and the professor grade decreased. Conversely, as students’ grades decreased, the absolute difference between the two grades became greater. This finding alludes to the fact that students with lower grades are not as familiar with an ideal preparation or restoration when compared to the higher-scoring subset of students. Perhaps, then, the lower scoring students’ inability to perform well during operative dentistry preclinical practical examinations could be attributed to a lack of calibration, rather than inherently poor hand skills. This lack of calibration could be attributed to low class attendance, lack of attention during calibration sessions, or disconnect between faculty instruction and student interpretation. Given the significant findings of this study, it may be appropriate to experiment further with blind student grading on a larger scale and with a wider scope to retest the hypothesis. Therefore, this study will be replicated with the TUSDM class of 2017 during the 2013–2014 academic year. Six varied operative dentistry practicals will be included.
Shear Bond Strength of Different Dentin and Zirconia Treatments

Kyler McEwen,1* Masly Harsono,1 R. Tuttle,2 and Ronald Perry1
1Tufts University School of Dental Medicine, Boston; 2Ultradent Products, Inc., South Jordan, Utah

OBJECTIVE: To compare shear bond strength (SBS) values on dentin with differently treated dentin and zirconia.

METHODS: One hundred sixty-eight 3.5-mm diameter zirconia buttons were sintered, air-abraded, and set aside. Each zirconia button has four 25-micron-high feet to ensure even and uniform cement thickness. Eighty-four de-identified, non-carious, extracted human molars were sectioned longitudinally to produce 168 specimens; each were embedded in acrylic resin and polished with 600-grit grinder to expose clean, smooth dentin. Specimens were randomly divided into 7 groups. In groups 1–3, the zirconia was air-abraded only. In groups 4–7, zirconia was air-abraded and treated with Peak™ Z Primer (PZ), bonded, and light cured. Information is listed in Table 1. Each group was incubated in water for 24 hours at 40°C. SBS testing was performed on an Ultra Tester machine (Ultradent™, 91043/KB3) at a crosshead speed of 1 mm/min. Mode of failure was observed at the bond-bond interface using a stereo microscope.

A one-way ANOVA was used to test the SBS among the different treatments. Pairwise differences were determined using post-hoc Fisher LSD tests. Statistical significance was determined at p<0.05.

Table 1:

<table>
<thead>
<tr>
<th>Group (n=24/group)</th>
<th>Etchant</th>
<th>Bond</th>
<th>Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>UE</td>
<td>PUB</td>
<td>UC</td>
</tr>
<tr>
<td>2*</td>
<td>NONE</td>
<td>PSE + PUB</td>
<td>UC</td>
</tr>
<tr>
<td>3*</td>
<td>TE</td>
<td>EVP</td>
<td>UC</td>
</tr>
<tr>
<td>4†</td>
<td>UE</td>
<td>PUB</td>
<td>UC</td>
</tr>
<tr>
<td>5†</td>
<td>NONE</td>
<td>PSE + PUB</td>
<td>UC</td>
</tr>
<tr>
<td>6†</td>
<td>TE</td>
<td>EVP</td>
<td>UC</td>
</tr>
<tr>
<td>7‡</td>
<td>TE</td>
<td>EVP</td>
<td>UC</td>
</tr>
</tbody>
</table>

Ultradent™ Products: 35% UltraEtch™ (UC), Peak™ Universal Bond (PUB), UltraCem™ (UC), Peak Z (PZ)
Ivoclar™ Products: 37% Total Etch™ (TE), ExcITE™F Viva Pen (EVP)
RESULTS:

<table>
<thead>
<tr>
<th>Group</th>
<th>Adhesive System</th>
<th>Mean Shear Bond Strength (MPa±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>UE + PUB + UC</td>
<td>10.21±5.77 b</td>
</tr>
<tr>
<td>2*</td>
<td>PSE + PUB + UC</td>
<td>14.08±8.11 a</td>
</tr>
<tr>
<td>3*</td>
<td>TE + EVP + UC</td>
<td>8.09±4.36 b</td>
</tr>
<tr>
<td>4†</td>
<td>UE + PUB + UC</td>
<td>5.34±2.75 c</td>
</tr>
<tr>
<td>5†</td>
<td>PSE + PUB + UC</td>
<td>9.56±4.25 b</td>
</tr>
<tr>
<td>6†</td>
<td>TE + EVP + UC</td>
<td>9.39±4.57 b</td>
</tr>
<tr>
<td>7‡</td>
<td>TE + EVP + UC</td>
<td>6.70±3.26 c</td>
</tr>
</tbody>
</table>

CONCLUSIONS: Shear bond strength of group 2 was statistically higher than all other groups. Therefore, using PSE and PUB on air-abraded zirconia could increase clinical bond strength of zirconia to dentin. This could eliminate the need for a zirconia primer. Further testing is needed.

Characterization and Mapping of Two Novel Zebrafish Mineralized Tissue Mutants

Sharod McKinney,* Azadeh Zadmehr, and Pamela Yelick

OBJECTIVES: Mineralized tissue defects in developmentally staged 152N and 156N zebrafish mutants were characterized, and DNA was collected from 40 individual 152N/156N mutants and 40 individual wild-type (WT) sibling zebrafish for next generation mapping. The goal of these studies is to better understand the growth patterns of mineralized tissue in WT and 152N/156N mutant zebrafish.

METHODS: Zebrafish bred and raised from heterozygous 152N and 156N parents were monitored and imaged for several weeks using bright field and fluorescent microscopy. Mineralized tissue formation was assessed by vital staining with 2% Calcein solution for one hour at room temperature, followed by a one-hour rinse in zebrafish system water. Bright field and fluorescent images were then obtained on anesthetized zebrafish using a Zeiss M2Bio microscope.

RESULTS: At 9 weeks post-fertilization (wpf), 152N mutants were identified by eye and exhibited abnormal growth of all fins, appearing thicker and brittle as compared to age matched WT siblings. Calcein staining revealed increased mineralized tissue formation relative to WT siblings. The 156N mutants were examined over a 4-week period from 4 to 8 wpf. Homozygous 156N mutants were not easily identified by eye, but were found to exhibit delayed fin ray mineralization and segmented calcification of fin rays when stained.

CONCLUSIONS: Both 152N and 156N mutations result in abnormal growth of mineralized fin ray tissue in zebrafish. The 152N mutation results in atypically thick and brittle bone growth in the fins. In contrast, the 156N mutation results in retarded mineralized fin ray growth as compared with age-matched WT siblings. In addition, 156N mutants exhibited discontinuous mineralized fin ray growth as compared to the continuous fin ray mineralization pattern observed in WT siblings. We anticipate that further elucidation of the genes mutated in each mutant will identify novel regulators of bone growth to facilitate bone regeneration and repair.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1568.
Shear Bond Strength Tests of Different Types of Silane Primers after Stress and Aging

Amanda Merikas and Liang Chen

OBJECTIVES: The study is to investigate the long-term priming efficacy of different types of commercial silane primers using shear bond strength test methods after stress and aging.

METHODS: Five silane-containing primers were used in this study, including Porcelain Primer (Bisco), RelyX Ceramic Primer (3M ESPE), Monobond Plus (Ivoclar Vivadent), Kerr Silane (Kerr), and Scotchbond Universal (3M ESPE). Silica-based ceramics (Lithium Disilicate, IPS e. Max) were wet-polished by 320-grit SiC paper and etched with Porcelain Etchant (4% HF, 25 seconds, Bisco). The silane primer was applied to the etched lithium disilicate and left undisturbed for 5 minutes. The primed ceramics were cleaned by ultrasonication in ethanol bath for 2 minutes and dried. A shear bond strength test was done on polished lithium disilicate using a dual-cure resin cement (Duolink, Bisco) in light-cure mode (40 sec/500 mW/cm²) using an ultradent jig method (bonding area 4.5 mm²). The cured specimens were stored in de-ionized water for 6 months at 37°C, thermal cycled for 1000 cycles, then tested until failure using a universal tester (Instron 4466) at a speed of 1 mm/min.

RESULTS:

Shear Bond Strength on Primed Lithium Disilicate

<table>
<thead>
<tr>
<th>Primer Types</th>
<th>Primer Name</th>
<th>Shear Bond Strength, MPa (SD), n=16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>No primer</td>
<td>7.15 (1.97)</td>
</tr>
<tr>
<td>Silane/No Additive</td>
<td>Bisco Porcelain Primer</td>
<td>25.81 (4.20)</td>
</tr>
<tr>
<td></td>
<td>RelyX Ceramic Primer</td>
<td>25.34 (5.10)</td>
</tr>
<tr>
<td>Silane/Extra Resin</td>
<td>Kerr Silane</td>
<td>14.86 (6.61)</td>
</tr>
<tr>
<td>Silane/Acidic Monomer</td>
<td>Monobond Plus</td>
<td>17.31 (7.25)</td>
</tr>
<tr>
<td>Silane/Universal Adhesive</td>
<td>ScotchBond Universal</td>
<td>5.58 (3.66)</td>
</tr>
</tbody>
</table>

CONCLUSION: The silane primer with no additives (BISCO Porcelain Primer, RelyX Ceramic Primer) demonstrated the highest shear bond strengths. The silanes tested with additives (extra resin in Kerr Silane, Scotchbond Universal, and Monobond Plus with acidic monomer) demonstrated bond strengths that were significantly lower than the silane primers with no additives. This data is consistent with the previous data collected and aged for only a period of 24 hours. Aged samples that have been stressed through the use of a thermal cycler are more representative of the ability of a primer to withstand conditions present in the oral cavity.
Comparing Compressive Strengths of New Self-Adhesive Bulk Fill Material to Restorative Materials

Courtney Michelson,* Ronald Perry, and Gerard Kugel

OBJECTIVES: Amalgams are being phased out of modern-day dentistry; a need for an easy use over bulk fill material has developed. The following study tests a new product that has potential to meet those objectives. Evaluate the compressive strength of a new self-adhesive bulk fill material (DO-UC, 3M ESPE) to glass ionomer (GI), resin-modified glass ionomer (RMGI), and composite materials.

METHODS: Materials tested (n=8 per group): Group A, Dyract® (DENTSPLY); Group B, Heliomolar® (Ivoclar Vivadent); Group C, DO-UC Capsule (3M ESPE); Group D, DO-UC Handmix (3M ESPE); Group E, Fuji II™ LC (GC America); Group F, Vitremer™ (3M ESPE); Group G, Kentac™ N100 (3M ESPE); Group H, Ketac™ Nano (3M ESPE); Group I, Fuji IX™ GP Capsule (GC America); Group J, Fuji IX™ GP Handmix (GC America); Group K, Chemfil® Rock (DENTSPLY). All samples were made using polyoxymethylene (Delrin®) molds with 3 x 3 x 5 mm for light-cured specimens and 4 x 6 mm for self-cured specimens. Samples were fabricated and cured according to manufacturers’ instructions. Self-cured specimens were put in 37°C water bath for 1 hr after preparation. All samples sat in distilled water (37°C/24hrs) to complete cure. A universal Zwick machine loaded (10kN; crosshead speed 1.0 mm/min) measured compressive strengths until fracture. One-way ANOVA and Fisher method tests showed a p<0.05.

RESULTS:

Light-Cured (n=8 for each group):

<table>
<thead>
<tr>
<th>Group</th>
<th>Mix System</th>
<th>Type of Material</th>
<th>Results Mean±SD (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Compule</td>
<td>Composite</td>
<td>313.9±33.4</td>
</tr>
<tr>
<td>B</td>
<td>Compule</td>
<td>Composite</td>
<td>309.5±17.8</td>
</tr>
<tr>
<td>C</td>
<td>Capsule</td>
<td>New</td>
<td>292.4±23.4</td>
</tr>
<tr>
<td>D</td>
<td>Handmix</td>
<td>New</td>
<td>26.6±22.0</td>
</tr>
<tr>
<td>E</td>
<td>Handmix</td>
<td>RMGI</td>
<td>229.0±15.0</td>
</tr>
<tr>
<td>F</td>
<td>Handmix</td>
<td>RMGI</td>
<td>195.5±14.6</td>
</tr>
<tr>
<td>G</td>
<td>Clicker</td>
<td>RMGI</td>
<td>195.5±47.3</td>
</tr>
<tr>
<td>H</td>
<td>Compule</td>
<td>RMGI</td>
<td>223.4±5.2</td>
</tr>
</tbody>
</table>

Self-Cured (n=8 for each group):

<table>
<thead>
<tr>
<th>Group</th>
<th>Mix System</th>
<th>Type of Material</th>
<th>Results Mean±SD (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Capsule</td>
<td>New</td>
<td>273.3±12.2</td>
</tr>
<tr>
<td>D</td>
<td>Handmix</td>
<td>New</td>
<td>272.0±19.4</td>
</tr>
<tr>
<td>I</td>
<td>Capsule</td>
<td>GI</td>
<td>199.5±37.1</td>
</tr>
<tr>
<td>J</td>
<td>Handmix</td>
<td>GI</td>
<td>187.0±21.2</td>
</tr>
<tr>
<td>K</td>
<td>Capsule</td>
<td>GI</td>
<td>191.5±6.4</td>
</tr>
</tbody>
</table>

For light-cured groups, both composites and the DO-UC capsule were significantly higher than the GI and RMGIs. For self-cured, the DO-UC materials performed significantly higher than the GI materials.
CONCLUSIONS: The compressive strength of the DO-UC was significantly higher in comparison to the tested GI and RMGI materials. Values for DO-UC were comparable to the composites, and there was no statistically significant difference between these groups. Further testing is required; this new material shows potential for use as a self-adhesive bulk fill product.

Research funded in part by a grant from 3M ESPE. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1149.
Growth Factors Secreted from Diabetic Foot Ulcer Fibroblasts

Joanne O’Brien,1* Anna Maione,1 Avi Smith,1 Julia Caine,1 A. Vezes,2 L. Pradhans,2 D. Mooney3, and Jonathan Garlick1

1Department of Oral and Maxillofacial Pathology, Tufts University School of Dental Medicine, Boston; 2Beth Israel Deaconess Medical Center, Boston; 3School of Engineering and Applied Sciences, Harvard University, Cambridge, Massachusetts

OBJECTIVES: Altered growth factor-mediated communication between fibroblasts and other cell types in chronic wounds are linked to a failure to heal. The aim of our study was to characterize growth factor secretion in 3D tissues harboring chronic wound fibroblasts grown with and without keratinocytes. The long-term objective of this study is to develop stem cell therapies that can effectively treat non-healing, diabetic foot ulcers (DFU).

METHODS: Biopsies were obtained from DFUs and site-matched normal skin (NFF). Fibroblasts were isolated and 3D, skin-like tissues were generated. Tissues grown with fibroblasts in collagen gel were compared to those grown with fibroblasts and keratinocytes (NHKs). Supernatants were collected and growth factor secretion was measured from tissues on a per cell basis.

RESULTS: Both NFF and DFU fibroblasts increased in number when co-cultured with NHKs compared to fibroblasts alone. NFFs were more responsive than DFU in secretion of HGF and IL-8. DFUs showed an 8- to 10-fold increase in IL-8 versus a 20-fold increase in NFF. Similarly, HGF showed a 6- to 10-fold increase in NFF. In contrast, IL-6 did not show a conclusive pattern while KGF secretion was below detection range. In general, growth factor secretion was increased in tissues harboring NFF when compared to those harboring NFF fibroblasts.

CONCLUSION: This study determined that DFU fibroblasts were deficient in secretion of growth factors in 3D skin like tissues. This helps explain why these cells are repair-deficient. Our next step will be to reprogram these cells to induced pluripotent stem cells, in the hope that this may improve healing through enhanced growth factor signaling.

Supported by NIH Grant #RO1 DK98055-06A1 and the TUSDM Dean’s Scholars Program. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1088.
Oral Health Quality of Life in Intellectually/Developmental Disabled Individuals

Khusbu Patel,* Wanda Wright, Matthew Finkelman, and John Morgan

OBJECTIVE: Little is known about the functional, physical, social and psychological impacts of oral conditions as perceived by adults with intellectual and developmental disabilities (IDD). The aim of this study was to develop an instrument to measure oral health related quality of life (OHQOL) in the adults with IDD.

METHODS: A 25-item OHQOL instrument designed for adults with ID was developed through a review of the literature and existing QOL questionnaires. Written informed consent was obtained from the subject/guardian as appropriate. Two subjects with mild to moderate intellectual disability were asked to complete the survey. A series of 8 questions was asked of each subject to assess the clarity of the questions and the ability of the respondent to understand each question. Each subject was then asked to complete the survey again and the responses to the surveys for each subject were compared.

RESULTS: Based on the field test (pilot) of the survey questionnaire, two subjects were able to successfully complete the survey. One subject recommended minor alteration of one question that was either unclear or confusing. The question asked, “Have you felt that life in general was less satisfying because of problems with your teeth or mouth?”

CONCLUSION: The field test of this survey indicated that this is a potentially useful instrument for use with IDD adults to better understand oral quality of life in this population. Further testing and development is warranted.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #904.
Thermal Effect Due to Laser and Handpiece Usage on Pulp
Christina Penn,* Christopher Beninati, Alissa Mariano, Daniel Dooley, Ronald Perry, Gerard Kugel, and Masly Harsono

OBJECTIVES: The purpose of this study was to determine the thermal effect of the Solea™ (SL) CO2 Laser (Convergent Dental) on the pulp of extracted human teeth compared to other lasers on the market and a high-speed handpiece.

METHODS: Four groups, each containing 20 extracted non-carious human molars, were established to collect thermal data: SL (group 1); Lightwalker® DT (LW-DT) Laser (Fotona) (group 2); Waterlase® MD (W-MD) Laser (Biolase) (group 3); and Midwest® (MW) High Speed Handpiece (DENTSPLY) (group 4). Each molar was digitally radiographed to locate pulp chamber for thermocouple placement to detect temperature changes created by the instruments during hard tissue removal. A hole at CEJ was drilled to create a space for insertion of the thermocouple; thermal epoxy was placed into the hole to secure the thermocouple once it was inserted. Another radiograph was taken to confirm thermocouple placement. Samples were instrumented for 60 seconds and temperatures were recorded within the pulp chamber of each tooth using an Apollo IV DT304 Digital Temperature Logger (UEI Test Instruments) over a period of 60 seconds as dental hard tissue was removed from the occlusal surface of each molar. Four thousand eight hundred temperatures (20 samples x 60 seconds x 4 groups; 1 temp record per second) were recorded. One-way ANOVA and post hoc two-sample t-tests were calculated to pairwise analyze among groups (95% confidence level).

RESULTS: The average start, mean maximum and average temperature change for each device was calculated (Table 1).

Table 1.

<table>
<thead>
<tr>
<th>Sample Group</th>
<th>Average Start Temp (°C)</th>
<th>Mean Maximum Temp (°C)±SD</th>
<th>Average Temp Change (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 (SL)</td>
<td>23.14</td>
<td>26.44±1.40</td>
<td>3.30</td>
</tr>
<tr>
<td>Group 2 (LW-DT)</td>
<td>21.84</td>
<td>25.04±1.51</td>
<td>3.20</td>
</tr>
<tr>
<td>Group 3 (W-MD)</td>
<td>21.78</td>
<td>25.34±0.90</td>
<td>3.56</td>
</tr>
<tr>
<td>Group 4 (MW)</td>
<td>22.59</td>
<td>24.16±1.28</td>
<td>1.57</td>
</tr>
</tbody>
</table>

CONCLUSION: None of the average temperature changes exceeded 5.5°C for pulpal safety. The thermal effect of groups 1, 2, and 3 (lasers) demonstrated a relatively higher temperature increase compared to group 4 (handpiece). However, the thermal effect of group 1 is similar to other lasers tested.

Sponsored in part by Convergent Dental. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1416.
**Occupational Therapy and Oral Health of Individuals with Developmental/ Acquired Disabilities**

*Christina Piacquadio,* Wanda Wright, Matthew Finkelman, Angel Park, and John Morgan

**OBJECTIVE:** To explore occupational therapists’ knowledge of oral health for persons with disabilities and the extent to which they implement this knowledge into practice.

**METHODS:** A 35-item questionnaire was modeled on two validated questionnaires of health care providers. Prior to using the questionnaire, an 18-member review panel comprised of dentists, dental hygienists, and occupational therapists were asked to complete the survey to ensure face and content validity. The survey included questions regarding occupational therapy practices as they pertained to the oral health of individuals with disabilities as well as their attitudes toward and knowledge of oral health. Likert scales were used for ordinal and count responses.

**RESULTS:** Preliminary data showed most respondents (85%) agreed that they can play a useful role in improving the oral health of individuals with disabilities. Over half (67%) did not feel as confident providing recommendations regarding oral health as with other forms of personal health care, and 61% reported limited information and knowledge specifically regarding the oral health of individuals with intellectual and physical disabilities (IDD). A majority (71%) would like more information regarding how OT professionals and dentists can work together.

**CONCLUSIONS:** It was found that OTs believe there is an important role for them in the oral health care of individuals with developmental and acquired disabilities. Most respondents agreed that there is an opportunity for inter-professional education to assist the OT and dental professions to improve oral health of individuals with disabilities.

*Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #340.*
Microenvironmental Cues Affect Dab2 Expression in Squamous Cell Carcinoma Development

Shruti Pore,* Elizabeth Bingham, James Baleja, and Addy Alt-Holland

OBJECTIVES: Suppression of E-cadherin-mediated cell-cell contact is concomitant with advanced stages of squamous cell carcinoma (SCC), but the mechanisms that control the incipient stages of this disease are poorly understood. The adaptor protein Disabled-2 (Dab2) can potentially contribute to SCC development via its role in regulating the trafficking of surface proteins involved in cell adhesion and migration. Here we examined the effect of the microenvironmental context on Dab2 expression in SCC tumor cells.

METHODS: Bioengineered, three-dimensional (3D) tissues were fabricated by seeding human E-cadherin-competent (II-4) or E-cadherin-suppressed (II-4-Ecad-) skin SCC cells onto fibroblast-populated collagen scaffolds. Dab2 expression was analyzed by immunohistochemistry and immunofluorescence staining of these tissues and SCC tumors that developed from them after their transplantation to mice. Dab2 expression in cell cultures grown on coverslips was determined by immunofluorescence analysis.

RESULTS: In cell cultures, II-4 cells demonstrated intense Dab2 staining in comparison to faint Dab2 staining of II-4-Ecad- cells. II-4 tissues showed intense epithelial Dab2 staining whereas II-4-Ecad- tissues revealed faint Dab2 staining at the superficial layers of the epithelium and evident Dab2 staining at the basal and immediate basal cell layers, specifically in cells that invaded into the underlying matrix. II-4 tumors demonstrated intense Dab2 staining of well-differentiated sheets of tumor cells. However, high-grade II-4-Ecad- tumors showed faint Dab2 staining throughout the tumor mass but noticeable Dab2 at the invasive front of the tumors.

CONCLUSIONS: Dab2 expression level that is markedly reduced upon E-cadherin suppression can be modified by microenvironmental cues, depending on the location of the tumor cells and their interactions with adjacent tumor cells and stromal compartments. Thus, delineating mechanisms that regulate Dab2 levels can reveal potential therapeutic targets for skin SCC and life-threatening epithelial cancers, such as oral cancer.

A “Tufts Collaborates!” grant awarded to Drs. Alt-Holland and Baleja funded this study. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #444.
Effect of Contouring with Mylar on Composite Shear Bond Strength

Jessie Reisig,* Stephanie John, Steven Eisen, Angel Park, and Gerard Kugel

OBJECTIVE: Mylar strip placed against composite during curing is used to achieve contour in class IV restorations. Due to possible changes with composite surface’s oxygen-inhibited layer or surface roughness, the goal of this pilot study was to test for difference in SBS with or without the Mylar-treatment.

METHODS: Composite (Filtek™ Supreme Ultra, 3M) 4 mm width x 7 mm depth samples were made by curing (Demi, Kerr) for 20 s with a Mylar strip (n=79; Matrix Mylar Strips, Benco Dental) against the superficial surface or without a Mylar strip (n=97). Additionally the deep sides of samples were cured for 20 s, labeled by treatment, and further divided into 5 duration groups for distilled water storage: 5 min, 30 min, 1 hr, 24 hrs, or 72 hrs. Adhesive (ExciTE®F, Ivoclar Vivadent) was added, it was cured for 10 s, 4 mm³ composite was added, and it was cured for an additional 20 s. The samples were tested for SBS at a crosshead speed of 1mm/min (Instron™ 5566A, Norwood, Massachusetts). After testing for normality using a Shapiro-Wilk test, an independent samples t-test was performed to test difference between the means. Data was analyzed using SAS 9.2. A non-parametric test, Wilcoxon-Mann-Whitney U test was used to test the hypothesis (p<0.05).

RESULTS: SBS values from each group indicated normality (except for the 5 min untreated values). Statistical analysis failed to reject the null hypothesis for all time points except at 30 min (p=0.002, statistically significant) where median values were 6.02 MPa (Mylar-treated) and 14.82 MPa (untreated) (Table 1).

Table 1

<table>
<thead>
<tr>
<th>Sample Treatment</th>
<th>Time</th>
<th>N</th>
<th>Mean Shear-bond strength (MPa)</th>
<th>Standard Deviation</th>
<th>Median Shear-bond strength (MPa)</th>
<th>Shapiro-Wilk p-value</th>
<th>Wilcoxon-Mann-Whitney U p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>5 min</td>
<td>23</td>
<td>9.06</td>
<td>5.77</td>
<td>6.70</td>
<td>0.0200</td>
<td>0.8126</td>
</tr>
<tr>
<td>Mylar</td>
<td>5 min</td>
<td>15</td>
<td>8.11</td>
<td>4.37</td>
<td>7.06</td>
<td>0.3910</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>30 min</td>
<td>16</td>
<td>6.98</td>
<td>4.33</td>
<td>6.02</td>
<td>0.0480</td>
<td>0.0020</td>
</tr>
<tr>
<td>Mylar</td>
<td>30 min</td>
<td>15</td>
<td>15.13</td>
<td>6.27</td>
<td>14.82</td>
<td>0.7628</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1 hr</td>
<td>18</td>
<td>13.72</td>
<td>6.54</td>
<td>14.48</td>
<td>0.8552</td>
<td>0.7070</td>
</tr>
<tr>
<td>Mylar</td>
<td>1 hr</td>
<td>15</td>
<td>15.17</td>
<td>7.47</td>
<td>13.97</td>
<td>0.3460</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>24 hrs</td>
<td>20</td>
<td>9.45</td>
<td>5.54</td>
<td>7.97</td>
<td>0.1360</td>
<td>0.1390</td>
</tr>
<tr>
<td>Mylar</td>
<td>24 hrs</td>
<td>15</td>
<td>12.06</td>
<td>4.47</td>
<td>11.83</td>
<td>0.9240</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>72 hrs</td>
<td>20</td>
<td>9.99</td>
<td>5.95</td>
<td>9.78</td>
<td>0.4010</td>
<td>0.7270</td>
</tr>
<tr>
<td>Mylar</td>
<td>72 hrs</td>
<td>19</td>
<td>10.70</td>
<td>4.72</td>
<td>10.63</td>
<td>0.2060</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSION: In all groups but the 30 min time, there were no statistically significant differences between the presence of and absence of the Mylar treatment, suggesting that Mylar treatment does not affect SBS. Larger sample sizes and focused time points may help explore the difference at the 30 min time. Larger sample sizes would provide greater power and statistical support.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #464.
Comparing Publication Characteristics between Successful and Unsuccessful Dental Materials

Justin Richer,1* Gerard Kugel,1 Paul Stark,1 and Amy Bauer2
1Tufts University School of Dental Medicine, Boston; 2New York University, New York, New York

OBJECTIVE: Failed dental products pose a risk to patients and are costly to manufacturers. Therefore, benefit exists in being able to predict whether a product will be successful. This study attempted to identify fundamental differences in publications existing between successful and unsuccessful dental materials.

METHODS: Seven dental materials were chosen based upon their clinical performance and defined as either “unsuccessful” or “successful.” Unsuccessful products have been taken off the market due to failures or lack of success. Unsuccessful group consisted of ARTglass (Heraeus Kulzer, Germany), Dicor®, Empress II® Bridge material (ivoclarvivadent) and Fibrekor/Skulpture (smithsterling). The successful group consisted of Empress® (ivoclarvivadent), Lithium Disilicate, and Zirconia® (BruxZir). Using selective criteria, a literature review on these materials yielded 24 articles (12 “successful,” 12 “unsuccessful”). A scoring algorithm (Table 1) was developed and applied to each article to evaluate the strength of each study design. After review, each article’s data was combined into an Excel file and the scores were totaled. Independent samples t-tests, chi-square, and Fisher’s exact tests were performed using SPSS to compare continuous and categorical values between the successful and unsuccessful materials.

RESULTS: Unsuccessful materials yielded a statistically significantly lower mean (SD) total score of 10.51 than the successful materials (23.29, p<0.001). The study design criterion showed a statistically significant difference (p=0.014) indicating successful materials were more likely to be clinical studies than unsuccessful (100% vs. 50%). Successful materials were more likely to evaluate inclusion criteria (p<0.001), consider a sample size calculation (p=0.011), and assess marginal breakdown (p<0.001).

CONCLUSION: Articles published on dental products that were ineffective or unsafe on the open market demonstrated lower quality than articles published on comparable materials still in use today. More work must be done to develop methodology for using publications as predictive factors for success or failure of dental materials.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #457.
Ergonomic Prevention before Intervention: Early Education for Musculoskeletal Wellness

Melissa Ing,1 David Frantz III,Ⅰ* Courtney Robinson,Ⅰ* Vishavjeet Giri,Ⅰ Adam Paggi,2 Sage Yoo,Ⅰ Paul Shamiran,Ⅰ and Sheeva AhmadianⅠ

1Tufts University School of Dental Medicine; 2Northeastern University

Since dental providers are at risk for musculoskeletal injury, it is beneficial to provide ergonomic training and implementation of daily exercises as early as possible while in the educational setting, starting with the preclinic. The purpose of this video production is to provide schools with a tool to help promote more productive and longer careers through musculoskeletal health. Hopefully by administering injury prevention education, the next generation of dentists will report fewer occupational injuries. Injury prevention education includes three important areas: proper seated and standing dentistry ergonomics, dynamic movements to perform at key points throughout the day, and strengthening exercises to augment daily activity. Demonstrating these three facets of musculoskeletal health in a video is thorough, consistent, and gives students a resource to reference. The paramount reason for utilizing videography is it can be utilized as part of the curriculum at many dental schools, thus having a broad, positive effect. The dental ergonomics video provides instruction on both proper ergonomics, good and bad positioning, and stretching and strengthening exercises to promote musculoskeletal health while working. Although dentists take courses in anatomy and physiology, it is imperative to ask for help from experts of that field. The video utilizes the expertise of a doctor of physical therapy (DPT) who is versed in the injuries with which dentists commonly present. The video shows the DPT instructing actual dental students in a preclinical and clinical setting. The DPT demonstrates proper chair-side ergonomic positioning, daily warm-up, mid-day and cool down stretches, and strength exercises to perform outside of the clinical setting. By addressing the risk of musculoskeletal disorders in the preclinical setting and providing students with skills to maintain musculoskeletal health, this video production will help dental educators play a proactive role in the overall health of the profession.
Post Discharge Nausea/Vomiting after Ambulatory Anesthesia in Oral Surgery

Sepideh Sabooree,* Alireza Ashrafi,* Matthew Finkelman, Britta Magnuson, Maria Papageorge, and Archana Viswanath

AIM/OBJECTIVE: One of the most common ambulatory oral surgical procedures done today is removal of third molar teeth. However, as with any other surgeries, there are complications associated with oral surgeries. Post discharge nausea and vomiting (PDNV) is one of the complications commonly seen in ambulatory surgeries. While the overall incidence of PDNV after general anesthesia is well established to be about 25%, data on the incidence of PDNV after ambulatory surgery patients are limited and conflicting. Therefore, this study sought to measure the incidence of PDNV in patients undergoing third molar extractions under ambulatory anesthesia and, if clinically relevant, identify independent risk factors.

METHODS: A prospective study was conducted to obtain postoperative data from 25 adults who underwent third molar surgery under ambulatory anesthesia. The primary endpoint was the incidence of nausea and/or vomiting after discharge from the clinic until the second postoperative day. Fisher’s exact test was performed to identify predictors for PDNV: female gender, history of motion sickness, opioid consumption, antibiotic usage, and smoking status; a p<0.05 was considered significant.

RESULTS: Patient characteristics were: age 24.2±5.18 years, 44% females, 48% non-smokers, 32% current smokers, 16% former smokers, and 12% had a history of motion sickness. Sixteen patients completed the study. By 48 hours after discharge, 43.8% experienced nausea, 25% severe nausea. None of the predictors listed above were found to be significant predictors for PDNV (Table 1).

<table>
<thead>
<tr>
<th>Variables</th>
<th>P-value (2 sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex and nausea</td>
<td>0.36</td>
</tr>
<tr>
<td>Smoking and nausea</td>
<td>0.37</td>
</tr>
<tr>
<td>Motion sickness and nausea</td>
<td>0.55</td>
</tr>
<tr>
<td>Antibiotic usage and nausea</td>
<td>1.00</td>
</tr>
<tr>
<td>Oxycodone usage and nausea</td>
<td>1.00</td>
</tr>
</tbody>
</table>

CONCLUSIONS: These preliminary results show the incidence of PDNV after third molar extraction. This is an ongoing study and the initial data did not show significant predictors.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #1254.
Tumor-Stromal Interactions Alter the Metabolism of Squamous Cell Carcinoma Cells

Shawheen Saffari,* Ronney Tay, John Nolan, James Baleja, and Addy Alt-Holland

OBJECTIVE: Loss of E-cadherin-mediated cell-cell contact is critical for the development of aggressive squamous cell carcinoma (SCC). Whereas alterations in cellular metabolism are associated with cancer progression, the metabolic profile of E-cadherin-competent or E-cadherin-suppressed SCC cells and its contribution to tumor-stromal interactions has not been addressed. Here we determined the metabolic profile of these cells in the presence or absence of human dermal fibroblasts.

METHOD: Individual cell cultures or co-cultures of 2 x 10^5 E-cadherin-competent (II-4) or E-cadherin-suppressed (II-4-Ecad-) skin SCC cells and 5 x 10^4 fibroblasts were grown for 48 hours. 1H NMR was used to analyze metabolites that were secreted into or consumed from the culture media. Morphological analysis was performed by bright field microscopy.

RESULTS: II-4 SCC cultures demonstrated well-organized colonies, consumed more glutamine, valine, phenylalanine, and choline, and secreted more pyruvate than II-4-Ecad- SCC cultures in which random spread of individual cells was observed. In co-cultures, streams of fibroblasts closely surrounded compact II-4 colonies, whereas fibroblasts stretched in different directions between individual II-4-Ecad-cells. Unexpectedly, a significant decline in the overall metabolic rate, indicated by decreased consumption of glucose and various amino acids, was revealed in co-cultures of both SCC cell lines with fibroblasts. II-4 SCC co-cultures showed greater production of lactate and alanine as well as increased consumption of choline, glutamine and leucine compared to II-4-Ecad- SCC co-cultures.

CONCLUSIONS: This study provides new insights into tumor-stromal interactions and modulation of cell behavior via metabolites. The decline in overall energy metabolism in SCC cells-fibroblast co-cultures indicates the existing of a mechanism that enables fibroblasts to alter the metabolism of SCC cells, possibly by interfering with the spread of tumor cells. Thus, delineating alterations in the metabolic profile of skin and oral SCC cells can help identify new biomarkers of cancer progression and the base for developing novel targeted therapies.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #822.
Energy Delivery Based on Restoration Location and Light Curing Unit

Sara Samaha,* Sapan Bhatt, Ronald Perry, Richard Price, and Howard Strassler

Tufts University School of Dental Medicine, Boston; Department of Dental Clinical Sciences, Faculty of Dentistry, Dalhousie University, Halifax, Nova Scotia, Canada; University of Maryland School of Dentistry, Baltimore, Maryland

OBJECTIVE: The clinical setting poses complications for LCU use, such as location of a restoration, LCU size and shape, and size of the patient’s mouth. The purpose of this study was to examine the difference in energy delivered by three LCUs to two simulated restorations, and the difference in energy received by a restoration based on location in the mouth.

METHODS: Thirty dental students cured one 1-mm simulated anterior restoration and one 4-mm simulated posterior restoration twice using an Optilux 401® (Kerr Corporation, Orange, California), VALO® (Ultradent Products, South Jordan, Utah); and Bluephase G2® (Ivoclar Vivadent, Amherst, New York), for a total of twelve cures per student. LCUs were stabilized perpendicular to, and 1 mm off of, each restoration for one second then moved directly over the restoration for the remainder of the cure. Twenty-second cure times were used for all three lights for both restoration locations. A MARC-PS® (BlueLight Analytics, Halifax, Nova Scotia, Canada) dental mannequin containing the two simulated restorations collected data on irradiance (mW/cm²) in real time to determine energy delivered to the restorations.

RESULTS: A mixed model test determined energy delivered to the anterior restoration was significantly greater than that delivered to the posterior restoration (p=0.0009). The same analysis determined no statistical significance between energy delivered by the Bluephase G2 and VALO LCUs, although both delivered significantly more energy to the restorations than the Optilux 401 (p<0.0001). Table 1 shows the energy delivered by the three LCUs.

<table>
<thead>
<tr>
<th>LCU</th>
<th>Average energy delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALO</td>
<td>25.713 J/cm²</td>
</tr>
<tr>
<td>Bluephase G2</td>
<td>25.532 J/cm²</td>
</tr>
<tr>
<td>Optilux 401</td>
<td>17.649 J/cm²</td>
</tr>
</tbody>
</table>

DISCUSSION: Three LCUs delivered statistically different amounts of energy to two simulated restorations and to the restorations based on location in the mouth. Dental professionals should be aware of these discrepancies to avoid failure due to under-cured restorations.

Anti-VEGF Therapy Inhibits Hypothyroidism Associated with Infantile Hemangioma

Jacqueline Servais,* Diana Ramirez, Melissa Ramirez, Olin Liang, and Damian Medici

OBJECTIVE: Hemangiomas are the most common tumors of infancy and form by uncontrolled proliferation of vascular endothelial cells. Hemangiomas have also been shown to cause hypothyroidism by producing type III iodothyronine deiodinase (D3), an enzyme that catalyzes the inactivation of thyroid hormones T3 and T4. Hemangiomas form by genetic mutations that induce hyperactive vascular endothelial growth factor (VEGF) signaling, which stimulates tumor growth, but nothing is known about how D3 enzyme is produced by hemangiomas. Our goal was to determine whether the constitutive VEGF signaling in hemangioma endothelial cells (HemECs) promotes D3 expression and whether anti-VEGF therapy will inhibit the hypothyroidism associated with infantile hemangioma.

METHODS: Cultured primary HemECs isolated from surgically resected hemangiomas were exposed to VEGF neutralizing antibodies or a non-specific IgG control. Their effects on D3 expression were determined by immunoblotting. Resected proliferating hemangioma tissues were cut into pieces and surgically implanted under the skin of immunodeficient mice. The mice were intraperitoneally injected twice per week with bevacizumab (pharmaceutical grade VEGF neutralizing antibodies) or a non-specific IgG control to determine their effects on tumor growth and hypothyroidism. Blood samples were collected once per week for multiplex quantitative immunoassay analysis of D3, T3, and T4 levels.

RESULTS: Our data show that VEGF neutralizing antibodies inhibit D3 expression in cultured HemECs. Bevacizumab inhibited hemangioma tumor growth in vivo and also reduced the levels of D3 enzyme produced by the tumors. Furthermore, blood serum levels of D3 were reduced and thyroid hormone levels were increased in mice injected with bevacizumab.

CONCLUSION: Our results suggest that inhibition of the constitutive VEGF signaling with a drug such as bevacizumab should be sufficient to inhibit hypothyroidism in patients with infantile hemangiomas.
Comparison of Flipped and Standard Classrooms in a Dental School Setting

Laura Shim,* Paul Stark, and Yun Saksena

As there are many different styles of teaching and learning, it is sometimes difficult to know if students are more receptive to one method over another. The purpose of this study was to compare student performance and overall student experience between a flipped and a standard classroom setting in a pre-clinical course at Tufts University School of Dental Medicine (TUSDM). In standard classrooms, students usually attend a lecture in order to become introduced to a topic. After class, students are responsible for reviewing the material that was covered by studying the lecture slides, their notes, and reading the associated text. In a flipped classroom, students watch a video-captured lecture before class and spend class time in a more interactive and engaging fashion where students delve more deeply into the material. This study was conducted in the second year dental students’ Removable Partial Dentures course at TUSDM. Four flipped classroom sessions were preceded by available lecture slides and lecture video for students to watch online before class. Actual class time mainly consisted of students applying their knowledge by discussing case studies in small groups. The other nine classroom sessions were taught in a standard classroom setting. These standard classes were lecture-based, with some interactive elements (i.e., group discussions, clicker questions, etc.). Some designated material was covered only in the flipped classroom and other designated material was covered only in the standard classroom to facilitate the comparison of the two teaching methods. Student performance was assessed by both midterm and final examinations. On each exam, the questions used for this study were pre-selected with the criteria that the material was covered in either a flipped or standard classroom, but not both. Comparison of the percentages of correct answers in the two categories of questions was used to determine if students learned better from one teaching method over the other. The exact test for two proportions was used for the comparisons. In addition, online surveys were given to students at the end of the course. The responses to the surveys were used to assess student attitudes and overall student experience towards flipped classrooms. This study was approved by the Tufts Medical Center/Tufts University Health Sciences Institutional Review Board. In the midterm exam, 84.25% of students answered the flipped classroom questions correctly. The percentage was lower at 82.41% for the standard classroom questions. The p-value of the midterm exam was 0.0444. In the final exam, 83.56% of students answered the flipped classroom questions correctly. Again, a lower percentage of 82.13% answered the standard classroom questions correctly. The p-value for the final exam was 0.0701. Overall, 83.90% of students answered flipped classroom questions correctly while 82.27% of the standard classroom questions were answered correctly. The p-value for the combined midterm and the final was 0.0045. The p-value of 0.0045 suggests that the difference in the percentage of correct answers of the flipped and standard classrooms was statistically significant. This evidence indicates that students had better performance in flipped classrooms as compared with standard classrooms. In the surveys, students thought that flipped classrooms were a good idea in theory. However, the majority did not consistently listen to the lectures before the flipped classroom sessions and agreed that the concept of flipped classrooms was not practical or useful with their busy dental school schedules. The discrepancy between student performance and overall attitude towards flipped classrooms should be an area of further study.

Also presented at the 2014 ADEA Annual Session in San Antonio, Texas.
Fluoride Ion Penetration on Ionic Resin Materials

Leslie Slowikowski,* Stephanie John, Matthew Finkelman, Ronald Perry, Masly Harsono, and Gerard Kugel

OBJECTIVE: To observe the release and recharge of fluoride ions from a new therapeutic bioactive material using fluoride ion concentration gradient diffusion methodology.

METHODS: Three groups (n=10 each group) were tested: Group 1, ACTIVA BioActive Restorative (Pulpdent); Group 2, Ketac™ Nano Lightcuring Glass Ionomer (RMGI) (3M ESPE); Group 3, GC Fuji Triage® (GI) (GC America). Sample tabs were created according to manufacturers’ specifications for each group using a Teflon® mold (13 mm diameter by 2 mm depth). Tabs were placed as filters within a Swinnex® syringe filter holder. The upper chamber was filled with 0.5 mL of a 5% NaF solution, and the lower was filled with 0.5 mL of de-ionized water. The upper chamber was recharged and the lower chamber was refreshed daily. Fluoride ion release was measured after each recharge using a fluoride ion electrode after 1, 2, 24, and 72 hours and 1, 2, and 3 weeks.

RESULTS: Values for the median and interquartile range were tabulated. Kruskal-Wallis test using the Bonferroni correction (p-value approximately 0.007) found statistical significance at 3 time points: 24 hours, 1 week, and 3 weeks with p-values 0.001, 0.002, and <0.001 respectively. Further analysis using the Mann-Whitney U for significant comparison with the Bonferroni correction (p-value=0.017) determined that statistical difference at 24 hours between groups 1 and 3 (p-value<0.001) and groups 2 and 3 (p-value=0.015) but not between groups 1 and 2. At 1 week, there was statistical difference between groups 1 and 3 (p-value=0.001) and at 3 weeks between groups 1 and 3 (p-value=0.001) and groups 2 and 3 (p-value<0.001).

Median fluoride release:

<table>
<thead>
<tr>
<th></th>
<th>1 hr ppm</th>
<th>2 hrs ppm</th>
<th>24 hrs ppm</th>
<th>72 hrs ppm</th>
<th>1 wk ppm</th>
<th>2 wks ppm</th>
<th>3 wks ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>Median</td>
<td>799.00</td>
<td>883.00</td>
<td>842.50</td>
<td>910.50</td>
<td>1004.00</td>
<td>902.00</td>
</tr>
<tr>
<td></td>
<td>Interquartile range</td>
<td>118.50</td>
<td>162.75</td>
<td>191.75</td>
<td>181.86</td>
<td>417.00</td>
<td>330.00</td>
</tr>
<tr>
<td>Group 2</td>
<td>Median</td>
<td>744.50</td>
<td>809.50</td>
<td>723.50</td>
<td>802.00</td>
<td>776.50</td>
<td>689.00</td>
</tr>
<tr>
<td></td>
<td>Interquartile range</td>
<td>110.25</td>
<td>213.00</td>
<td>264.25</td>
<td>337.25</td>
<td>499.50</td>
<td>436.75</td>
</tr>
<tr>
<td>Group 3</td>
<td>Median</td>
<td>715.50</td>
<td>562.50</td>
<td>462.00</td>
<td>643.50</td>
<td>546.00</td>
<td>663.00</td>
</tr>
<tr>
<td></td>
<td>Interquartile range</td>
<td>173.75</td>
<td>423.00</td>
<td>310.50</td>
<td>614.75</td>
<td>431.25</td>
<td>436.25</td>
</tr>
</tbody>
</table>

CONCLUSIONS: At the seven time points tested, the new therapeutic bioactive material has statistically greater fluoride release after recharge at 24 hours, 1 week, and 3 weeks compared to the other groups tested.

This study was supported in part by Pulpdent. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #268.
Polyvinyl-Siloxane Impression Materials Performance in a Tensile Strength Test

Jesse Small,* Elena Ciciolla, Ronald Perry, and Masly Harsono

OBJECTIVES: To compare the tear strengths of eight polyvinyl-siloxane impression materials under tensile force, mimicking the clinical settings of a final impression.

METHOD: A total of 8 groups (n=20) of impression material were tested using the Boghosian and Lautenschlager Methodology. Stainless steel molds of 101.6 mm long x 19.05 mm wide x 2.7 mm thick were used to produce specimens with a V-notch in the center, measuring either 0.30 mm or 0.50 mm (n=10 each thickness). The impression material was injected into the mold and placed in a water bath with a temperature of 35±1°C at T=20 seconds. Materials were set according to manufacturer’s specified set time. The samples were placed into the Instron® machine (model 5582) and tested at T=90 seconds after removal from the water bath. Tensile force was applied at a cross-head speed of 500 mm/min. Average tensile strength was recorded for each of the molds. Statistical analysis was conducted using One-way ANOVA with a post hoc Tukey HSD for pairwise analysis among groups. P-value<0.05.

RESULTS:

<table>
<thead>
<tr>
<th>Group</th>
<th>Material</th>
<th>Average Tensile Strength Force, MPa±SD Mold 338 (0.50 mm)</th>
<th>Average Tensile Strength Force, MPa±SD Mold 348 (0.30 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aquasil™ Monophase (DENTSPLY Caulk)</td>
<td>541.42±34.52A</td>
<td>520.4±45.98D</td>
</tr>
<tr>
<td>2</td>
<td>Tissue Management Impression Material (DENTSPLY Caulk)</td>
<td>540.03±83.59A</td>
<td>514.6±57.57D</td>
</tr>
<tr>
<td>3</td>
<td>TMIM Tray (DENTSPLY Caulk)</td>
<td>527.97±74.03A</td>
<td>532.0±60.2D</td>
</tr>
<tr>
<td>4</td>
<td>Aquasil™ XLV</td>
<td>426.54±51.4B</td>
<td>388.38±51.4E</td>
</tr>
<tr>
<td>5</td>
<td>Sultan Genie® (DENTSPLY)</td>
<td>369.19±46.52B</td>
<td>342.0±37.89F</td>
</tr>
<tr>
<td>6</td>
<td>3M Imprint™ 4 Ultralight (3M ESPE)</td>
<td>273.81±19.58C</td>
<td>220.9±36.96F</td>
</tr>
<tr>
<td>7</td>
<td>Flexitime® (Heraeus)</td>
<td>257.96±32.98C</td>
<td>248.2±21.05F</td>
</tr>
<tr>
<td>8</td>
<td>Take 1® Advanced (Kerr)</td>
<td>257.31±31.41C</td>
<td>229.35±42.28F</td>
</tr>
</tbody>
</table>

Means that are statistically the same are represented by the same superscript letters (A, B, or C for 0.50 mm thickness and D, E, F for 0.30 mm thickness).

CONCLUSION: For both mold thickness, groups 1, 2, and 3 had statistically significant higher tensile strength values when compared to the other groups. The specified notch thicknesses of 0.50 mm and 0.30 mm estimate the sulcus width around the margin of a preparation and thus indicate that these materials may perform better in a clinical setting.

Sponsored in part by DENTSPLY Caulk. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #283.
Epigenetically Modified BMSCs in Regenerating Dental and Craniofacial Bone Tissues

Qianqian Han, Kyle Smith,* Yuwei Wu, Qisheng Tu, and Jake Chen

OBJECTIVE: 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. As a nuclear matrix protein, special AT-rich sequence-binding protein 2 (SATB2) is expressed in branchial arches and in cells of the osteoblast lineage, therefore it is required for bone development and formation. However, our previous understanding of the modulation of SATB2 impedes our further insight into this important osteogenic transcription factor. In this study, we hypothesize that PHF8 promotes osteoblastogenesis by epigenetically regulating the expression of master gene SATB2.

METHODS: Our design consisted of treating preosteoblasts (MC3T3-E1) and bone marrow stromal cells (BMSCs) with an osteogenic medium. Once treated, we performed real time PCR, Western blot, gain and loss functions, and chromatin immunoprecipitation (ChIP) assays.

RESULTS: Our results showed that expression levels of PHF8 and SATB2 in MC3T3-E1 and BMSCs increased simultaneously during osteogenic induction. Overexpressing PHF8 in BMSCs and MC3T3-E1 cells with wild type PHF8 upregulated the expression of SATB2, Runx2 and osterix, and bone matrix proteins. Conversely, knockdown of PHF8 reduced the expression of SATB2 and other bone marker genes. Furthermore, using ChIP assays, we found that PHF8 specifically bound to the transcription start site (TSS) of the SATB2 promoter.

CONCLUSION: Taken together, our results suggest, for the first time, that PHF8 enhances osteogenic differentiation via modulating histone methylation states of the master gene SATB2 and subsequently converting its chromatin into a transcriptionally active conformation. We expect that epigenetic regulation of BMSCs during osteogenic differentiation will promote SATB2-dependent activation and facilitate bone regeneration in tissue engineering.
Delineating Regulatory Mechanisms of Nasopharyngeal Carcinoma Development by Comparative Metabolomics

Ronney Tay,* Shawheen Saffari, Samuel Kamlarz, Leah Leahy, Pamela Smith, James Baleja, and Addy Alt-Holland

OBJECTIVE: Among epithelial tumors of the head and neck, nasopharyngeal carcinoma (NPC) is associated with the highest rate of metastasis, a catastrophic development with a median survival of less than one year. Thus, there is an unmet medical need for development of new therapeutics that relies on understanding the regulatory mechanisms of NPC cell behavior that drive metastasis. As altered metabolism is associated with cancer progression, we determined the metabolic profiles of human NPC cell lines and bona fide tumor spheres.

METHODS: $^1$H NMR was used to analyze metabolites that were secreted into or consumed from the media of cultures of human NPC C666-1 cell line, metastatic C666-1 sub-line, cisplatin-treated C666-1 cells, and NPC tumor spheres isolated from a mediastinal lymph node metastasis. Additionally, 8 months following subcutaneous injection of these spheres to mice, animals were sacrificed and examined for cancer development. Cultures were routinely imaged by bright field microscopy.

RESULTS: Elevated arginine, glutamate, and lactate levels and decreased pyruvate, glutamine, and glucose levels were detected in media samples from the cell lines in comparison to those of the spheres. Conversely, elevated alanine and glutamine levels were detected in media samples of sphere cultures. Importantly, the tumor spheres maintained their metastatic potential in vivo. Following their subcutaneous injection to mice, sphere-like structures were found in microscopic examination of the lung tissue, a common site of metastasis of this cancer. These structures, likely representing NPC metastases, continued to develop in dissected lung tissues in vitro.

CONCLUSIONS: Using comparative metabolomics, this study revealed distinct metabolic profiles of NPC cell lines and tumor spheres that may correlate with the culture growth state and metastatic capabilities. These data provide new insights into potential metabolites and corresponding biochemical pathways that can serve as biomarkers for NPC progression or as targets for novel mechanism-based intervention strategies.

Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #821.
Influence of Air/Vinylpolysiloxane on Residual Layers of Temporization Materials

Michelle Tsao,1* Ronald Perry,1 B. Hofmann,2 and J. Farr2
1Tufts University School of Dental Medicine, Boston; 23M ESPE, Seefeld, Germany

OBJECTIVES: To compare the thickness of residual layers created by temporization crown and bridge materials against air and two experimental vinylpolysiloxane (VPS) materials via Penta™ or Garant™ delivery systems. Less residual layer may translate to a product with better handling characteristics and more aesthetic provisionals.

METHODS: Seven temporary materials were selected to test the thickness of residual layers against air and VPS impression materials dispensed with either a Pentamix™3 (3M-ESPE) or Garant™ Dispenser. Temporary materials tested were: Integrity® Fluorescence-IN (DENTSPLY), LuxatempStar-LU (DMG), Protemp™4-PR (3M-ESPE), Visalys Temp-VI (Kettenbach), PreVISION®-PV (Heraeus), Structur 3-VO (VOCO), and Structur Premium-ST (VOCO). Six samples per group (N=6) of impression material tiles 3 cm x 3 cm x 3 mm were created. Each temporary material was dispensed according to manufacturers’ directions into Delrin-rings (d=20 mm; h=3.5 mm) and mounted on either impression tiles or glass slides (for air). Samples were removed from tiles, slides, and ring after setting 15 minutes at room temperature. Samples were weighed, first with the residual layer and again after removing residual layer with isopropranol. For VPS materials, impression tiles were also weighed before and after removing residual layers. Weight differences were calculated.

RESULTS: Data was analyzed using one-way ANOVA with Fischer test, achieving 95% confidence interval. Summary of results, mean values, and standard deviations calculated. Means in each column with same letters (A–E) are statistically the same.

<table>
<thead>
<tr>
<th>Material</th>
<th>Air (mg/cm²)</th>
<th>Exp. Mat. w/ Pentamix™ (mg/cm²)</th>
<th>Exp. Mat. Garant™ (mg/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>2.66±0.28E</td>
<td>1.80±0.21D</td>
<td>1.19±0.45F</td>
</tr>
<tr>
<td>LU</td>
<td>4.00±0.19D</td>
<td>2.33±0.32C</td>
<td>1.77±0.34D</td>
</tr>
<tr>
<td>PR</td>
<td>2.59±0.16E</td>
<td>1.49±0.20D</td>
<td>1.28±0.14DE</td>
</tr>
<tr>
<td>VI</td>
<td>4.34±0.32C</td>
<td>3.52±0.59B</td>
<td>2.69±0.44C</td>
</tr>
<tr>
<td>PV</td>
<td>4.96±0.18B</td>
<td>5.33±0.53A</td>
<td>5.02±0.79* A</td>
</tr>
<tr>
<td>VO</td>
<td>4.32±0.26C</td>
<td>3.29±0.45B</td>
<td>2.44±0.32C</td>
</tr>
<tr>
<td>ST</td>
<td>6.18±0.27A</td>
<td>4.99±0.57A</td>
<td>3.82±0.20B</td>
</tr>
</tbody>
</table>

*PreVISION VPS-Garant samples tested twice due to a high standard deviation, but yielded same results. Second group results used for statistical analyses.

CONCLUSION: Across all seven provisional materials, thicknesses of residual layers were lowest against PVS-Garant, then VPS-Pentamix, and highest against air. PreVISION had thickest residual layer on VPS materials. StructurPremium had thickest residual layer against air and with VPS-Pentamix. Protemp and Integrity produced the least amount of residual layer at all conditions.

Sponsored by 3M ESPE. Also presented at the 2014 AADR Annual Session in Charlotte, North Carolina. Abstract #279
The Impact of Training Pre-School Teachers as Ambassadors of the Give Kids a Smile Program to Improve Children’s Oral Health Disparities

Michelle Webb,* Zuzana Mendez, Arlene Pimentel, Sheina Jean-Marie, Ana Tonet-Wescott, Elimin Tejada, Andrea Lugo, and Aidee Nieto-Herman

This descriptive analysis research examines the importance of the incorporation of pre-school teachers as ambassadors of the program Give Kids a Smile (GKAS). It was done in partnership with the Massachusetts Hispanic Dental Association (MHDA) and Tufts Student Hispanic Dental Association (TSHDA). This study examines current children oral health disparities and assesses the level of parents’ and pre-school teachers’ dental knowledge following their training sessions in oral health and evaluates if the parents have an established dental home for their pre-school children. The GKAS program is well described as a successful U.S. oral health program that was created in 2002. A survey was conducted of parents and pre-school teachers at the Neighborhood Involvement of Children Education (NICE) pre-school to determine their familiarity with oral health. A total of 41 parents and 10 pre-school teachers participated. The majority of the surveyed parents, 39/41 (90%) responded, and 100% considered it important that their children receive oral health care instructions from their pre-school teachers. The majority of the surveyed parents (72%) expressed that a dental home existed and after training, the number of dental homes increased to 78%. However, in regards to 10 teachers’ and parents’ oral health knowledge, the majority of them have correct basic oral health knowledge but some discrepancies exist. The ambassador program can help to eliminate this gap, while reinforcing correct oral health information. The findings of this study indicate that there is great value in utilizing pre-school teachers as oral health care ambassadors of the GKAS program. Furthermore, the GKAS program offers students and volunteer dentists from MHDA the opportunity to partner with the community and to be a constructive part of the solution to reduce children oral health disparities.
Association between Sleepiness and Stress and Simulated Clinical Performance

Esther Yun

PURPOSE: The goal of this project was to assess whether there is an association between students’ sleepiness and stress and their performance in a simulated clinical setting.

METHOD: The study was a cross-sectional study conducted at Tufts University School of Dental Medicine (TUSDM) using students in their third year. Students were asked to keep a sleep diary starting one week before their practice licensure competency exam. On the day of the exam, the participants were given two short questionnaires: the Epworth Sleepiness Scale (ESS) and the Perceived Stress Scale (PSS). After the grades from the clinical competency exam were obtained, correlations and t-tests were used for evaluations. All statistical analysis was conducted using IBM SPSS Version 19.

FINDINGS: In total, 68 students volunteered to participate in the study, but only 22 students completed the study. No significant associations were found between total grade and gender (p=0.929), average hours of sleep (p=0.533), ESS score (p=0.218), or PSS score (p=0.301). However, the negative correlation between grade and age was found to be significant (r = −0.43, p=0.048). In addition, there was a significant positive correlation between grade and the average time students took to fall asleep (r=0.53, p=0.011), how refreshed students felt in the morning (r=0.46, p=0.032), and the amount of exercise that students had during the week (r=0.42, p=0.049). When isolating data from only the night before the exam, the only significant correlation found from the isolated data was between total grade and the time it took the students to fall asleep (r=0.58, p=0.006).

CONCLUSION: These findings from the ESS and PSS questionnaires suggest that there is no association between sleepiness and stress and performance in a clinical setting. However, it was interesting to note that as age increased in the students, the grades significantly decreased. This study had many limitations in terms of sample size and grading structure, but was important in acknowledging that sleepiness and stress could impact clinical performance. Future studies on the effects of sleepiness and stress and the effects of possible interventional studies for stress reduction are required to understand how to better improve dental students’ educational environment.
POSTDOCTORAL STUDENT PRESENTATIONS

Long-Term Success Rates of Ketac and Photec in the Posterior Dentition

C. Marissa Alikpala* and Jennifer Logigian*

When working with medically complex and special needs patients, in many cases a dentist may have to forgo the more “ideal” restorations due to low patient cooperation. This includes the use of amalgam or composite in conjunction with a rubber dam. As a result, it is necessary to utilize quicker-setting materials or those that are less sensitive to moisture contamination. Two such materials that are being used with increased frequency are Photec and Ketac Molar. Photec is a light cured, radiopaque, fluoride-releasing resin glass ionomer. It is self-adhesive as well as biocompatible. It comes in 8 esthetic shades. With its user-friendly properties, it is ideal for those who are unable to undergo the ideal restoration. Ketac Molar is a chemically cured radiopaque restorative glass ionomer material that, like Photec, comes in 8 shades for improved aesthetics. It has a high fluoride release as well as an expansion coefficient similar to tooth structure. It has a number of clinical applications, including primary teeth fillings, single surface (non-occlusal) areas, cervical fillings in the posterior dentition and as a core build-up material. Because it does not need to be light cured, it is also useful in challenging clinical situations such as when working with patients with behavioral issues or when the provider has limited working time. Because these materials can be considered a definitive restoration in these latter cases, it is important to determine their wear resistance, particularly in the posterior dentition. The aim of this study is to better understand the long-term success of Ketac and Photec as a permanent restoration in the posterior dentition.
Case Report: Management of Obstructive Sleep Apnea and Insomnia in a Patient with Complete and Partial Removable Dentures

Ola Alshuhail* and Leopoldo Correa

INTRODUCTION: The American Academy of Sleep Medicine (AASM) last update of its guidelines indicated that oral appliance therapy is for individuals with primary snoring and upper airway resistance syndrome, mild to moderate obstructive sleep apnea (OSA) preferring oral appliance (OA) therapy to continuous positive airway pressure (CPAP), and severe OSA refusing CPAP.

OBJECTIVES AND IMPORTANCE: We assessed the feasibility of managing OSA with an oral appliance for an edentulous patient. Patient compliance with CPAP is challenging and OA therapy could improve patient adherence and quality of life.

CLINICAL PRESENTATION: A 56-year-old American male with a medical history of moderate OSA and insomnia was referred to our center from a sleep physician for OA therapy. He reported intolerance to using CPAP with different types of masks and nasal pads. Upon the clinical examination, the patient was fully edentulous in the maxilla and had three healthy abutment teeth in the mandible. He wore an upper complete denture and a lower partial denture during day and night.

INTERVENTION AND TECHNIQUE: We used a custom-made adjustable OA (semi-edentulous design) for over both dentures. In the last follow up visit, there was a significant improvement of OSA indexes. The apnea-hypopnea index (AHI) decreased from 11.8/hour to 6.8/hour and the nadir oxygen saturation increased from 83% to 92%. The rapid eye movement (REM) stage of sleep drastically improved from 15.7% to 26.6% and the respiratory disturbance index (RDI) decreased from 40/hour to 15.8/hour at REM stage.

CONCLUSION: In this case, OA therapy was an effective alternative to a tongue retainer device for a complete and partial edentulous patient refusing the use of CPAP and not able to tolerate the tongue retainer device. Further studies with larger sample sizes using different oral appliances are required in this field.
The Evaluation of a Non-Invasive Respiratory Volume Monitor in Patients Undergoing Dental Extractions during Moderate Sedation

Alireza Ashrafi,* Sepideh Sabooree, Maria Papageorge, Morton Rosenberg, Roman Schumann, and Archana Viswanath

PURPOSE: This study examines the clinical utility of the ExSpiron Respiratory Volume Monitor (RVM, ExSpiron™, Respiratory Motion, Inc., Waltham, Massachusetts) in oral surgery patients during moderate sedation. Previous work demonstrated the ability of this novel technology to provide non-invasive, real-time, continuous measurements of respiratory parameters including tidal volume (TV), minute ventilation (MV), and respiratory rate (RR) in spontaneously breathing patients. Current respiratory monitoring in non-intubated oral surgery patients relies mostly on oximetry, capnography, and subjective clinical assessment. We studied the changes in ventilator rates and volumes during moderate sedation with this device.

METHOD: Following IRB approval and written informed consent, subjects were enrolled in this prospective, observational study. TV and vital capacity were measured with a hand-held spirometer for baseline comparison to the RVM that uses an impedance-based technology and proprietary algorithms to obtain respiratory values. MV, TV, and RR measurements were collected from the RVM ExSpiron™ prior and during moderate sedation until discharge. Sedations were carried out using Midazolam, Fentanyl, and Diazepam. Age, sex, BMI, and sedatives (timing, type, and dose) along with vital signs were recorded and correlated with the device data. For each subject we determined an MV change to a threshold value of 80% from their baseline (10 minutes prior to sedation) at 2 time points; Sedation start and 10 minutes post drug administration. Paired t-test and ANOVA were utilized for comparison of the groups and dependent variable.

RESULTS: Of the total, 32 subjects (14 male, 18 female) completed the study for this analysis. For all patients, MV decreased to below 80% from baseline immediately after drug administration. At 10 minutes following initial drug administration, MV of 14 subjects remained below 80% of baseline and the other 18 had recovered to above this limit. The demographics and sedation variables between these two groups were not independently significantly different; all p-values were >0.05.

CONCLUSIONS: Our study demonstrated an early decline of MV to below 80% of baseline immediately following sedative administration. Of the total, 18 out of 32 patients recovered to above this threshold within 10 minutes. It is not clear from these preliminary data which factors influence this outcome. Further study is needed to determine how this new technology could improve monitoring and patient safety outcomes in this setting.
OBJECTIVE: The overall objective of this study is to determine the attitudes and prevalence of the usage of an ambulatory oral and maxillofacial surgery safety checklist among oral surgeons.

BACKGROUND: Patient safety has emerged as an important topic in recent years. Improving surgical safety has become a high priority in order to reduce adverse events in patients. In 2008 the WHO World Alliance for Patient Safety developed a “Surgical Safety Checklist” and published data on the efficacy of it. The implementation manual, published in parallel with the WHO Surgical Safety Checklist, suggests that the checklist should be adapted to fit in with local practice. The checklist is a powerful and inexpensive tool that will facilitate effective communication and teamwork.

METHODS: Recruitment for the survey consisted of emailing 500 oral surgeons with a valid email address published in the American Association of Oral and Maxillofacial Surgeons (AAOMS) directory. Since the response rate was less than 50%, another email was sent to 500 oral surgeons. Up to 1,000 surgeons were contacted. There was no bias in subject selection since the email addresses were randomly selected by a person not involved in the study. Qualtrics (Tufts University survey tool) was used to facilitate the distribution and completion of surveys.

RESULTS: A total of 110 oral surgeons responded to the survey. Of the responders, 94% were male, 82% were in private practice, and among them only 37% reported using a checklist in their practice. Of the participants, 60% (n=66) reported that they were not using a surgical safety checklist for ambulatory surgery; 93% reported that if provided they would consider implementing a surgical safety checklist in their practice. Of the oral surgeons, 26% reported that they were not using a safety checklist although they reported that they were performing more than 30 procedures a week. Although not statistically significant, the majority of the oral surgeons who had completed OMFS training for longer than 20 years reported not using a checklist in their practice.

CONCLUSION: According to our survey, the majority of practicing oral and maxillofacial surgeons do not currently use surgical safety checklists. Although the response rate was 11%, the survey does reflect a clear lack of use of checklists among practicing oral and maxillofacial surgeons despite the widespread acceptance in the medical community.
Special Considerations for the Dental Management of Patients with Osteogenesis Imperfecta

Ranju Bhasin* and Brianne McGuinness*

Osteogenesis Imperfecta (OI) is a genetic disorder characterized by bones that break easily, often from little or no apparent cause. There are special considerations that are necessary when caring for the health of patients diagnosed with OI, including oral health. Due to altered composition of bone, along with dental anomalies, management of dental needs in patients with OI may follow an alternative approach.
Accuracy of Periodontal Probing Depth and Calculus Detection through the Use of Kinoshita Nissin Periodontal Dental Model

Daniel Coleman,* Paul Levi Jr., and Matthew Finkelman

Dental education is a continually evolving process. This study seeks to develop evidence-based practices for the instruction of dental students to properly probe periodontal pockets and detect dental calculus.

The purpose of this study will be to evaluate the effectiveness of the Kinoshita dental model (KDM) as a pre-clinical training tool for pre-doctoral education in periodontal probing and calculus detection.

Prior to this study, students at Tufts University (TUSDM) were trained primarily through lecture in techniques for periodontal pocket probing and calculus detection. The KDM has been specifically designed by the authors of this study to facilitate hands-on instruction of probing depth measurement and calculus detection.

Study participants were second-year TUSDM students. Participants were given a hands-on lecture and workshop on proper techniques for periodontal probing and calculus detection using one of three KDM models. Three workshops were given. In each workshop, participants received a KDM with different simulated gingiva. The three preclinical groups were translucent gingiva, opaque gingiva, and both translucent and opaque gingiva. At the end of each workshop students were tested on opaque models to determine their accuracy in both periodontal probing and calculus detection.

Data from the pre-clinical study showed no significant difference in mean absolute difference between groups for accuracy in probing depth measurement. This indicates that both translucent and opaque model types are equally effective as teaching aids.

When determining differences in calculus detection, it was found that there was a significant difference (p<0.05) in the number of correctly identified surfaces with calculus between the opaque group and the group trained with both translucent and opaque models. Those trained with opaque models alone were able to correctly identify calculus more accurately than those trained using both model types. Results of this study bring insight into the effectiveness of each KDM as a teaching tool for periodontal probing and calculus detection.
**Assessing the Level of Evidence in Post-Graduate Experience at TUSDM**

Irina Dragan,* Taylor Newman,* Nadeem Karimbux, and Paul Stark

**AIM:** The aim of this project was to assess the format used in the literature review classes offered in the postgraduate (PG) programs at Tufts University School of Dental Medicine (TUSDM). A secondary aim was to evaluate the differences in how the course format and objectives are perceived by the students vs. the course directors.

**MATERIAL AND METHODS:** The proposed research study was an observational cross-sectional study. The subjects of the study, the PG students and the course directors of the literature review classes, received the same survey on the day of the literature review class. Two co-investigators (TN, ID) explained to all the subjects the purpose of the study and helped with the data collection. The survey consisted of multiple choice and short answer response questions regarding the format of the literature review class, as well as the role of EBD in these classes. The same two co-investigators reviewed and compared the written responses of both groups (course directors and students) for each literature review class, evaluating the agreement between the groups. Counts and percentages were reported for categorical data. SAS, Version 9.2 (SAS Institute, Cary, North Carolina) was used for all statistical analyses. This study was approved by the Tufts Health Sciences Institutional Review Board.

**RESULTS:** A total of seven course directors and 74 students completed the survey for seven literature review courses offered in the PG programs. Courses included four accredited advanced education programs (Endodontics, Orthodontics, Periodontology, Prosthodontics) and one advanced education program (Esthetic Dentistry). Endodontics and Periodontology offer both current and classic literature review courses. All of the classes meet at least once per week to discuss articles ultimately chosen by the course directors, except Orthodontics, which uses American Board of Orthodontics (ABO) criteria. The majority of the students were in partial agreement with the course directors’ stated objectives, except Orthodontics residents, which were in complete agreement, and Prosthodontics residents, which did not match at all. Only one of the seven classes, Periodontology Current, utilized a recognized way of evaluating the level of evidence.

**CONCLUSION:** PG literature review courses should adopt a more consistent format, while still adhering to each discipline’s accreditation or governing body requirements. More emphasis should be placed on incorporating EBD in the PG literature review curriculum.
Repeat Dental Treatment under General Anesthesia: A Retrospective Study
Jennifer Guidry,* Angel Park, Alfred Rich, and Cheen Loo

PURPOSE: The purpose of this retrospective chart review of pediatric dental patients who had at least one general anesthesia (GA1) visit was to evaluate whether there is an association between those who returned for a second GA (GA2) visit and attendance at their post GA1 follow-up (FU) appointment.

METHODS: A review of charts of patients treated at Tufts University School of Dental Medicine from 2004 to 2013 identified 541 subjects who met the inclusion criteria. Subjects were categorized as: group 1, those who did not have GA2; group 2, those who had GA2. The following were recorded: age, gender, payment type, dmfs, recall frequency, procedures done, and emergency appointments. Chi-square and t-tests were used to assess associations between variables. Data was analyzed using SAS 9.2 (Cary, North Carolina).

RESULTS: Out of 541 subjects, 27 (5%) had a GA2. The mean time difference between GA1 and GA2 was 2.7 years. At GA1, group 1’s mean age at their initial GA visit was 4.8 years compared to group 2’s 2.7 (p=0.06). Of GA2, 93% were Medicaid (p=0.013). Mean dmfs score prior to GA1 was 29.7 for group 1 and 35.7 for group 2 (p=0.02). In group 1, 57% attended their FU compared to 56% of those with GA2 (p=0.87).

CONCLUSION: Subjects who were younger, covered by Medicaid, or had a higher dmfs score at GA1 were more likely to need a repeat dental treatment under GA. There was no association between attendance at the GA FU appointment and the need for a second GA visit.

Research supported by DHHS-HRSA #D84HP1995.
Effect of Carbonated/Non-Carbonated and Sugary Drinks on Microleakage of Pit-Fissure Sealants

Aditi Jindal,* Matthew Finkelman, Sarah Bagher, Alfred Rich, Cheen Loo, and Masly Harsono

PURPOSE: The aim of this in vitro study is to determine the effects of different colas, sugary drinks, and similar acidic soft drinks on the microleakage of pit and fissure sealant after thermo-cycling.

MATERIALS AND METHODS: Fifty human molar teeth were obtained for this study. Embrace wetbond sealant was used for all samples. The samples were randomly divided into five groups with ten teeth each. Teeth in the treatment group were immersed into milk, cola, water (control), orange juice, and carbonated water respectively for 2 hours, three times a day for 14 days, under agitation. Samples were thermocycled for 10,000 cycles between 5°C and 55°C, immersed in 50% w/v amoniacal silver nitrate for three hours, then exposed in photo developing solution for sixteen hours. Each tooth was sectioned into two halves. Microleakage was examined under Olympus SZX16 stereomicroscope for each section.

RESULTS: Using the Kruskal-Wallis test significant difference was found between groups. Water and milk were significantly lower than other groups using the posthoc Mann-Whitney U-test with the Boneferroni correction.

<table>
<thead>
<tr>
<th>Microleakage*</th>
<th>% Microleakage</th>
</tr>
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<tbody>
<tr>
<td>Group</td>
<td>Median**</td>
</tr>
<tr>
<td>Milk</td>
<td>00.09a</td>
</tr>
<tr>
<td>Cola</td>
<td>26.80c</td>
</tr>
<tr>
<td>Water</td>
<td>00.00a</td>
</tr>
<tr>
<td>Orange Juice</td>
<td>30.33bc</td>
</tr>
<tr>
<td>Carbonated Water</td>
<td>12.06b</td>
</tr>
</tbody>
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* p-value of Kruskal-Wallis test <0.001

** Groups sharing a letter do not exhibit a statistically significant difference

*** IQR= Interquartile range

CONCLUSION: Based on statistical analysis, results showed that microleakage was higher for groups immersed in orange juice and cola as compared to groups immersed in milk, carbonated water, and plain water.
Shear Bond Strength of Acrylic Denture Teeth to Denture Base of Metal-Resin Implant-Supported Fixed Prosthesis: In Vitro Study

Rabie El Huni, Rami Muadab,* Xueying Wu, Khadiga Elfallah, and Roger Galburt

OBJECTIVES: The purpose of this in vitro study was to evaluate whether the high hardness of the acrylic teeth would decrease the bond strength of the acrylic teeth to the denture base material.

MATERIALS AND METHODS: Two groups of acrylic denture teeth with different hardnesses were used in the study. A total of 16 maxillary first molar denture teeth in each group were tested and analyzed. To provide a uniform surface for bonding, the teeth were embedded in a block of wax within a silicone mold. Subsequently all the denture teeth were ground with AL2O3 paper and the ground surfaces were thoroughly cleaned with air/water spray and ethanol (70%). All denture teeth were processed with heat-curing injection system (SR Ivocap Plus, Ivoclar-Vivadent, Florida). After processing, all the ride-labs were flattened with AL2O3 paper, and then all samples were cut into rod-shape of 4 mm diameter using a trephine bur in drill press. The specimens were then subjected to a shear bond strength test using an Instron universal testing machine (model 5566A, Norwood, Massachusetts). The load was applied to the interface between the acrylic teeth and denture base material at a crosshead speed of 1.0 mm/min until failure. The mean shear bond strength for each specimen was measured and analyzed.

RESULTS: Descriptive statistics are shown in table 2 and as side-by-side box-plots in Figure 3. A power calculation was conducted using nQuery Advisor (Version 7.0). Assuming a difference in means of 8.34 between the two groups, a standard deviation of 3.34 in the Zahn group, and a standard deviation of 2.09 in the Ivoclar group (the effect size that was observed in a pilot study using 5 samples per group), a sample size of n=15 per group was adequate to obtain a Type I error rate of 5% and a power greater than 99%. Descriptive statistics analysis (means, SDs) was calculated for each group. An independent sample t-test was used to assess statistical significance. All analyses were conducted using the software package IBM SPSS Statistics version 19.0 (SPSS). P-values less than 0.05 were considered statistically significant. The independent sample t-test showed significant difference between the two groups in terms of shear bond strength to the denture base (p=0.001) (Table 2). The limitations of the study include: 1. Pre-treatment of the bonding surface. 2. Artificial aging. 3. Screw holes and the magnitude of occlusal forces.

CONCLUSION: Within the limitations of this investigation, the following conclusions can be made:

1. Denture teeth with lower hardness show significantly higher shear bond strength to heat-polymerized denture base compared to higher hardness denture teeth.

2. Furthermore laboratory and clinical studies should be conducted to evaluate the shear bond strength between different types of denture teeth and heat polymerized denture base.
BabySteps: Innovative Obesity and Caries Prevention Pilot for Young Children

Hubert Park,* Cheen Loo, Carole Palmer, Susan Koch-Weser, Aviva Must, Lingxia Sun, and Virginia Rall Chomitz

PURPOSE: High rates of obesity and dental caries among very young children make prevention a national priority. Dental/nutrition partnerships show promise given that key dietary behaviors that prevent obesity can also improve oral health. We describe preliminary feasibility and short-term efficacy results from BabySteps, an obesity and dental caries primary prevention pilot program for very young children in a pediatric dental clinic setting.

METHODS: BabySteps used behavior change theory and behavioral motivation strategies to develop a program for participants 6–24 months of age and their caregivers at Tufts Dental Baby Clinic in Boston. Parents/guardians completed a dietary practice assessment in the waiting room. They then received customized dietary behavior guidance and goal setting from dental staff during an initial pediatric dental exam. Provider guidance comprises synergistic messages for early dietary practices and caries prevention. Implementation feasibility is assessed by tracking additional clinic visit time and staff satisfaction with the program. Short-term efficacy of BabySteps on obesogenic/cariogenic behavior goals is assessed at a one-month, post-visit phone interview with parent/guardian.

RESULTS: Data collection and analysis were ongoing through April 2014. Initial findings suggest the BabySteps intervention adds approximately 12 minutes to the routine baby dental exam. The majority of parents/guardians report that the customized behavior guidance and goal setting has positive impact on facilitating the targeted behavior change.

CONCLUSIONS: Pediatric dental settings hold promise for positively influencing healthy eating behaviors that also promote oral health. The final results of this pilot study will inform future efficacy trials.

Research supported by the Tufts Clinical and Translational Science Institute (CTSI) #UL1 TR000073.
Effectiveness of an Oral Health Education Program for Obstetrician/Gynecologist Residents at Tufts Medical Center

Devina Shah,* Angel Park, Ester Kim, Alfred Rich, and Cheen Loo

PURPOSE: The purpose of the study was to assess obstetrician/gynecologist (OB/GYN) residents’ knowledge and training in oral health and the effectiveness of an educational program for OB/GYN residents at Tufts Medical Center. An informational seminar session on oral health was used to determine how beneficial such training would be in improving OB/GYN residents’ dental knowledge.

METHODS: A pre/post test design with a three-month follow-up was used to evaluate the effectiveness of a seminar session given to OB/GYN residents at Tufts Medical Center. Knowledge-based and belief-based questions were used to determine the level of knowledge of oral health.

RESULTS: The study included 18 subjects who participated in oral health awareness sessions and completed the questionnaire. The mean age of participants was 29 years old. Results show that for the knowledge-based questions, there was an increase in scores between the pre- and post-tests with a slight decrease in scores during the 3-month follow-up. Further statistical analysis is necessary after collection of data is completed.

CONCLUSIONS: Pregnancy affords a unique opportunity to educate women on the importance of oral health. The study showed that many benefit from an oral health educational session for OB/GYN residents at Tufts Medical Center. Therefore, a similar training module can be brought to other OB/GYN residencies and OB/GYNs.
Characterization of Cognitive Dysfunction in Sjögren’s Syndrome Patients

Lynn Epstein, Gina Masse, Jerold Harmatz, Tammy Scott, Athena Papas, and David Greenblatt

Sjögren’s syndrome is an autoimmune disorder primarily affecting women, with decreased saliva and tear production as the principal characteristic. Cognitive, neurological, and psychiatric disorders also are associated with Sjögren’s. The present study addressed the hypothesis that patients with Sjögren’s syndrome differ significantly from matched controls in the prevalence and impact of a number of neuropsychiatric abnormalities. Sjögren’s patients and controls (n=37 per group) underwent medical and psychiatric evaluation, demographic assessments, quality of life and symptom evaluation, and extensive testing of cognitive function and memory. Patients and controls were closely matched for age, gender distribution, verbal IQ, marital status, educational level, employment status, and current/past medical or psychiatric history. On most subjective self-ratings, Sjögren’s patients reported greater fatigue, impaired physical functioning, feeling depressed, and autonomic symptomatology compared to controls. Impaired memory was described mainly as loss of thought continuity in the midst of a task or activity. However, the majority of objective measures of cognition, psychomotor function, and memory showed minimal differences between groups. Sjögren’s patients rate themselves as impaired on multiple ratings of emotional, cognitive, and physical function, but objective measures of cognition reveal fewer substantive differences between patients and matched controls. Sjögren’s patients perceive deteriorated physical function over time, but they achieve a level of functioning comparable to controls despite the burden of their illness.


Relationship between Duration of Treatment and Oral Health in Adults with Intellectual and Developmental Disabilities

Matthew Finkelman, Paul Stark, Wen Tao, and John Morgan

The purpose of this study was to evaluate how dental outcomes changed over time among subjects with intellectual and developmental disabilities (IDD) who were under treatment. This retrospective study included 107 subjects who were treated at a Tufts Dental Facilities clinic. Data from each subject were collected at three time points: initial visit, midpoint visit, and most recent visit. Generalized estimating equations were used to assess the relationship between time in treatment and several outcome variables (cooperation level, hygiene rating, presence of caries, periodontitis, dental pain, and infection). Statistically significant decreases in caries (p<0.001) and increases in periodontitis (p=0.002) were found over time. Associations between time and other outcome variables were not statistically significant. The prevalence of caries decreased and the prevalence of periodontitis increased over time among patients with IDDs receiving regular comprehensive dental care. Even among patients under routine maintenance, significant oral health problems remain.

Published in Special Care in Dentistry, 34, 171-175.
Personal Oral Health Practices: Caregivers of Adults with Developmental Disabilities

John Morgan, Angel Park, and Paula Minihan

OBJECTIVE: Adults with developmental disabilities (DD) have a high risk for dental disease and rely on their caregivers to assist with daily oral home care and dental visits. Information about the oral health (OH) practices of caregivers and the impact of these practices on the individuals they care for is limited. A survey conducted to learn about the role of caregivers in promoting the OH of adults with DD included questions about their own OH practices.

METHOD: A convenience sample of English-speaking caregivers who accompanied DD adults (>20 years) to dental appointments in four dental clinics in a specialized statewide dental care system in Massachusetts completed computer-assisted interview surveys from September 2011 to May 2012. Exploratory analyses including chi-square tests were completed using SAS 9.2.

RESULT: A total of 808 caregivers (84.5% paid; 15.5% family) completed surveys. More family than paid caregivers were aged ≥50 years (79.2% to 33.0%; p<0.01) and were edentulous (8.0% to 3.8%, p=0.04). Overall 60.1% visited the dentist at least twice/year; 23.2% once/every year-two years; and 16.7% only when they had a problem. Among dentate caregivers, 86.4% brushed more than twice/day and 50.4% flossed once/day; 24.7% flossed less than once/week or never. Reasons cited by the 33.1% who did not visit the dentist as often as desired included cost (54.6%) and lack of dental insurance (34.7%).

CONCLUSION: Daily oral hygiene and regular dental care help prevent dental disease. Findings suggest that many but not all caregivers visited the dentist and brushed their teeth at recommended frequencies; only about half flossed as often as recommended. It is unclear if caregivers who do not brush or floss at recommended frequencies or visit the dentist regularly support these behaviors in others. Further research into the links between caregivers’ OH behaviors and the OH supports they provide for adults with DD is needed.


Is Periodontal Health in the Elderly More Sensitive to the Effects of Chronic Diseases, Medications, and Smoking?

Zuhair Natto and Athena Papas

The objective of this research was to evaluate whether or not there is an interaction in a sample of the elderly between the clinical attachment level (CAL) or probing depth (PD) of teeth with the number of medications, smoking, or major causes of death, such as cardiovascular disease (CVD) and diabetes mellitus. Dental examinations were conducted on 284 patients by one examiner. Periodontal assessments were performed by probing with a manual UNC-15 periodontal probe to measure PD and CAL at 6 sites. Complete lists of the patients’ medications were obtained during the examination and causes of death of some of these patients were abstracted from death certificates. Statistical analyses involved ANOVA/Kruskal Wallis, chi-square, and multivariate logistic regression analysis. Our results demonstrated that patients in our sample who died of CVD had higher CAL than the group still living (OR=2.16, 95% CI: 1.47–3.17) and this effect persisted even after...
controlling several variables (OR=2.03, 95% CI: 1.35–3.03). The number of medications had a greater effect on CAL and the attachment loss increased after 4 medications; it did not have any effect on periodontal PD. In multivariate logistic regression analyses, 6 or more medications led to a higher risk of attachment loss (>3 mm) compared with no medication in crude odds ratio (OR=1.20, 95% CI: 0.22–6.64), and age adjusted (OR=1.16, 95% CI: 0.21–6.45), but not with a multivariate model (OR=0.71, 95% CI: 0.11–4.39). Smoking showed the same dose response pattern on CAL by comparison with PD. We concluded that, when compared with PD, attachment level seemed to be more sensitive to chronic diseases, number of medications and smoking. Among those factors, CVD and smoking had the strongest effects. However, it was not possible to discriminate exactly what number of combined drugs led to the breakdown in CAL.

Source of Funding: USDA Human Nutrition Research Center on Aging (HNRCA) and Educational Foundation of America. Presented at the National Oral Health Conference and the 15th joint meeting of the Association of State and Territorial Dental Directors (ASTDD) and the American Association of Public Health Dentistry (AAPHD). Fort Worth, Texas, April 28–30, 2014.

Exploring HIV-Testing Intentions in Young Asian/Pacific Islander Women as It Relates to Acculturation, Theory of Gender and Power, and the AIDS Risk-Reduction Model

Margaret Salud, Helen Hopp Marshak, Zuhair Natto, and Susanne Montgomery

While HIV rates are low for Asian/Pacific Islanders (APIs), they have been increasing, especially for API women in the United States. We conducted a cross-sectional study with 299 young API women (18–24 years old) in the Inland Empire region of Southern California to better understand their intention for HIV testing and their perceptions about HIV/AIDS. Data analyses included descriptive statistics, bivariate exploration for model building, and multivariate analyses to determine variables associated with HIV-testing intentions. Results suggest that more lifetime sexual partners, greater perceived gender susceptibility, higher HIV/AIDS knowledge, sexual activity, more positive attitudes about HIV testing, and higher self-perceptions/experiences related to risk contribute to stronger intentions for HIV testing in young API women. Findings from this study will contribute to the limited literature on HIV/AIDS in API women and provide information that can be used for developing and implementing culturally appropriate programs that encourage HIV prevention and testing in this population.

Published in AIDS Care, 26(5):642-647.

Cotinine Levels among Betel Quid Users and Cigarette Smokers in Cambodia

Pramil Singh, Zuhair Natto, Rituraj Saxena, Hiya Banerjee, Daravuth Yel, Sothy Khieng, and Jayakaran Job

Smokeless tobacco use in the form of the betel quid is common in the Western Pacific Region, and yet few studies have determined the nicotine delivery of this habit. During a validation sub-study, we randomly sampled 201 adults from a rural province of Cambodia and determined nonparametric (bootstrapped) confidence intervals (CIs) for salivary cotinine levels in tobacco users. We found that cotinine levels for daily betel quid use among women (95% CI=218.6–350.0 ng/mL) were (1) similar to the levels for daily cigarette smoking in men (95% CI=240.2–317.1 ng/mL) and (2) significantly higher than the levels for daily cigarette smoking in women.
(95% CI=71.8–202.7 ng/mL). The 95% confidence range for these habits exceeded the threshold for addiction. Our findings from rural Cambodia indicate that the typical betel quid habit among women supports the same level of nicotine addiction as the typical cigarette habit in men.


**Adverse Drug and Device Reactions in the Oral Cavity: Surveillance and Reporting**

**Athanasios Zavras, Gregory Rosenberg, Jared Danielson, and Vassiliki Cartsos**

**BACKGROUND:** According to the U.S. Centers for Disease Control and Prevention, 48% of Americans (roughly 144 million people) used at least one prescribed medication in the preceding month; 11% used five or more. The authors describe the U.S. Food and Drug Administration’s (FDA’s) MedWatch program, the safety surveillance system for drugs and devices in the United States, and the dentist’s role with regard to voluntary reporting of adverse effects (AEs). They also identify the most frequent AEs in the oral cavity as reported in the FDA Adverse Event Reporting System (FAERS).

**METHODS:** The authors reviewed the literature regarding MedWatch, and they mined data in the FAERS public database for the 100 most commonly prescribed medications and their associated AEs.

**RESULTS:** Pharyngitis was the most common AE. Cough, dysgeusia, and dysphagia also were common.

**CONCLUSION:** The MedWatch program and its related databases contain useful information about AEs of pharmaceuticals and devices manifested in the oral cavity. Increased participation in the reporting of suspected adverse reactions will improve the national surveillance system and ultimately will protect patients’ safety.

**PRACTICAL IMPLICATIONS:** As pharmaceutical consumption increases exponentially for a growing segment of the population, and as innovation in dental technology and devices flourishes, dentists have a distinct role in safeguarding patients’ well-being. Promptly reporting AEs in the oral cavity improves quality of care and protects patients’ well-being.

Published in J Am Dent Assoc. 2013 Sep;144(9):1014-21.
CANCER BIOLOGY AND TISSUE ENGINEERING

Tooth Tissue Engineering: The Influence of Hydrophilic Surface on Nanocrystalline Diamond Films for Human Dental Stem Cells
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¹University of São Paulo, São Paulo, Brazil; ²INCT-Biofabris, São Paulo; ³University of Ulm, Ulm, Germany; ⁴Massachusetts General Hospital, Boston; ⁵Harvard Medical School, Boston; ⁶Tufts University School of Dental Medicine, Boston

New techniques for tissue engineering (TE) are rapidly emerging. The basic concept of autologous TE is to isolate cells from small biopsy specimens, and to expand these cells in culture for subsequent seeding onto biodegradable scaffolds. Nanocrystalline diamond films have attracted the attention of researchers from a variety of different areas in recent years, due to their unique and exceptional properties. In this approach, human dental stem cells (hDSCs) were characterized by flow cytometry and grown on diamond films with hydrogen (H)-terminated and oxygen (O)-terminated surfaces for 28 days, and then removed by lysis and washing with distilled water. Energy dispersive spectroscopy analysis was performed, showing that the regions with O-terminated surfaces contained much higher levels of deposited calcium, oxygen, and phosphorus. These results suggest that the extracellular matrix was considerably more developed in the O-terminated regions, as compared with the H-terminated regions. In addition, optical microscopy of hDSCs cultured on the diamond substrate with H- and O-terminated surfaces, before washing with distilled water, showed preferential directions of the cells arrangement, where orthogonal lines suggest that the cells appeared to be following the O-terminated regions or hydrophilic surface. These findings suggest that O-terminated diamond surfaces prepared on biodegradable scaffolds can be useful for mineralized dental tissue formation.


Metabolic Models of Nasopharyngeal Carcinoma Invasion and Metastasis
Sam Kamlartz,¹ Addy Alt-Holland,² Pamela Smith,³ and James Beleja³
¹University of Massachusetts Amherst; ²School of Dental Medicine, Tufts University; and ³School of Medicine, Tufts University

The goal of this project is to find out new ways to target nasopharyngeal carcinoma (NPC) and discover new therapies through an in vitro metabolic analysis of tumor cells. Our collaborator, Dr. Alt-Holland, supplied twenty-nine media samples from cell lines derived from patient tumors. We used nuclear magnetic resonance spectroscopy in order to determine what metabolites can be found in our samples and at what concentrations these metabolites are found. We compared the concentrations of the metabolites in the samples grown in different conditions such as different cell lines, different media, location of tumor, and whether co-culturing the cells with fibroblasts alters the concentration of the metabolites. The cell lines used in this study are all derived from a single patient infected with NPC. The patient underwent cisplatinin treatment to combat the cancer. The treatment seemed to work but after five years the patient’s cancer came back with tumors in his lungs. In this study cells from different stages of the cancer were assessed, including a knee metastasis of a mouse injected with the parental cell line. We found that even within a particular cancer there is great metabolic heterogeneity.
alluding to the fact that it is important to study particular cancer types in order to discover better therapeutic drug targets.

*Presented at the Building Diversity in Biological Sciences Poster Presentation and Competition, Tufts University, August 2013.*

**Delineating the Metabolic Profiles of Skin Cancer Cells and Stromal Fibroblasts In Vitro**

Shawheen Saffari,1 Ronney Tay,1 John Nolan,2 James Baleja,2 and Addy Alt-Holland1*

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

E-cadherin loss is one of the hallmarks of squamous-cell carcinoma (SCC) development. However, how loss of E-cadherin in cancer cells and how tumor-stromal interactions between cancer cells and fibroblasts affect cellular metabolic pathways that can promote SCC or basal-cell carcinoma (BCC) development in the human skin remain elusive. To that end, individual cell cultures and co-cultures of human E-cadherin-competent (II-4) or E-cadherin-suppressed (II-4-Ecad-) SCC cells and dermal fibroblasts were cultured for 24 to 48 hours. Extracellular metabolites in the growth medium were analyzed by nuclear magnetic resonance (1H-NMR). Microscopy analysis showed that in individual monolayer cell cultures, fibroblasts presented elongated cell morphology, II-4 cells grew as compact colonies, and II-4-Ecad- cells grew as single and randomly spread cells. In co-cultures, II-4 colonies were tightly surrounded by streams of fibroblasts, whereas in co-cultures of II-4-Ecad- cells and fibroblasts, the tumor cells spread around the latter. NMR revealed that II-4 cultures consumed more glutamine, valine, and leucine and secreted more pyruvate than II-4-Ecad- cultures that showed less metabolic activity. Notably, the overall energy metabolism of co-cultures of fibroblasts with either II-4 or II-4-Ecad- cells was lower than that of individual SCC cell cultures. This was evident by the decrease in consumption of glucose and production of lactate in co-cultures of SCC cells and fibroblasts. Thus, the cross-talk between epithelial tumor cells and dermal fibroblasts can alter the metabolic profile of these cell types upon their interaction with each other. These findings can shed light on the behavior of these cells in vivo during cancer progression. Furthermore, metabolites or their corresponding biochemical pathways can serve as targets for new mechanism-based therapeutic strategies or as biomarkers to monitor the progression of SCC, and potentially of BCC.

*Presented at the World Forum on Biology, the Society for In Vitro Biology, Savannah, GA, May, 2014.*

**Fibroblasts Derived from Human Pluripotent Stem Cells Activate Angiogenic Responses In Vitro and In Vivo**

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1Tufts University, Boston; 2Harvard University, Cambridge, Massachusetts; 3Technion—Israel Institute of Technology, Haifa, Israel

Human embryonic and induced pluripotent stem cells (hESC/hiPSC) are promising cell sources for the derivation of large numbers of specific cell types for tissue engineering and cell therapy applications. We have describe a directed differentiation protocol that generates fibroblasts from both hESC and hiPSC (EDK/iPDK) that support the repair and regeneration of epithelial tissue in engineered, 3D skin equivalents. In the current study, we analyzed the secretory profiles of EDK and iPDK cells to investigate the production of
factors that activate and promote angiogenesis. Analysis of in vitro secretion profiles from EDK and iPDK cells demonstrated the elevated secretion of pro-angiogenic soluble mediators, including VEGF, HGF, IL-8, PDGF-AA, and Ang-1, that stimulated endothelial cell sprouting in a 3D model of angiogenesis in vitro. Phenotypic analysis of EDK and iPDK cells during the course of differentiation from hESCs and iPSCs revealed that both cell types progressively acquired pericyte lineage markers NG2, PDGFRβ, CD105, and CD73 and demonstrated transient induction of pericyte progenitor markers CD31, CD34, and Flk1/VEGFR2. Furthermore, when co-cultured with endothelial cells in 3D fibrin-based constructs, EDK and iPDK cells promoted self-assembly of vascular networks and vascular basement membrane deposition. Finally, transplantation of EDK cells into mice with hindlimb ischemia significantly reduced tissue necrosis and improved blood perfusion, demonstrating the potential of these cells to stimulate angiogenic responses in vivo. These findings demonstrate that stable populations of pericyte-like angiogenic cells can be generated with high efficiency from hESC and hiPSC using a directed differentiation approach. This provides new cell sources and opportunities for vascular tissue engineering and for the development of novel strategies in regenerative medicine.


The Influence of Electrospun Fibre Scaffold Orientation and Nano-Hydroxyapatite Content on the Development of Tooth Bud Stem Cells In Vitro

Elisabeth H. C. van Manen,1 Weibo Zhang,2 X. Frank Walboomers,1 Betsy Vazquez,2 Fang Yang,1 Wei Ji,1 Na Yu,1 Daisy Spear,2 John A. Jansen,1 and Pamela Yelick2

1Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands; 2Tufts University School of Dental Medicine, Boston

In stem-cell-based dental tissue engineering, the goal is to create tooth-like structures using scaffold materials to guide the dental stem cells. In this study, the effect of fiber alignment and hydroxyapatite content in biodegradable electrospun PLGA scaffolds have been investigated. Fiber orientation of the scaffolds was random or aligned in bundles. For scaffolds with prefabricated orientation, scaffolds were fabricated from PLGA polymer solution containing 0%, 10%, or 20% nano-hydroxyapatite. The scaffolds were seeded with porcine cells isolated from tooth buds (dental mesenchymal, dental epithelial, and mixed dental mesenchymal/epithelial cells). Samples were collected at 1, 3, and 6 weeks. Analyses were performed for cell proliferation, ALP activity, and cell morphology. Fiber alignment showed an effect on cell orientation in the first week after cell seeding, but had no long-term effect on cell alignment or organized calcified matrix deposition once the cells reach confluency. Scaffold porosity was sufficient to allow migration of mesenchymal cells. Hydroxyapatite incorporation did not have a positive effect on cell proliferation, especially of epithelial cells, but seemed to promote differentiation.

CONCLUSION: Scaffold architecture is important to mesenchymal cell morphology, but has no long-term effect on cell alignment or organized ECM deposition. nHA incorporation does have an effect on cell proliferation, differentiation and ECM production, and should be regarded as a bioactive component of dental bioengineered scaffolds.

Published in Odontology 2014 Jan;102(1):14-21.
CARIOLOGY RESEARCH

Bridging the Gap between Preventive and Restorative Dentistry: Identification of Caries Risk Factors and Strategies for Minimizing Risk

Pamela Maragliano-Muniz

Following the introduction of caries management by risk assessment (CAMBRA) in 2007, a number of recommendations for office protocols were introduced, and many companies have formulated products and procedures for implementing CAMBRA. As a result, the implementation of a caries management program can be confounding and overwhelming to a dental practitioner. Understanding risk factors as they contribute to the caries process can help mitigate confusion and guide the practitioner when selecting materials for their practice. Ultimately, knowing how the risk factors play a role in the progression of dental caries will lead to appropriate risk management and product recommendations. The purpose of this article is to discuss the contribution of risk factors to the caries process and to introduce strategies that restorative dentists can utilize to minimize caries risk.

Published in Compend Contin Educ Dent. 2013 Oct;34(9):664-8; quiz 669.
CRANIOFACIAL BIOLOGY

The Novel Zebrafish Mutant fantome/wdr43 as a Human Craniofacial Ribosomopathy Model

Melissa LaBonty,1 Chengtian Zhao,1 K. McCann,2 Viktoria Andreeva,1 S.J. Baserga,2 and Pamela Yelick1
1Tufts University, Boston; 2Yale Medical School, New Haven, Connecticut

INTRODUCTION: The zebrafish mutant fantome (fan) exhibits severe pharyngeal arch cartilage defects. Positional cloning was used to map the fan allele to a premature stop codon in wdr43, which encodes a t-Utp ribosomal protein characterized in yeast to function in rRNA biogenesis. The objective of this study is to use the fantome/wdr43 mutant to define roles for wdr43 in craniofacial development.

METHODS: WISH, Alcian blue stain, Y2H, IF histochemistry, shRNA targeted knock-down, qRT-PCR, antisense morpholino oligomer (MO), mRNA injections, Western and Northern blot analyses.

RESULTS: The fan/wdr43 mutation was confirmed by rescue with single cell wdr43 mRNA injections and by anti-sense wdr43 MO phenocopy. WISH analyses revealed reduced neural crest cell populations, and qRT-PCR revealed upregulated p53 signaling in fan mutants. In vitro subcellular localization studies showed that full length wdr43 localized to nucleoli, while truncated fan mutant wdr43 did not. Stable cell lines expressing shRNAs targeting wdr43 are being used to examine the subcellular localization of other nucleolar phosphoproteins including t-Utps and TCOF1/Treacle, commonly mutated in Treacher Collins Syndrome.

CONCLUSIONS: The fantome/wdr43 mutant exhibits features similar to TCS, and may be an informative model for human neurocristopathies, including TCS.


Roles for wdr43 in Craniofacial Development

Pamela Yelick,1 Viktoria Andreeva,1 Chengtian Zhao,2 Yann Gibert,3 Shubhangi Prabhudesai,3 Yi Zhou,4 Leonard Zon,4 and Susan Baserga5
1Tufts University School of Dental Medicine, Boston; 2Institute of Evolution and Marine Biodiversity, Ocean University of China, Qingdao, China; 3Tufts University, Boston; 4Children’s Hospital, Boston; 5Yale University, New Haven, Connecticut

Neural crest cells (NCCs), a unique cell population originating from the dorsal side of the embryonic neural tube, contribute to a significant portion of the craniofacial skeleton. Aberrant NCC specification, migration, and differentiation can lead to craniofacial defects. In recent years, it has become evident that mutations in a variety of ribosome biogenesis proteins result in distinct craniofacial defects.

OBJECTIVE: Here we investigate the function of the ribosome biogenesis protein wdr43 in craniofacial development.

METHOD: A forward genetic chemical mutagenesis screen combined with Alcian blue/Alizarin Red staining was used to identify zebrafish mineralized tissue mutants.

RESULT: We identified the zebrafish mutant, fantome (fan), which exhibits severe craniofacial cartilage defects. Positional cloning was used to identify a premature stop codon mutation at amino acid 356 in zebrafish Wdr43,
the ortholog to yeast Utp5 known to function in ribosome biogenesis. The fan mutants exhibit increased apoptosis, reduced cell proliferation, and reduced craniofacial cartilage formation, all of which are partially relieved by targeted depletion of p53. In vitro and in vivo studies were used to demonstrate that wdr43 is required for the proper subnucleolar localization of a variety of nucleolar proteins including TCOF1, the gene commonly mutated in Treacher-Collins Syndrome.

**CONCLUSION:** We reveal, for the first time, roles for the ribosome biogenesis gene Wdr43 in craniofacial development. We anticipate that the zebrafish fan mutant will be a useful tool for devising effective methods to prevent and/or treat a variety of craniofacial ribosomopathy mutations, including Treacher-Collins Syndrome.

*This research was supported by NIH/NIDCR R01DE018043 (PCY), NIH/NIGMS R01GM52581 (SJB) and Tufts University School of Dental Medicine, Boston. Presented at the 2014 AADR General Session in Charlotte, North Carolina. Abstract #163.*

**Tissue Specific Roles for the Ribosome Biogenesis Factor wdr43 in Zebrafish Development**

*Chengtian Zhao,1,2 Viktoria Andreeva,1 Yann Gibert,1 Melissa LaBonty,1 Victoria Lattanzi,1 Shubhangi Prabhudesai,1 Yi Zhou,3 Leonard Zon,3 Kathleen L. McCann,4 Susan Baserga,4 and Pamela Yelick1*

1Tufts University School of Dental Medicine, Boston; 2Ocean University of China, Qingdao, China, 3Children’s Hospital Boston and Harvard Medical School, Boston; 4Yale School of Medicine, New Haven, Connecticut

During vertebrate craniofacial development, neural crest cells (NCCs) contribute to most of the craniofacial pharyngeal skeleton. Defects in NCC specification, migration, and differentiation resulting in malformations in the craniofacial complex are associated with human craniofacial disorders including Treacher-Collins Syndrome, caused by mutations in TCOF1. It has been hypothesized that perturbed ribosome biogenesis and resulting p53 mediated neuroepithelial apoptosis results in NCC hypoplasia in mouse TCOF1 mutants. However, the underlying mechanisms linking ribosome biogenesis and NCC development remain poorly understood. Here we report a new zebrafish mutant, fantome (fan), which harbors a point mutation and predicted premature stop codon in zebrafish wdr43, the ortholog to yeast UTP5. Although wdr43 mRNA is widely expressed during early zebrafish development, and its deficiency triggers early neural, eye, heart, and pharyngeal arch defects, later defects appear fairly restricted to NCC derived craniofacial cartilages. Here we show that the C-terminus of wdr43, which is absent in fan mutant protein, is both necessary and sufficient to mediate its nucleolar localization and protein interactions in metazoans. We demonstrate that wdr43 functions in ribosome biogenesis, and that defects observed in fan mutants are mediated by a p53 dependent pathway. Finally, we show that proper localization of a variety of nucleolar proteins, including TCOF1, is dependent on that of wdr43. Together, our findings provide new insight into roles for wdr43 in development, ribosome biogenesis, and also ribosomopathy-induced craniofacial phenotypes including Treacher-Collins Syndrome.

*Published in PLoS Genetics 2014 Jan;10(1).*
DENTAL MATERIALS

Effect of Chlorhexidine-Gluconate on Microleakage of Different Bonding Agents

Laila Aldeeb, David Bardwell, Ronald Perry, Hiroshi Hirayama, and Matthew Finkelman

OBJECTIVE: The primary aim was to compare the microleakage between total-etch, self-etch, and selective-etch adhesive systems, both with and without 2% chlorhexidine. Secondary aim was to compare the microleakage between the chlorhexidine and the non-chlorhexidine groups.

METHOD: Standardized Class II preparations were set on 105 extracted molars, and randomized into seven groups (n=15): group 1, total-etch adhesive; group 2, self-etch adhesive; group 3, selective-etch adhesive; group 4, total-etch adhesive with 2% chlorhexidine; group 5, self-etch adhesive then 2% chlorhexidine; group 6, 2% chlorhexidine then self-etch adhesive; group 7, selective-etch adhesive with 2% chlorhexidine. After restoring with the assigned system, samples were thermocycled. Samples were immersed in ammoniacal silver nitrate for 24 hours, followed by 8 hours in a photo-developing solution. Finally, they were sectioned and analyzed by two raters and scored according to the degree of dye penetration: score 0, no marginal leakage; score 1, silver nitrate (SN) penetrates up to half the gingival wall length; score 2, SN penetrates beyond half the gingival wall length; score 3, SN penetrates along the gingival and axial walls toward the pulp.

RESULT: There was a statistically significant difference between group 1 and 2 (p-value<0.0001), and between group 2 and 3 (p-value<0.0001). There was no significant difference between group 5 and 6 (p-value=0.681). When the groups were compared based on the type of adhesive system used, the results revealed no statistically significant difference.

Table 1: Microleakage scores in counts and percentages for groups 1–7 as rated by two evaluators.

<table>
<thead>
<tr>
<th>Group</th>
<th>Microleakage Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N</td>
<td>25</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>83.3%</td>
<td>16.7%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>2</td>
<td>N</td>
<td>5</td>
<td>13</td>
<td>8</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>16.7%</td>
<td>43.3%</td>
<td>26.7%</td>
<td>13.3%</td>
<td>100.0%</td>
</tr>
<tr>
<td>3</td>
<td>N</td>
<td>24</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>80.0%</td>
<td>20.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>4</td>
<td>N</td>
<td>23</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>76.7%</td>
<td>13.3%</td>
<td>6.7%</td>
<td>3.3%</td>
<td>100.0%</td>
</tr>
<tr>
<td>5</td>
<td>N</td>
<td>9</td>
<td>11</td>
<td>9</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>30.0%</td>
<td>36.7%</td>
<td>30.0%</td>
<td>3.3%</td>
<td>100.0%</td>
</tr>
<tr>
<td>6</td>
<td>N</td>
<td>6</td>
<td>15</td>
<td>6</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>20.0%</td>
<td>50.0%</td>
<td>20.0%</td>
<td>10.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>7</td>
<td>N</td>
<td>25</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>83.3%</td>
<td>16.7%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>N</td>
<td>117</td>
<td>59</td>
<td>25</td>
<td>9</td>
<td>210</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
<td>55.7%</td>
<td>28.1%</td>
<td>11.9%</td>
<td>4.3%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

CONCLUSION: Total-etch and selective-etch adhesive systems have superior results over self-etch adhesive.
systems, with or without the use of chlorhexidine. Chlorhexidine did not adversely affect the marginal adaptation of either of the adhesive systems. Applying chlorhexidine, either before the self-etch adhesive or after, did not have a statistically significant effect on the microleakage scores.


**Erosion of Conventional Glass Ionomer Cements in Lactic Acid Solution**

*Sapan Bhatt, Michael Kreitzer, Ronald Perry, and Gerard Kugel*

**OBJECTIVES:** To investigate the amount of erosion of glass ionomer cements (GICs) when placed in a lactic acid solution as compared to ISO standard compared to ISO standard 9917-1:2007.

**METHODS:** Eleven GIC groups were prepared in PMMA sample molds (30 x 30 x 5 mm) with a central perforation of 5 mm in diameter and 2 mm depth. Samples (n=5) were then submerged in vials of distilled water and incubated at 37°C for 1 hour. Measurements comparing the height of the sample to the sample holder were taken with a micrometer (Digimatic Mitutoyo Corporation). Samples were then submerged in jars each containing 30 mL of lactic acid/sodium lactate buffer solution with pH 2.74 and incubated at 37°C for 24 hours. Sample height was measured again in comparison to the sample holder. Average difference in the sample height (sample erosion) and standard deviation were calculated for each GIC.

**RESULTS:** One-way ANOVA and Tukey test were conducted to compare the mean erosion for each GIC.

<table>
<thead>
<tr>
<th>GIC</th>
<th>Mean Erosion (mm)</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riva SC™ (SDI)A</td>
<td>0.116</td>
<td>0.004</td>
</tr>
<tr>
<td>Maxxion RTM (FGM)C</td>
<td>0.349</td>
<td>0.019</td>
</tr>
<tr>
<td>VitroFil™ (Nova DFL)C</td>
<td>0.300</td>
<td>0.052</td>
</tr>
<tr>
<td>VitroMolar™ (Nova DFL)B</td>
<td>0.199</td>
<td>0.008</td>
</tr>
<tr>
<td>Ionomaster RTM (Wilcos)B</td>
<td>0.214</td>
<td>0.009</td>
</tr>
<tr>
<td>Riva Luting™ (SDI)A,B</td>
<td>0.155</td>
<td>0.021</td>
</tr>
<tr>
<td>Ionomaster CTM (Wilcos)B</td>
<td>0.207</td>
<td>0.058</td>
</tr>
<tr>
<td>Ionomaster RTM (Wilcos)A,B</td>
<td>0.169</td>
<td>0.014</td>
</tr>
<tr>
<td>Maxxion CTM (FGM)B</td>
<td>0.200</td>
<td>0.033</td>
</tr>
<tr>
<td>Vidrion CTM (SS White)A</td>
<td>0.132</td>
<td>0.006</td>
</tr>
<tr>
<td>VitroFil CTM (Nova DFL)C</td>
<td>0.308</td>
<td>0.017</td>
</tr>
</tbody>
</table>

Materials with the same letter are not significantly different from each other.

**CONCLUSION:** There was a significant difference (p<0.05) in the amount of erosion sustained by the selected GICs. Samples in group A showed the least acid erosion and had mean erosion values below the ISO standard 9917-1:2007 maximum for GICs, 0.170 mm. Samples in group C showed the most acid erosion, all having mean erosion values greater than 0.170 mm. This data suggests that there are GICs on the market that do not meet ISO specifications for acid erosion.

*Supported in part by SDI. Presented at the 2014 AADR General Session in Charlotte, North Carolina. Abstract #488.*
Assessing Surface Roughness on Composite Restorations Using Different Abrasive Products

Stephanie John, James Vlahakis, Masly Harsono, and Ronald Perry

OBJECTIVE: To evaluate the effect of different abrasive discs products on surface roughness of composite restorations.

METHODS: Nine composite groups (n=5 each group listed in Table 1) were prepared by packing uncured composite into a stainless steel mold (20 mm x 10 mm x 5mm). Mylar sheets were placed over each surface of uncured composite. Glass plates were placed over the Mylar sheets and pressed down to extrude excess material. Specimens were then light-cured in a TRIAD 2000 visible light-curing unit (DENTSPLY) for two minutes each side. Specimens were taken from the mold, and one side of each specimen was polished down with a #320 sand paper using light pressure to remove the initial shiny surface resulting from curing against the Mylar. Specimens were then paired with the finishing and polishing systems described in Table 1. To standardize finishing/polishing, one operator treated all samples, each polishing device was used only once, and polishing motion was kept circular and constant. Polishing devices were used dry and the same slow speed hand piece (NSK EX-6) was used for all samples. Average surface roughness (Ra, µm) was measured with a contact surface profilometer (Veeco Dektak 6 m) using a tracing area of 3 mm x 3 mm and a cutoff value of 0.8 mm to filter surface waviness. The effectiveness of various polishing systems was evaluated based on the mean percentage difference of surface roughness before and after polishing procedures. Statistical analysis was conducted using one-way ANOVA with post hoc Tukey HSD test for pair wise analysis. Statistical significance was predetermined at p<0.05.

RESULTS:

<table>
<thead>
<tr>
<th>Group (n=5)</th>
<th>Resin Composite</th>
<th>Polishing Systems (F) and Polishing (P)</th>
<th>Mean (Ra, µm) Before polish (µm±SD)</th>
<th>Mean (Ra, µm) After polish (µm±SD)</th>
<th>Percentage difference (%±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Filtek™ Supreme Plus A2 (3M ESPE)</td>
<td>Sof-Lex discs (3M ESPE) F: Coarse + Medium P: Fine + Superfine</td>
<td>0.515±0.162</td>
<td>0.052±0.012</td>
<td>89.28±3.87 a</td>
</tr>
<tr>
<td>2</td>
<td>Herculite® Ultra A2 (Kerr)</td>
<td>OptiDisc (Kerr) F: Extra coarse + Coarse/Medium P: Fine + Extrafine</td>
<td>0.296±0.025</td>
<td>0.056±0.012</td>
<td>80.97±4.15 a</td>
</tr>
<tr>
<td>3</td>
<td>GrandioSo® (Voco)</td>
<td>F: Enhance finishing discs (DENTSPLY Caulk) P: Diamanto polishing lens (Voco)</td>
<td>0.328±0.028</td>
<td>0.064±0.013</td>
<td>80.24±4.51 a</td>
</tr>
<tr>
<td>4</td>
<td>TPH3® (DENTSPLY Caulk)</td>
<td>F: Enhance finishing discs (DENTSPLY Caulk) P: PoGo polishing discs (DENTSPLY Caulk)</td>
<td>0.885±0.165</td>
<td>0.083±0.046</td>
<td>90.47±5.85 a</td>
</tr>
<tr>
<td>5</td>
<td>TPH3® (DENTSPLY Caulk)</td>
<td>F: Enhance finishing discs (DENTSPLY Caulk) P: Prisma gloss + Prisma gloss extra fine (DENTSPLY Caulk)</td>
<td>0.885±0.165</td>
<td>0.166±0.072</td>
<td>80.99±8.36 a</td>
</tr>
</tbody>
</table>
### Comparative Response of Whitening Strips Versus In-Office Light-Assisted Whitening

**Gerard Kugel,¹ Ronald Perry,¹ Britta Magnuson,¹ Masly Harsono,¹ M.K. Anastasia,² Robert Gerlach,² and S. Farrell²**  
¹Tufts University School of Dental Medicine, Boston; ²Procter & Gamble Company, Mason, Ohio

**OBJECTIVE:** This clinical study compared peroxide-based whitening with 10-day take-home whitening strips to an immediate in-office light-enhanced whitening treatment.

**METHODS:** After institutional review and informed consent, 49 adults with no history of previous bleaching and a Vita shade of A2 or darker on maxillary anterior teeth were randomized (2:1) to at-home strips or in-office whitening treatments. The experimental group was daily 2-hour application of 10% hydrogen peroxide high-adhesion whitening strips (Crest® 3D White 2-Hour Express Whitestrips®) for at-home use over 10 days. The positive control was professional light-assisted application of a 25% hydrogen peroxide gel (Zoom!® Advanced Power Chairside Whitening System) after soft tissue isolation following manufacturer’s recommendations. Efficacy was measured objectively as L*a*b* color change using digital images at baseline and day 11, and safety was assessed by intraoral examination and subject report.

**RESULTS:** Mean (SD) age was 36.6 (11.8), 57% of subjects were female, and treatments were balanced (p>0.54) on starting tooth color. At day 11, both groups exhibited significant (p<0.001) color improvement from

<table>
<thead>
<tr>
<th>Group (n=5)</th>
<th>Resin Composite</th>
<th>Polishing Systems Finishing (F) and Polishing (P)</th>
<th>Mean (Ra, µm) Before polish (µm±SD)</th>
<th>After polish (µm±SD)</th>
<th>Percentage difference (%±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>TPH4® Cream (DENTSPLY Caulk)</td>
<td>F: Enhance finishing discs (DENTSPLY Caulk) P: PoGo polishing discs (DENTSPLY Caulk)</td>
<td>0.742±0.116 0.061±0.034</td>
<td>91.22±12.82 a</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>TPH4® Cream (DENTSPLY Caulk)</td>
<td>F: Enhance finishing discs (DENTSPLY Caulk) P: Prisma gloss + Prisma gloss extra fine (DENTSPLY Caulk)</td>
<td>0.742±0.116 0.350±0.065</td>
<td>51.77±12.82 b</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Experimental Composite 1 (stiff)</td>
<td>F: Enhance finishing discs (DENTSPLY Caulk) P: PoGo polishing discs (DENTSPLY Caulk)</td>
<td>0.600±0.082 0.061±0.038</td>
<td>90.18±5.29 a</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Experimental Composite 1 (stiff)</td>
<td>F: Enhance finishing discs (DENTSPLY Caulk) P: Prisma gloss + Prisma gloss extra fine (DENTSPLY Caulk)</td>
<td>0.600±0.082 0.244±0.040</td>
<td>58.14±12.47 b</td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSION:** All groups evaluated showed a significant decrease in surface roughness with the exceptions of groups 7 and 9.


## 2013-2014 FACULTY ABSTRACTS
baseline. After adjusting for baseline and age, day 11 $\Delta b^*$ means (SE) were $-2.1 (0.14)$ for the strip group and $-1.8 (0.20)$ for the in-office group. Groups did not differ ($p>0.22$) on post-treatment $\Delta b^*$ or $\Delta L^*$ whitening at day 11. Tooth sensitivity and oral irritation were the most common adverse events, with the latter more common (38% of subjects) in the professional control.

**CONCLUSION:** Daily use of take home whitening strips resulted in similar tooth whitening as a professional light-assisted whitening treatment.

**Sponsored in part by Procter & Gamble. Presented at the 2014 AADR General Session in Charlotte, North Carolina. Abstract #518.**

### Effects of Surface Treatments and Cement Types on the Bond Strength of Porcelain-to-Porcelain Repair

**F.F. Mohamed,1 Matthew Finkelman,2 Roya Zandparsa,2 Hiroshi Hirayama,2 and Gerard Kugel2**  
1School of Dentistry, University of Michigan, Ann Arbor, Michigan; 2Tufts University School of Dental Medicine, Boston

**PURPOSE:** The purpose of this in vitro study was to evaluate the effects of four surface treatments and two resin cements on the repair bond strength of a ceramic primer.

**MATERIALS AND METHODS:** Eighty-eight pairs of disks (10 and 5 mm in diameter, 3 mm thickness) were prepared from heat-pressed feldspar ceramics (GC Initial IQ). After being stored in mucin-artificial saliva for 2 weeks, the 10-mm disks were divided into four surface treatment groups ($n=22$) and then treated as follows: (1) no treatment (control); (2) 40% phosphoric acid; (3) 5% hydrofluoric acid + acid neutralizer + 40% phosphoric acid; (4) silica coating (CoJet-sand) + 40% phosphoric acid. The 5-mm disks were treated with 5% hydrofluoric acid + 40% phosphoric acid. The two sizes of porcelain disks, excluding the control group, were primed with Clearfil Ceramic Primer. The specimens in each group were further divided into two subgroups of 11 each, and bonded with Clearfil Esthetic Cement (CEC) or Panavia F 2.0 Cement (PFC). The specimens were stored in distilled water at 37°C for 24 hours, thermocycled for 3000 cycles at 5 to 55°C, and stored at 37°C for an additional 7 days. Shear bond strength (SBS) was measured with a universal testing machine at a 0.5 mm/min crosshead speed until fracture. Statistical analysis of the results was carried out with a two-way ANOVA and Tukey HSD test ($\alpha=0.05$). Debonded specimen surfaces were examined under an optical microscope to determine the mode of failure.

**RESULTS:** The statistical analysis showed that the SBS was significantly affected by surface treatment and resin cement ($p<0.05$). For treatment groups bonded with CEC, the SBS (MPa) values were (1) 2.64±1.1; (2) 13.31±3.6; (3) 18.88±2.6; (4) 14.27±2.7; while for treatment groups cemented with PFC, the SBS (MPa) values were (1) 3.04±1.1; (2) 16.44±3.3; (3) 20.52±2.2; and (4) 16.24±2.9. All control specimens exhibited adhesive failures, while mixed types of failures were observed in phosphoric acid-treated groups. The other groups revealed mainly cohesive and mixed failures.

**CONCLUSIONS:** Combined surface treatment of etching with hydrofluoric acid and phosphoric acid provides the highest bond strengths to porcelain. Also, PFC exhibited higher SBS than CEC did.

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Comparative Performance of Two Whitening Systems in a Dental Practice

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OBJECTIVE: A randomized, controlled clinical trial was conducted to compare the safety and whitening efficacy of high-adhesion tooth-whitening strips with a marketed in-office professional tooth-whitening system.

METHODS AND MATERIALS: This open-label study was conducted in a private dental practice, and adult volunteers were assigned (2:1) to either 9.5% hydrogen-peroxide whitening strips (strip group) or an in-office light plus 25% hydrogen-peroxide whitening gel treatment (in-office group). The strip group was instructed to treat the maxillary arch once daily for 30 minutes over a 20-day period, while the in-office group underwent professional application of light plus whitening gel in a single office visit. Whitening response was measured as change in yellowness (b*) and lightness (L*) at Day 21 using standardized digital images of the maxillary anterior teeth, while safety was assessed as tooth sensitivity and oral irritation occurrence. A total of 45 subjects enrolled, were randomized, and received treatment; 44 completed the study.

RESULTS: At day 21, significant improvement in b* and L* was noted in both groups (p≤0.001). The adjusted mean (SE) ΔL* in the strip group (1.72 (0.104)) was significantly greater than that in the in-office group (1.17 (0.153)) (p=0.005). Both test products were well tolerated. Overall, both the strip and in-office treatments resulted in significant tooth whitening.

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Dental Imaging and Fabrication

Roya Zandparsa

Bioceramics have been adopted in dental restorations for implants, bridges, inlays, onlays, and all-ceramic crowns. Dental bioceramics include glass ceramics, reinforced porcelains, zirconias, aluminas, fiber-reinforced ceramic composites, and multilayered ceramic structures. The process of additive manufacturing is ideally suited to dentistry. Models are designed using data from a computed tomography scan or magnetic resonance imaging. Since its development in 2001, direct ceramic machining of presintered yttria tetragonal zirconia polycrystal has become increasingly popular in dentistry. There are wide variety of commercially available cements for luting all-ceramic restorations. However, resin cements have lower solubility and better aesthetic characteristics.

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Latest Biomaterials and Technology in Dentistry

Roya Zandparsa

Navigation technology is applied successfully in oral and maxillofacial surgery. Laser beams are used for caries removal. With nanodentistry, it is possible to maintain comprehensive oral health care. Nanorobots induce oral analgesia, desensitize teeth, and manipulate the tissue. They can also be used for preventive, restorative, and curative procedures. Strategies to engineer tissue can be categorized into three major classes: conductive, inductive, and cell transplantation approaches. Several populations of cells with stem cell properties have been isolated from different parts of the tooth.

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**DIAGNOSTIC SCIENCES**

**Systematic Interpretation of CBCT Scans: Why Do It?**

*Rumpa Ganguly and Aruna Ramesh*

Cone beam computed tomography (CBCT) is being extensively used by dentists and dental specialists. Although the advantages of using this modality are enormous, with information comes responsibility. Most dental clinicians are not maxillofacial radiologists and are generally not familiar with interpretation of anatomy and pathosis in the head-and-neck area outside their immediate area of clinical interest. This leaves a larger part of extragnathic anatomy unassessed in a CBCT volume that is prescribed for specific dental diagnosis and treatment planning. This is critical because literature shows that most often, incidental findings—those that are found unrelated to immediate clinical interest—are found in the extragnathic areas. Incidental findings are abnormal findings that are unrelated to the initial purpose of the CBCT study. The failure to identify and report these findings, especially if these findings are pathological in nature, can lead to medical complications in the patient and have potential medicolegal ramifications for the dentist/specialist.


**Coincidence of Calcified Carotid Atheromatous Plaque, Osteoporosis, and Periodontal Bone Loss in Dental Panoramic Radiographs**

*Aruna Ramesh, Sheila Soroushian, and Rumpa Ganguly*

**PURPOSE:** This study was performed to assess the correlation of calcified carotid atheromatous plaque (CCAP), the mandibular cortical index, and periodontal bone loss in panoramic radiographs.

**MATERIALS AND METHODS:** One hundred eighty-five panoramic radiographs with CCAP and 234 without this finding were evaluated by three observers for the presence of osseous changes related to osteoporosis and periodontal bone loss. Chi-squared and Mann-Whitney *U* tests were used to compare the two groups for an association of CCAP with the mandibular cortical index and periodontal bone loss, respectively.

**RESULTS:** There was a statistically significant coincidence of CCAP and osseous changes related to osteopenia/osteoporosis, with a *p*-value<0.001. There was no statistically significant coincidence of CCAP and periodontal bone loss. When comparing the 2 groups, “with CCAP” and “without CCAP,” there was a statistically significant association with the mean body mass index (BMI), number of remaining teeth, positive history of diabetes mellitus, and vascular accidents. There was no statistically significant association with gender or a history of smoking.

**CONCLUSION:** This study identified a possible concurrence of CCAP and mandibular cortical changes secondary to osteopenia/osteoporosis in panoramic radiographs. This could demonstrate the important role of dental professionals in screening for these systemic conditions, leading to timely and appropriate referrals resulting in early interventions and thus improving overall health.

EDUCATION RESEARCH

Pioneering Toolkit Pilot Course Enhances Student Research and Learning Experience

Addy Alt-Holland and Eileen Doherty

PURPOSE: Facilitating the involvement of dental students in basic, clinical or educational research is essential for the future of dental education, and for over two decades Tufts University School of Dental Medicine (TUSDM) has offered a student summer research program. This program encourages dental students to conduct research primarily during the summer and offer stipends on a competitive basis to support this activity. Enrolled students are mentored by faculty members and are expected to write a research proposal, perform the research, submit a research abstract, and present their research at the school’s Bates-Andrews Research Day and in various conferences. Students who participate in this program do so for a variety of reasons, including the quest for knowledge, increased resume visibility, supplementary stipend, travel opportunity, and building a stronger relationship with faculty members. However, the experiences that students have under various research mentors and projects are wide-ranging. A faculty-driven effort to provide comprehensive research guidelines for dental students and to promote camaraderie between them, regardless their perspective research areas, was needed. To address these shortcomings, a pioneering pilot course was designed to enhance the learning and teaching experience, provide life-long learning tools, and broaden the students’ skills, scientific thinking, and satisfaction in their research experience and accomplishments.

METHODS: Our pilot course was offered to 53 research students during the 2013 summer. The course included educational and practical sections and was designed to be fun, interactive and informative. The educational section consisted of four lectures given by faculty members and staff aimed to orient the students as they become involved in research and to provide them with comprehensive guidelines that are applicable to any research discipline in which they are engaged. In the course’s practical section, students were assigned to four groups, each encompassing basic science research, clinical research, dental materials, and population data analysis, and were encouraged to participate in round-table discussions and online discussion boards through the Tufts University Sciences Knowledgebase (TUSK) internet site.

FINDINGS: The lectures provided the students with an overview on institutional personnel, managing the advisor-advisee relationship, critical aspects of scientific research, the basics of good study design, and the methods for an effective literature search and writing successful scientific abstracts. Students’ feedback was positive for the round-table discussions as it allowed them to introduce their research plan to their group members, reflect on their progress, achievements, and frustrations, and listen to their peers’ input. We found that the weekly TUSK online board discussions enabled them to continuously share their research progress, success and obstacles, and support each other in their research journey. However, out of the course’s 53 students, the first-year students were most inclined to take advantage of the online discussion board. Out of the 24 first-year students, 12 students (50%) participated on a regular basis and provided weekly research updates at least 3 times during the summer. Of these, 9 students posted once or twice during the summer, and 3 students did not participate. Second- and third-year students seemed to be less enthusiastic about the online tool; 16 of them (55%) participated once or twice in the online discussions and 16 students (30%) did not participate in the online discussion board. Throughout the course, students were prompted to give feedback on the course structure and content. Currently an assessment online survey of the effectiveness of this pilot course on students’ research and learning experience is underway and will be presented in the poster.
**CONCLUSION:** This pioneering “Student Summer Research Toolkit” pilot course aimed to “plant the seeds of research” in dental students, introduce them to teamwork concepts, and provide them with diverse educational and scientific tools to support and enhance their learning experience. We found that the course was more effective for first-year students as they began their research experience at TUSDM. We anticipate that overall the course increased the students’ research experience, the ways they write about it, and the confidence with which they present it. The online survey will allow us to assess the students’ overall learning outcomes, revise and improve the course, and respond to the students’ learning needs. We intend to disseminate the course concept and assessment plan to other schools that involve student research in their programs.

*Presented at the annual meeting of the American Dental Education Association in San Antonio, Texas.*

**Online, Interactive Discussion Boards Enhance Student Research and Learning Experience**

**Addy Alt-Holland, Eileen Doherty, and Jennipher Murphy**

Tufts University School of Dental Medicine offers a student summer research program that fosters the involvement of its students in basic, clinical, and educational research. We created a pilot course with educational and practical sections that aimed to be fun, interactive, and informative. This course was designed to enhance learning and teaching, broaden the students’ skills, scientific thinking, and satisfaction in their research experience, and promote camaraderie between them. One of the course’s unique aspects was the participation of the students in online discussion boards through the Tufts University Sciences Knowledgebase (TUSK) internet site. We generated discussion groups that included students that were involved in diverse research areas as a means to introduce them to teamwork concepts and to support each other in their research journey by sharing their research progress, success, and obstacles in an open, interactive online weekly journal. We found that the first-year students were willing to take advantage of the online discussion board; half of them participated on a regular basis and provided weekly research updates, questions and self-reflections. In general, second- and third-year students seemed to be less enthusiastic about the new online tool. An assessment survey of the effectiveness of this pilot course on students’ research and learning experience is underway and the results will be discussed in our presentation.

*Presented at the annual meeting of the American Dental Education Association, San Antonio, Texas.*

**Problem-Based Learning in Dental Education: A Systematic Review of the Literature**

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The purpose of this systematic review was to compare the effectiveness of problem-based learning (PBL) with that of traditional (non-PBL) approaches in dental education. The search strategy included electronic and manual searches of studies published up to October 2012. The population, intervention, comparator, and outcome (PICO) framework was utilized to guide the inclusion or exclusion of studies. The search strategy identified 436 articles, 17 of which met the inclusion criteria. No randomized controlled trial was found comparing the effectiveness of PBL with that of lecture-based approach at the level of an entire curriculum.
Three randomized controlled trials had evaluated the effectiveness of PBL at a single course level. The quality assessment rated four studies as being of moderate quality, while the other studies were assessed as being of weak quality. This review concludes that there are a very limited number of well-designed controlled studies evaluating the effectiveness of PBL in dental education. The data in those studies reveal that PBL does not negatively influence the acquisition of factual knowledge in dental students and PBL enhances the ability of students in applying their knowledge to clinical situations. In addition, PBL positively affects students’ perceived preparedness.


**MedEdPORTAL: A Report on Oral Health Resources for Health Professions Educators**

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MedEdPORTAL is a unique web-based peer-reviewed publication venue for clinical health educators sponsored by the Association of American Medical Colleges (AAMC). The open exchange of educational resources promotes professional collaboration across health professions. In 2008, the American Dental Education Association (ADEA) collaborated with AAMC to allow dental educators to use the platform to publish dental curriculum resources. Oral health is integral to general health; hence, collaboration among healthcare professionals brings enormous value to patient-centered care. The aim of this study was to conduct a current survey of metrics and submission statistics of MedEdPORTAL resources. The data were collected using the MedEdPORTAL search engine and ADEA and AAMC staff. The data collected were categorized and reported in tables and charts. Results showed that at the time of this study there were over 2,000 medical and dental resources available to anyone worldwide. Oral health resources constituted approximately 30% of the total resources, which included cross-indexing with information relevant to both medical and dental audiences. There were several types of dental resources available; the most common were the ones focusing on critical thinking. The usage of MedEdPORTAL has been growing, with participation from over 190 countries and 10,000 educational institutions around the world. The findings of this report suggest that MedEdPORTAL is succeeding in its aim to foster global collaborative education, professional education, and educational scholarship. As such, MedEdPORTAL is providing a new forum for collaboration and opens venues for promising future work in professional education.

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Perceptions and Practices of U.S. Dental Schools Regarding Curriculum Integrated Format and Traditional Format Licensure Exams

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The dental licensure exam in the United States has evolved over the past ten years, and two formats—the traditional format and curriculum-integrated format—are now available for students to satisfy licensure requirements. The objective of this study was to examine the differences and relative merits of the two formats. A 25-question survey was distributed to the 57 U.S. dental schools at the time. The survey included both quantitative and discrete variables and followed a strategic sequential order. The first set of questions sought to determine what type of board preparatory/mock exam each dental school offered, and the next set of questions asked which licensure exam each school formally offered. The final questions were qualitative in nature and aimed to determine the school representatives’ opinions about the curriculum-integrated format versus traditional format. Of the 57 schools contacted, 37 agreed to participate (response rate=64.9%). Of these, 14 schools reported that they administer the traditional format only and 12 administer the curriculum integrated format only, while 11 offer both. Also, 32 schools offered mock board exams to their graduating students, and 24 of those said their mock exams were identical in format to the actual qualifying clinical exams offered at their institution. The respondents reported no significant advantage to preparing for the curriculum-integrated format examination as compared to the traditional format examination with regards to number of clock hours taken from regular curriculum time. In reporting on this study, this article provides an overview of the relative advantages and disadvantages of the two examination formats used for the dental licensure process in the United States.


Criteria Considered by Program Directors in the AGEP Admission Process

Irina Dragan, Noshir Mehta, and E. Anderson

Throughout the history of higher education, the method for selecting students has changed as attitudes among faculty and administrators changed and as scientists developed new instruments of measurement. Colleges and universities have altered what they are by changing whom they admit. Information regarding the postgraduate selection process in dentistry is sparse and available only for certain specialties. The aim of this presentation is to describe and discuss the results of a survey distributed among the advanced dental education program directors in the United States, in order to review and compare the criteria considered to select the candidates for their programs.

Presented at the 6th Dental Students’ Scientific Meeting in Saudi Arabia, February 2014.
Assessing the Level of Evidence in the Postgraduate Experience at TUSDM

Irina Dragan, Taylor Newman, Nadeem Karimbux, and Paul Stark

AIM: The aim of this project was to assess the format used in the literature review classes offered in the postgraduate (PG) programs at Tufts University School of Dental Medicine (TUSDM). A secondary aim was to evaluate the differences in how the course format and objectives are perceived by the students vs. the course directors.

MATERIAL AND METHODS: The proposed research study was an observational cross-sectional study. The subjects of the study, the PG students and the course directors of the literature review classes, received the same survey on the day of the literature review class. Two co-investigators (TN, ID) explained to all the subjects the purpose of the study and helped with the data collection. The survey consisted of multiple choice and short answer response questions regarding the format of the literature review class, as well as the role of evidence-based dentistry (EBD) in these classes. The same two co-investigators reviewed and compared the written responses of both groups (course directors and students) for each literature review class, evaluating the agreement between the groups. Counts and percentages were reported for categorical data. SAS, Version 9.2 (SAS Institute, Cary, North Carolina) was used for all statistical analyses. This study was approved by the Tufts Health Sciences Institutional Review Board.

RESULTS: A total of 7 course directors and 74 students completed the survey for 7 literature review courses offered in the PG programs. Courses included 4 accredited advanced education programs (endodontics, orthodontics, periodontology, prosthodontics) and 1 advanced education program (esthetic dentistry). Endodontics and periodontology offer both current and classic literature review courses. All of the classes meet at least once per week to discuss articles ultimately chosen by the course directors, except orthodontics, which uses American Board of Orthodontics (ABO) criteria. The majority of the students were in partial agreement with the course directors stated objectives, except orthodontics residents, which were in complete agreement, and prosthodontics residents, which did not match at all. Only 1 of the 7 classes, periodontology current, utilizes a recognized way of evaluating the level of evidence.

CONCLUSION: PG literature review courses should adopt a more consistent format, while still adhering to each discipline's accreditation or governing body requirements. More emphasis should be placed on incorporating EBD in the PG literature review curriculum.

Presented at the annual meeting of the American Dental Education Association, San Antonio, Texas.

Valuable Tips for Designing a Successful Research Project

Irina Dragan and Paul Stark

Research methodology, biostatistics, and epidemiology are seldom part of the dental school’s curriculum. The number of research studies currently developed in the dental field and the manuscripts published have steadily increased. Multiple studies have revealed the poor quality of the dental literature and mentioned the need for more training for dentists interested in conducting research projects. For clinicians who are not interested in developing new projects, a basic understanding about the study design and statistical analyses is required for evaluating the literature. The current presentation will summarize the basic concepts that should be considered for developing a successful research project and highlight important aspects commonly lacking in dental research projects.

Presented at the XXII Portuguese Dental Association Annual Meeting, Portugal, November 2013.
Interprofessional Teams: Collaborative Management of the Medically Complex Patient

Diana Eshaki,* Kanchan Ganda, Sanjay Chand, and Wai-Choong Foong

Dental accreditation standards emphasize the need for medical science instruction in dentistry. Tufts University School of Dental Medicine and University of Detroit Mercy School of Dentistry have introduced two models of chair-side medical education in the undergraduate dental clinic. These unique programs enable students to become confident in treating medically complex patients, learn about the work of other healthcare practitioners, enhance the role of the dentist as a partner in interprofessional healthcare delivery, and improve patient outcomes. Participants will learn two teaching models about the care of the medically complex patient to dental students on the clinic floor.

Presented at the ADEA Annual Session and Exhibition in San Antonio, Texas.

Performance of Dental Students Versus Prosthodontists Residents on a 3D Immersive Haptic Simulator

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1Harvard School of Dental Medicine; 2Tufts University School of Dental Medicine; 3European University of Britain; 4Harvard Medical School and Massachusetts General Hospital

This study evaluated the performance of dental students versus prosthodontics residents on a simulated caries removal exercise using a newly designed, 3D immersive haptic simulator. The intent of this study was to provide an initial assessment of the simulator’s construct validity, which in the context of this experiment was defined as its ability to detect a statistically significant performance difference between novice dental students (n=12) and experienced prosthodontics residents (n=14). Both groups received equivalent calibration training on the simulator and repeated the same caries removal exercise three times. Novice and experienced subjects’ average performance differed significantly on the caries removal exercise with respect to the percentage of a carious lesion removed and volume of surrounding sound tooth structure removed (p<0.05). Experienced subjects removed a greater portion of the carious lesion, but also a greater volume of the surrounding tooth structure. Efficiency, defined as percentage of carious lesion removed over drilling time, improved significantly over the course of the experiment for both novice and experienced subjects (p<0.001). Within the limitations of this study, experienced subjects removed a greater portion of carious lesion on a 3D immersive haptic simulator. These results are a first step in establishing the validity of this device.

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Science Literacy for Civic Engagement: Bringing Science to Life

Jonathan Garlick

Our goal is to bring the world of science to life by allowing students to reflect on, explore, and assess its personal relevance and meaning, so they can thoughtfully engage to solve big problems facing the world. To do this, our educational initiative, “Science Literacy for Civic Engagement,” links foundational science literacy to “public learning” as a process of inquiry through which a civil and democratic society searches for solutions to problems at the interface of science and the public interest. Our students tell us that to learn the value and consequences of science is to learn what it means to be human. This initiative is designed to help our students engage in
an open-minded discussion about the impact of science in their lives and to make this public conversation more open and accessible. To accomplish this, we have implemented several undergraduate courses and small-group seminars to help students with interests in the humanities and social sciences better understand the broad socio-cultural impacts of science and medicine through an interdisciplinary lens. We create teaching teams that bridge disciplines and expertise in medicine, dentistry, veterinary medicine, occupational therapy, biology, anthropology, policy, literature, philosophy, law, and ethics. These freshman seminars, “Science and the Human Experience,” have helped Tufts students discover a compelling, personal rationale to explore science-based citizenry issues that lie at the interface of science and society. Our goal is to ensure that all students, both science and non-science majors, gain the tools to understand, assess, analyze, and evaluate the social, moral, philosophical, political, and ethical issues that are grounded in science and play an increasingly larger role in contemporary life. This includes end-of-life and reproductive issues, as well as stem-cell research. Students grapple with multiple points of view about how science-based issues dramatically impact their lives. Addressing these issues requires the tools to interpret scientific content including skepticism, critical thinking, and the ability to recognize and deal with the many gray areas—the unexplored spaces between the “facts” postulated by traditional scientific inquiry. We have developed pedagogy termed “ensemble learning”—an approach where students don’t merely talk about issues that are important to them, but also seriously consider and weigh the worth of opinions other than their own. Faculty model this conversation for their students, as class discussions became personal and poignant when students entertain a spectrum of views related to diversity, inclusion, and social justice. Ultimately, the goal of “Science Literacy for Civic Engagement” is to create a forum in which citizens have a voice and can find common ground in the science conversation that impacts their lives.


Use of Lecture Recordings in Dental Education: Assessment of Status Quo and Recommendations

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This research project was part of a planned initiative at the University of Pittsburgh School of Dental Medicine to incorporate lecture recordings as standard educational support technologies. The goal of an institutional survey was 1) to gather current data about how dental educators across the United States and Canada use lecture recordings; 2) determine dental educators’ perceived value and outcomes of using lecture recordings; and 3) develop recommendations based on #1 and #2 for the dental education community. Of the 66 North American dental schools at the time of the study, 45 schools responded to the survey, for a 68% response rate. Of the respondents, 28 schools were found to currently conduct lecture recording; these comprised the study sample. This study focused on the dental schools’ past experiences with lecture recording; thus, those not currently engaged in lecture recording were excluded from further analysis. The survey questions covered a wide range of topics, such as the scope of the lecture recording, logistics, instructional design considerations, outcomes related to student learning, evaluation and reception, barriers to lecture recording, and issues related to copyright and intellectual property. The literature review and results from the survey showed that no common guidelines for best practice were available regarding lecture recordings in dental education. The article concludes with some preliminary recommendations based on this study.

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An Initial Assessment of Haptics in Preclinical Operative Dentistry Training

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The purpose of this study was to assess novice student perception of haptic-based manual dexterity training. The short-term impact of haptic training in the early phase of preclinical operative dentistry education was also investigated. Dental students performed a class II amalgam and a class III resin tooth preparation in a typodont model at baseline. The experimental group performed exercises on the manual dexterity module of the IDEA™ software using a haptic device. The exercises required removing the maximum amount of three-dimensional geometric shapes within a predetermined width and depth. Tooth preparations were repeated 2 weeks later. A questionnaire survey was given to assess the subjective evaluation of the haptic simulation exercise. Tooth preparations were scored regarding external outline, internal form, and integrity of adjacent tooth. Improvement of overall tooth preparation scores post-haptic use was not statistically significant compared to controls (p>0.05). However, students found the game-feature of the haptic device made the learning experience more fun and interesting. The haptic exercises with the manual dexterity module software were not superior in improving the dexterity of students for tooth cavity preparations in short-term. Benefits of ease of use and fun learning experience can be further investigated in future studies.

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Using Dental Students’ Preclinical Performance as an Indicator of Clinical Success

Bianca Velayo, Paul Stark, Steven Eisen, and Gerard Kugel

The purpose of this study was to evaluate part of one dental school’s predoctoral curriculum by investigating correlations between students’ final grades in two preclinical courses and their performance in the related clinical courses. The sample consisted of 301 students at Tufts University School of Dental Medicine who graduated in 2010 and 2011. All final grades used as data were obtained from the Registrar’s Office and evaluated anonymously. The average preclinical final grades differed significantly for students in the 2010 (M=84.92, SD=3.35) and 2011 (M=79.67, SD=4.67) classes, as did their average clinical final grades (2010: M=88.38, SD=2.13; 2011: M=87.45, SD=2.06). The data for each class were therefore examined separately. Results showed that the correlation between students’ preclinical grades and clinical grades in operative dentistry and fixed prosthodontics was statistically significant (2010: r²=0.144, p<0.001; 2011: r²=0.261, p<0.001). This finding suggests there may be a positive relationship between preclinical and clinical performance of these students; however, the discrete factors contributing to that relationship were not investigated in this study and require further research.

The Need for Dentists with Formal Training in Public Health: The Development of the DMD/MPH Program

Wanda Wright and Jennifer Au

Many graduate programs in public health offer students the opportunity to enroll in combined degree programs. The most frequent dual degrees offered at member schools of the Association of Schools of Public Health are: MD/MPH, JD/MPH, MSN/MPH, MSW/MPH, and MBA/MPH. Dentistry and public health have traditionally not worked as synergistic disciplines because they are based on different care models. However, a number of different imperatives emphasize the need for this type of combined expertise to address oral-health problems and workforce shortages. As a recognized specialty by the American Dental Association, dental public health remains a very small group with less than 200 diplomats credentialed in dental public health. Most advanced degree programs in public health do not offer a specialty in dental public health, and those dental professionals receiving masters or doctoral public health degrees may have had no specific coursework related to dental public health. In response to this need, a new option at Tufts University School of Dental Medicine (TUSDM) was initiated to offer a combined DMD/MPH program. We describe the development process, which includes the philosophy guiding the program, initiation of the program, setting goals and objectives, identifying course content, funding, and selecting applicants, as well as first-year challenges and successes. The program was successfully funded and participant selection, registration, and enrollment procedures have been developed. Course content and performance standards have been established. The experience at TUSDM can help guide others contemplating a combined dental/MPH program.

Presented at the 141st APHA Annual Meeting in Boston, Massachusetts. Abstract #282286.
ENDODONTICS RESEARCH

Rubber Dam Use During Post Placement Influences the Success of Root Canal-Treated Teeth

Joshua Goldfein, Chad Speirs, Matthew Finkelman, and Robert Amato

INTRODUCTION: Salivary leakage after root canal therapy is of great concern and can lead to failure of the endodontic therapy. The aim of this study was to investigate whether the use of a rubber dam (RD) during post placement impacts the success of root-canal-treated teeth.

METHODS: Retrospective chart reviews of 185 patients with an average recall of 2.7 years were assessed for the incidence of a new periapical lesion (periapical index score>2) after root canal therapy and post placement. The patients were divided into 2 groups based on the presence or absence of an RD clamp in the verification radiograph during post placement.

RESULTS: In the study, 26 patients (30 teeth) had a post placed with the use of an RD and 159 patients (174 teeth) had a post placed without an RD. In the non-RD group, 128 (73.6%) teeth were considered successful at follow-up. In the RD group, 28 (93.3%) teeth were considered successful at follow-up. Based on the bivariate GEE model, the difference in success between these 2 groups was statistically significant (p=0.035).

CONCLUSIONS: The use of an RD during prefabricated post placement provides a significantly higher success rate of root-canal-treated teeth. Using an RD is already considered a standard of care for nonsurgical root canal therapy; in addition, using an RD during restorative procedures that involve open teeth should also become a standard of care.

Published in Journal of Endodontics 39(12), 1481-1484.

A Survey of Root Canal Treatment in Saudi Arabia: A Pilot Study

Zuhair Natto

OBJECTIVE: To characterize the methods and practices used in root canal treatment in Saudi Arabia.

METHODS: A questionnaire was developed and distributed in 2010–2011 to a simple random sample of 205 dental practitioners and distributed among private and governmental sectors in 8 different Saudi Arabian cities. The questions were designed to provide understanding of the awareness and knowledge of dentists regarding the new instruments and modern techniques that exist in the practice of endodontics. Completed questionnaires were analyzed in terms of a simple summary statistic.

RESULTS: A total of 85.9% of the practitioners responded. The majority of respondents reported using step-back instrumentation as their main root canal preparation technique (79%) and K-type files as intracanal instruments (75%). Overall, 47% of respondents did not use intracanal medications in their practice. Cold lateral compaction was the method of choice for 86% of respondents. Only 3%, however, used magnification devices and only 20% used electronic apex locators. Among those who indicated using rotary nickel titanium files, 80% use a ProFile system.

CONCLUSIONS: In Saudi Arabia, there are traditional trends in practice that do not appear to be supported by scientific evidence. The results of this survey demonstrate the importance of integrating evidence-based practice concepts into teaching curriculums, continuous education courses, and postgraduate studies. However, further studies are necessary to evaluate this trend.

IMPLANTOLOGY RESEARCH

An In Vitro Comparison of the Accuracy of Implant Impressions with Coded Healing Abutments and Different Implant Angulations

Khaled Al-Abdullah, Roya Zandparsa, Matthew Finkelman, and Hiroshi Hirayama

STATEMENT OF PROBLEM: Fabricating implant definitive casts with CAD/CAM technology (Robocasts) from coded healing abutment impressions represents a simpler and innovative alternative to conventional implant impression techniques. However, information about the accuracy of the impressions and the resultant definitive casts is limited.

PURPOSE: The purpose of the study was to evaluate the accuracy of the Robocasts and compare them to those definitive casts fabricated with conventional implant impression techniques (open tray with splinted impression copings technique).

MATERIAL AND METHODS: A reference epoxy resin cast was fabricated and shaped to simulate a dental arch. Two regular platform implant replicas (Biomet 3i Certain, 4.1 mm diameter and 15 mm length) with internal connections were placed 10 mm apart with a 10-degree convergence for one side of the reference resin cast and a 30-degree convergence for the other. Coded healing abutments (Encode) were placed at 3 different heights above the level of the soft tissue replication material (approximately 1, 2, and 4 mm) and served as test groups (E1, E2, and E4), and open trays with splinted impression copings (OTSC) served as a control group. The control group was compared to the impressions of the coded healing abutments by using a standardized measurement protocol. Impressions were made for each group (n=18) and poured with vacuum mixed (100 g powder/20 mL water) Type IV dental stone. The vertical discrepancy (Z axis) between 2 prefabricated passively fitting titanium reference frameworks and the platforms of the implant replicas was measured with an optical comparator applying the 1 screw test. Data were analyzed with Kruskal-Wallis and post-hoc Mann-Whitney U tests, as well as the Wilcoxon signed-rank tests. The Bonferroni correction was used to account for multiple comparisons. The significance level (α) used in a given set of tests was equal to 0.05 divided by the number of tests performed in that set.

RESULTS: The median vertical discrepancy of each coded healing abutment impression group was higher than the corresponding median of the control group (OTSC) for every combination of angulation and position. Kruskal-Wallis tests indicated a statistically significant difference (p<0.001) between groups for each angulation/position combination. All post hoc Mann-Whitney U tests indicated statistically significant differences (all p≤0.002) between OTSC and the other groups. Differences between the angulations and positions were not statistically significant when accounting for multiple comparisons.

CONCLUSIONS: The implant definitive casts fabricated from the coded healing abutment impressions were found to be less accurate than those fabricated from the open tray with splinted impression copings technique for restoring 2 paired (10 or 30 degrees) convergent internal connection implants with nonengaging screw-retained splinted 2-unit implant restorations. Accuracy of fit was not influenced by the implant angulation or position for either impression technique or by the Encode healing abutment height for the Encode impression technique.

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Effect of Different Implant Heights and Angulations on Overdenture Retention

Ekaterini Antonellou,* Nopsaran Chaimattayompol, Gerard Kugel, Matthew Finkelman, and Samia Elhamdy

OBJECTIVE: The aim of this in vitro study was to evaluate the retentive properties of an overdenture attachment system when two implants were placed at different heights and/or different buccal-lingual angulations.

METHOD: In this study, 40 sets of 2 implant-supported overdenture models were evaluated (N=10 per group). An acrylic resin block was used to house the overdenture Locator® attachments, while an artificial bone block was used to house two implants. The groups consisted of the following: group A (control group), implants were placed parallel to each other at same height; group B, implants were placed parallel to each other at different heights (3 mm difference); group C, implants were placed at different angulations (20°) at same height; and group D, implants were placed at different angulations (20°) at different heights (3 mm difference). The height was pre-determined by the bone block, and different abutment heights were used to compensate for the difference. The angulations were determined by a digital goniometer; all angled implants were lingually tilted. Retention loss was defined as the number of cycles required for the dislodgement force to drop below 20 N. A texture analyzer was programmed to apply dislodgment force to the attachment system in a wet condition and to stop cycling when retentive forces drop below 20 N. Two-way ANOVA and four independent-samples t-tests (α=0.05) between each group were used to analyze the difference in retention loss.

RESULT: Results of two-way ANOVA were significant. Results of independent sample t-tests (α=0.05) revealed significant differences between groups C and D, A and C, and B and D, while there was no significant difference between groups A and B.

Table 1: Two-way ANOVA results.

<table>
<thead>
<tr>
<th>Source</th>
<th>F</th>
<th>P-Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heights</td>
<td>7.502</td>
<td>0.010</td>
</tr>
<tr>
<td>Angulations</td>
<td>65.067</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 2: Independent samples t-test results.

<table>
<thead>
<tr>
<th>Group Comparison</th>
<th>T</th>
<th>P-value P-Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A, B</td>
<td>-0.726</td>
<td>0.477</td>
</tr>
<tr>
<td>Group C, D</td>
<td>5.887</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Group A, C</td>
<td>2.656</td>
<td>0.016</td>
</tr>
<tr>
<td>Group B, D</td>
<td>9.543</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

CONCLUSION: Results of this study demonstrated that implants placed at different heights and angulations resulted in a significant difference in the retention of the attachments of implant supported overdentures.

Titanium-Zirconium Narrow-Diameter Versus Titanium Regular-Diameter Implants for Anterior and Premolar Single Crowns: One-Year Results of a Randomized Controlled Clinical Study

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AIM: To test whether titanium-zirconium (TiZr) 3.3-mm diameter implants perform differently from titanium (Ti) 4.1-mm diameter implants with respect to marginal bone level (MBL) and clinical parameters.

MATERIAL AND METHODS: Forty subjects in need of a single implant-supported crown in the anterior or premolar regions were recruited in two centers. After random allocation, either a Ti or a TiZr implant was placed. Definitive crowns were inserted 6 months after implant placement. Implant survival, change in MBL, clinical parameters and occurrence of adverse events were assessed at the 1-year examination.

RESULTS: At 1 year, 38 of the 40 included patients were examined (18 Ti and 20 TiZr implants). All the implants were in place and stable. From the implant placement to the 1-year examination, the change of MBL amounted to −0.40 mm in the Ti group and −0.41 mm in the TiZr group. There were no significant differences between the groups regarding the change in MBL, the clinical parameters, and the occurrence of adverse events.

CONCLUSIONS: The use of TiZr implants with narrow diameter for the support of single crowns in the anterior and premolar regions leads to successful tissue integration and clinical performance over a 1-year period.


A Five- to Six-Year Radiological Evaluation of Titanium Plasma Sprayed/Sandblasted and Acid-Etched Implants: Results from Private Practice

Hamasat Gheddaf Dam, Semaan Abi Najm, Nathalie Nurdin, Mark Bischof, Matthew Finkelman, and Rabah Nedir

OBJECTIVES: This study aimed to determine bone level changes after 5 to 6 years of follow-up for a large group of one-stage dental implants consecutively placed in private practice. Potential confounding factors influencing crestal bone loss (CBL) were also assessed.

MATERIALS AND METHODS: A total of 378 transmucosal Straumann implants in 174 patients were examined radiographically. Half of the study population’s implants (189 implants) had a titanium plasma sprayed (TPS) surface, and the other half (189 implants) were sandblasted and acid-etched (SLA). Mean CBL was measured from 5 to 6 years post-operative radiographs on the basis of known implant landmarks. Correlations of increased CBL with various independent variables were also investigated. Statistical analyses were performed using generalized estimating equations.

RESULTS: Radiographic measurements showed a CBL≤1.5 mm for 65% of studied implants. A CBL>1.5 mm was found for 28% of implants, while 7% of implants had a CBL≥3 mm. Three factors significantly influenced CBL (p<0.05): implant surface texture (TPS>SLA), smoking status (smokers>non-smokers), and implant location (anterior>posterior).

CONCLUSIONS: CBL was ≤1.5 mm after 5 to 6 years for the majority of followed implants. For implants with a
CBL > 1.5 mm, statistically significant correlations were found for TPS surface type, anterior jaw locations, and smoking. Implant length did not influence CBL.

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The Effect of Keratinized Mucosa Width on Peri-Implant Health: A Systematic Review

Luca Gobbato, Gustavo Avila-Ortiz, Keyvan Sohrabi, C.W. Wang, and Nadeem Karimbux

PURPOSE: The aim of this systematic review was to investigate the effect of keratinized mucosa width (KMW) on clinical parameters of peri-implant health and stability.

MATERIALS AND METHODS: Two independent reviewers conducted a comprehensive search to identify studies on human subjects reporting KMW as a bivariate factor (≥2 mm and <2 mm), along with mean pocket depth (PD), bleeding on probing (BOP), modified bleeding index (mBI), gingival index (GI), plaque index (PI), modified PI (mPI), and implant survival with a minimum follow-up of 6 months after implant loading. Eight studies were included in the systematic review and seven in the meta-analyses to ascertain summary effects for differences in the aforementioned parameters among groups of KMW.

RESULTS: Pooled analyses showed that GI, PI, and mPI were significantly higher in the group with KMW of <2 mm, while mBI was also higher but only marginally significant. In contrast, PD was not significantly different between the two groups. Differences in BOP and implant survival rate could not be analyzed because of limited data availability. Heterogeneity was highly significant among the pooled studies for all investigated variables.

CONCLUSION: Reduced KMW around implants appears to be associated with clinical parameters indicative of inflammation and poor oral hygiene. However, based on the selected evidence, the predictive value of KMW is limited.


Comparison of the Effect of Two Interdental Cleaning Devices around Implants on the Reduction of Bleeding: A Thirty-Day Randomized Clinical Trial

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1Tufts University School of Dental Medicine, Boston; 2Water-Pik Inc., Fort Collins, Colorado

OBJECTIVE: To determine the effectiveness of a water flosser in reducing the bleeding on probing (BOP) index around dental implants as compared to flossing.

METHODS AND MATERIALS: Patients with implants were randomly assigned to one of two groups in this examiner-masked, single-center study. The study compared the efficacy of a manual toothbrush paired with either traditional string floss or a water flosser.

RESULTS: The primary outcome was the reduction in the incidence of BOP after 30 days. There were no differences in the percent of bleeding sites between the groups at baseline. At 30 days, 18 of the 22 (81.8%) implants in the water flosser group showed a reduction in BOP compared to 6 of the 18 (33.3%) in the floss group (p=0.0018).

CONCLUSIONS: These results demonstrate that the water flosser group had statistically significantly greater
bleeding reduction than the string floss group. The authors concluded that water flossing may be a useful adjuvant for implant hygiene maintenance.

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The Effect of Different Implant-Abutment Connections on Screw Joint Stability

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1Tufts University School of Dental Medicine, Boston; 2Aristotle University of Thessaloniki, School of Dentistry, Thessaloniki, Greece; 3Northeastern University, Boston

Dental implants with an internal connection have been designed to establish a better stress distribution when lateral external forces act on the prosthesis and minimize the forces transmitted to the fastening screw. In the present study, 10 externally and 10 internally hexed implants were tested with a compressive force applied with an Instron Universal machine. Four cycles of loading-unloading were applied to each specimen to achieve displacements of 0.5, 1, 2, and 2.5 mm. The mean loads for the first cycle were 256.70 N for the external connection and 256 N for the internal connection implants. The independent t-test did not reveal any significant differences among the 2 tested groups (p=0.780). For the second cycle, the mean loads needed for a displacement of 1 mm were 818.19 N and 780.20 N for the external connection and the internal connection implants, respectively. The independent t-test revealed significant differences among the 2 tested groups (p<0.001). In the third cycle, the mean load values for a 2-mm displacement were 1394.10 N and 1225.00 N. The independent t-test revealed significant differences among the 2 tested groups (p<0.001). The mean loads for the fourth cycle were 1488.00 N for the external connection and 1029.00 N for the internal connection implants. These loads were required for a displacement of 2.5 mm. The independent t-test revealed significant differences among the 2 tested groups (p<0.001). The results of this in vitro study suggest that the internal connection design of the examined implant system could not prevent screw loosening during overloading. No implant or prosthesis failure was noticed in either group.


Human Histologic Value of Platform-Switched Osseointegrated Dental Implant

Myron Nevins,1 Marcelo Camelo,1 Samuel Koo,1,2 Richard J. Lazzara,3 and David M. Kim1
1Harvard School of Dental Medicine; 2Tufts University School of Dental Medicine; 3Private Practice

This case report examined crestal bone level maintenance surrounding a platform-switched implant that was retrieved due to prosthetic difficulty. The retrieved platform-switched implant threads demonstrated tight contact with the surrounding bone and demonstrated both radiographic and histologic features that were indicative of successful osseointegration. Very high bone-to-implant contact (BIC) without epithelial downgrowth to the implant thread was noted. The BIC consisted of a combination of newly formed bone and native bone. The buccal and lingual bone levels coincided with the original platform position noted at the time of the surgery, and did not appear to resorb at all. The result of the present investigation confirms the maintenance of the crestal bone level for platform-switched implants.

**Implant Loading Protocols for Edentulous Patients with Fixed Prostheses: A Systematic Review and Meta-Analysis**

*Panos Papaspyridakos, C.J. Chen, S.K. Chuang, and Hans-Peter Weber*

**PURPOSE:** To report on the effect of immediate implant loading with fixed prostheses compared to early and conventional loading on implant and prosthesis survival, failure, and complications.

**MATERIALS AND METHODS:** An electronic and manual search was conducted to identify randomized controlled clinical trials (RCTs) as well as prospective and retrospective studies involving rough surface implants and implant fixed complete dental prostheses for edentulous patients.

**RESULTS:** The 62 studies that fulfilled the inclusion criteria featured 4 RCTs, 2 prospective case-control studies, 34 prospective cohort studies, and 22 retrospective cohort studies. These studies yielded data from 2,695 patients (2,757 edentulous arches) with 13,653 implants. Studies were grouped according to the loading protocol applied: 45 studies reported on immediate loading; 8 on early loading; and 11 on conventional loading. For the immediate loading protocol with flap surgery, the implant and prosthesis survival rates ranged from 90.1% to 100% and 93.75% to 100%, respectively (range of follow-up, 1 to 10 years). When immediate loading was combined with guided flapless implant placement, the implant survival rates ranged from 90% to 99.4%. For the early loading protocol, the implant and prosthesis survival rates ranged from 94.74% to 100% and 93.75% to 100%, respectively (range of follow-up, 1 to 10 years). For the conventional loading protocol, the implant and prosthesis survival rates ranged from 94.95% to 100% and 87.5% to 100%, respectively (range of follow-up, 2 to 15 years). No difference was identified between maxilla and mandible.

**CONCLUSIONS:** When selecting cases carefully and using dental implants with a rough surface, immediate loading with fixed prostheses in edentulous patients results in similar implant and prosthesis survival and failure rates as early and conventional loading. For immediate loading, most of the studies recommended a minimal insertion torque of 30 Ncm. The estimated 1-year implant survival was above 99% with all three loading protocols. Caution is necessary when interpreting these results, as there are many confounding factors that affect treatment outcomes with each of the loading protocols.


**Accuracy of Implant Impressions for Partially and Completely Edentulous Patients: A Systematic Review**

*Panos Papaspyridakos, C.J. Chen, G.O. Galluci, A. Doukoudakis, Hans-Peter Weber, and V. Chronopoulos*

**PURPOSE:** To compare the accuracy of digital and conventional impression techniques for partially and completely edentulous patients and to determine the effect of different variables on the accuracy outcomes.

**MATERIALS AND METHODS:** An electronic and manual search was conducted to identify studies reporting on the accuracy of implant impressions. Pooled data were descriptively analyzed. Factors affecting the accuracy were identified, and their impact on accuracy outcomes was assessed.

**RESULTS:** The 76 studies that fulfilled the inclusion criteria featured 4 clinical studies and 72 in vitro studies. Studies were grouped according to edentulism; 41 reported on completely edentulous and 35 on partially edentulous patients. For completely edentulous patients, most in vitro studies and all three clinical studies...
demonstrated better accuracy with the splinted vs. the nonsplinted technique (15 studies, splint; 1, nonsplint; 9, no difference). One clinical study and half of the in vitro studies reported better accuracy with the open-tray vs. the closed-tray technique (10 studies, open-tray; 1, closed-tray; 10, no difference). For partially edentulous patients, one clinical study and most in vitro studies showed better accuracy with the splinted vs. the nonsplinted technique (8 studies, splint; 2, nonsplint; 3, no difference). The majority of in vitro studies showed better accuracy with the open-tray vs. the closed-tray technique (10 studies, open-tray; 1, closed-tray; 7, no difference), but the only clinical study reported no difference.

CONCLUSION: The splinted impression technique is more accurate for both partially and completely edentulous patients. The open-tray technique is more accurate than the closed-tray for completely edentulous patients, but for partially edentulous patients there seems to be no difference. The impression material (polyether or polyvinylsiloxane) has no effect on the accuracy. The implant angulation affects the accuracy of implant impressions, while there are insufficient studies for the effect of implant connection type. Further accuracy studies are needed regarding digital implant impressions.


Transcription Factor and Bone Marrow Stromal Cells in Osseointegration of Dental Implants

Shi-guo Yan,1,2,3 Jin Zhang,1,2 Qisheng Tu,1 Jin-Hai Ye,1,4 En Luo,1,5 M. Schuler,6 M.M. Dard,7 Y. Yu,8 Dana Murray,1 David L. Cochran,9 Sung-Hoon Kim,10 P. Yang,2 and Jake Chen1

1Tufts University School of Dental Medicine, Boston; 2School of Stomatology, Shandong University, Jinan, China; 3Shandong Academy of Medical Sciences, Jinan, China; 4School of Stomatology, Nanjing Medical University, Nanjing, China; 5School of Stomatology, Sichuan University, Chengdu, China; 6Institute Straumann AG, Basel, Switzerland; 7New York University College of Dentistry, New York, New York; 8Fudan University, Shanghai, China; 9University of Texas Health Science Centre at San Antonio, San Antonio; 10College of Oriental Medicine, Kyunghee University, Seoul, South Korea

Titanium implants are widely used in dental clinics and orthopaedic surgery. However, bone formation surrounding the implant is relatively slow after inserting the implant. The current study assessed the effects of bone marrow stromal cells (BMSCs) with forced expression of special AT-rich sequence-binding protein 2 (SATB2) on the osseointegration of titanium implants. To determine whether SATB2 overexpression in BMSCs can enhance the osseointegration of implants, BMSCs were infected with the retrovirus encoding SATB2 (pBABE-SATB2) and were locally applied to bone defects before implanting the titanium implants in the mouse femur. Seven and twenty-one days after implantation, the femora were isolated for immunohistochemical (IHC) staining, haematoxylin eosin (H&E) staining, real-time quantitative reverse transcription polymerase chain reaction (qRT-PCR), and micro-computed tomography (μCT) analysis. IHC staining analysis revealed that SATB2-overexpressing BMSCs were intensely distributed in the bone tissue surrounding the implant. Histological analysis showed that SATB2-overexpressing BMSCs significantly enhanced new bone formation and bone-to-implant contact 3 weeks after implantation. Real-time qRT-PCR results showed that the local delivery of SATB2-overexpressing BMSCs enhanced expression levels of potent osteogenic transcription factors and bone matrix proteins in the implantation sites. μCT analysis demonstrated that SATB2-overexpressing BMSCs significantly increased the density of the newly formed bone surrounding the implant 3 weeks post-operatively. These results conclude that local delivery of SATB2-overexpressing BMSCs significantly accelerates osseointegration of titanium implants. These results provide support for future pharmacological and clinical
applications of SATB2, which accelerates bone regeneration around titanium implants.

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**Effect of Chronic Kidney Disease on the Healing of Titanium Implants**

H. Zou¹, X. Zhao¹, N. Sun¹, S. Zhang¹, T. Sato², H. Yu¹, Q. Chen¹, Hans-Peter Weber³, M. Dard⁴, Q. Yuan¹,² and B. Lanske²

¹Sichuan University, Chengdu, China; ²Harvard School of Dental Medicine, Boston; ³Tufts University School of Dental Medicine, Boston; ⁴New York University College of Dentistry, New York, New York

Chronic kidney disease (CKD) has become a worldwide public health problem. However, its effect on osseointegration of dental implants is largely unknown. The aim of this study is to investigate whether CKD impairs the quality of the osseointegration of titanium implants. Uremia was induced by 5/6 nephrectomy in mice, and serum levels of BUN, FGF23, PTH, and ALP were significantly increased. For in vitro tests, bone marrow mesenchymal stem cells (BMMSCs) were obtained and cultured on titanium discs. There was no significant difference in term of expression of osteogenic marker genes including Osx, Col-1, Ocn, and Opn, as quantified by qPCR. Moreover, Alizarin Red S staining showed comparable mineralized nodules formation. Histomorphometrical analysis of experimental implants inserted in the femurs of CKD mice revealed a trend of decreased BIC ratio at 2-week healing. The strength of bone-implant integration, as measured by a push-in method, was significantly lower for the CKD group at 2 weeks, although a comparable level was reached at 4 weeks. These results demonstrated that CKD only negatively affects the osseointegration of titanium implants at the early stage.

METHODOLOGY AND CLINICAL TRIALS

Outcomes of Implants and Restorations Placed in General Dental Practices: A Retrospective Study by the Practitioners Engaged in Applied Research and Learning Network

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OBJECTIVES: The authors conducted a study to determine the types, outcomes, risk factors and esthetic assessment of implants and their restorations placed in the general practices of a practice-based research network.

METHODS: All patients who visited network practices three to five years previously and underwent placement of an implant and restoration within the practice were invited to enroll. Practitioner-investigators (P-Is) recorded the status of the implant and restoration, characteristics of the implant site and restoration, presence of peri-implant pathology, and an esthetic assessment by the P-I and patient. The P-Is classified implants as failures if the original implant was missing or had been replaced, the implant was mobile or elicited pain on percussion, or there was overt clinical or radiographic evidence of pathology or excessive bone loss (>0.2 millimeter per year after an initial bone loss of 2 mm). They classified restorations as failures if they had been replaced or if there was abutment or restoration fracture.

RESULTS: The authors enrolled 922 implants and patients from 87 practices, with a mean (standard deviation) follow-up of 4.2 (0.6) years. Of the 920 implants for which complete data records were available, 64 (7.0%) were classified as failures when excessive bone loss was excluded from the analysis. When excessive bone loss was included, 172 implants (18.7%) were classified as failures. According to the results of univariate analysis, a history of severe periodontitis, sites with preexisting inflammation or type IV bone, cases of immediate implant placement and placement in the incisor or canine region were associated with implant failure. According to the results of multivariate analysis, sites with preexisting inflammation (odds ratio [OR]=2.17; 95% confidence interval [CI], 1.41–3.34]) or type IV bone (OR=1.99; 95% CI, 1.12–3.55) were associated with a greater risk of implant failure. Of the 908 surviving implants, 20 (2.2%) had restorations replaced or judged as needing to be replaced. The majority of P-Is and patients were satisfied with the esthetic outcomes for both the implant and restoration.

CONCLUSIONS: These results suggest that implant survival and success rates in general dental practices may be lower than those reported in studies conducted in academic or specialty settings.

PRACTICAL IMPLICATIONS: The results of this study, generated in the private general practice setting, add to the evidence base to facilitate implant treatment planning.

What You Need to Know about Data Management: Special SIVB Workshop at the World Forum

Kathryn Houk and Addy Alt-Holland

Today, the world’s hottest commodities are technology and information, and as scientists and researchers, we not only use technology to consume information, but we are also major users and producers of this information. When so much information is being produced, how is an information consumer supposed to: 1) find the relevant information, 2) determine its quality, and 3) build and test hypotheses based on this data? The answer to all these questions is fairly straightforward: academic librarians. Academic librarians are expertly trained in information organization, retrieval, and evaluation of information in physical and digital formats. The librarians who work at academic and health sciences libraries are what make the difference between researchers using a “satisficing” versus an “optimal decision” approach to their literature searches. The interactive workshop titled “Conquering Chaos in the Age of Networked Science: The Importance of Data Management” at the SIVB’s 2014 World Forum of Biology will be focusing on data management. New mandates from the Office of Science and Technology Policy, the bipartisan Fair Access to Science and Technology Research Act (FASTR) introduced in 2013, points to a new focus on providing access to research data used in publications. This workshop will be using a real lab’s research project as an example to cover the steps for good data management, the seven common issues you will likely encounter, and resources to assist you along the way. It aims to provide you with the knowledge and tools to better manage your data and to create the 2-page data management plan required by NSF and NIH grants.

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MINERALIZED TISSUE

BET Inhibitor JQ1 Blocks Inflammation and Bone Destruction

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BET proteins are a group of epigenetic regulators controlling transcription through reading acetylated histone tails and recruiting transcription complexes. They are considered as potential therapeutic targets in many distinct diseases. A novel synthetic bromodomain and extraterminal domain (BET) inhibitor, JQ1, was proved to suppress oncogene transcription and inflammatory responses. The present study was aimed to investigate the effects of JQ1 on inflammatory response and bone destruction in experimental periodontitis. We found that JQ1 significantly suppressed lipopolysaccharide (LPS)-stimulated inflammatory cytokine transcription, including interleukin (IL)-1β, IL-6, and tumor necrosis factor alpha (TNF-α), as well as receptor activator of nuclear factor kappa-B ligand (RANKL)-induced osteoclast markers, such as c-Fos, nuclear factor of activated T-cells, cytoplasmic, calcineurin-dependent 1 (NFATc1), tartrate-resistant acid phosphatase (TRAP), and cathepsin K in vitro. JQ1 also inhibited toll-like receptors 2/4 (TLR2/4) expression and nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB) phosphorylation and nuclear translocation. Chromatin immunoprecipitation and quantitative polymerase chain reaction (ChIP-qPCR) revealed that JQ1 neutralized BRD4 enrichment at several gene promoter regions, including NF-κB, TNF-α, c-Fos, and NFATc1. In a murine periodontitis model, systemic administration of JQ1 significantly inhibited inflammatory cytokine expression in diseased gingival tissues. Alveolar bone loss was alleviated in JQ1-treated mice because of reduced osteoclasts in periodontal tissues. These unprecedented results suggest the BET inhibitor JQ1 as a prospective new approach for treating periodontitis.

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Central Adiponectin Administration Reveals New Regulatory Mechanisms of Bone Metabolism in Mice

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Adiponectin (APN), the most abundant adipocyte-secreted adipokine, regulates energy homeostasis and exerts well-characterized insulin-sensitizing properties. The peripheral or central effects of APN regulating bone metabolism are beginning to be explored but are still not clearly understood. In the present study, we found that APN-knockout (APN-KO) mice fed a normal diet exhibited decreased trabecular structure and mineralization and increased bone marrow adiposity compared with wild-type (WT) mice. APN intracerebroventricular infusions decreased uncoupling protein 1 (UCP1) expression in brown adipose tissue, epinephrine and norepinephrine serum levels, and osteoclast numbers, whereas osteoblast osteogenic marker expression and trabecular bone mass increased in APN-KO and WT mice. In addition, centrally administered APN
increased hypothalamic tryptophan hydroxylase 2 (TPH2), cocaine- and amphetamine-regulated transcript (CART), and 5-hydroxytryptamine (serotonin) receptor 2C (Htr2C) expressions but decreased hypothalamic cannabinoid receptor-1 expression. Treatment of immortalized mouse neurons with APN demonstrated that APN-mediated effects on TPH2, CART, and Htr2C expression levels were abolished by downregulating adaptor protein containing pleckstrin homology domain, phosphotyrosine domain, and leucine zipper motif (APPL)-1 expression. Pharmacological increase in sympathetic activity stimulated adipogenic differentiation of bone marrow stromal cells (BMSC) and reversed APN-induced expression of the lysine-specific demethylases involved in regulating their commitment to the osteoblastic lineage. In conclusion, we found that APN regulates bone metabolism via central and peripheral mechanisms to decrease sympathetic tone, inhibit osteoclastic differentiation, and promote osteoblastic commitment of BMSC.

NEUROSCIENCE/TMJ

Temporomandibular Joint Osteoarthritis: Diagnosis and Long-Term Conservative Management: A Topic Review

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Degenerative joint disease (DJD), a common osteoarthritic problem encountered in clinical practice presents as a chronic debilitating disease resulting in altered joint structure due to degradation and loss of articular cartilage, along with changes in the subchondral bone and other soft tissues. DJD is a frequent finding in the temporomandibular joints (TMJs). Consequently, a good understanding of the use of a diagnostic algorithm will lead to a better control of DJD in the TMJ. The etiopathogenesis of osteoarthritis is complex, and it is associated with multiple risk factors. The condition progresses slowly through different phases with periods of remission and activity finally reaching the burnout phase. Conservative management forms the cornerstone for the treatment of most of these cases. This review attempts to acquaint the dentist with the diagnosis, pathogenesis and general characteristics of the disease while highlighting and updating them with the current conservative treatment algorithms in order to assist in the formulation of a treatment plan for these patients.


The Effect of Dental Occlusal Disturbances on the Curvature of the Vertebral Spine in Rats

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OBJECTIVE: To determine whether a unilateral increase or decrease in the bite affects the curvatures of the vertebral spine in rats.

METHODS: The study included 25 male Sprague Dawley rats. Of these, 5 animals received no alteration on their bite. Bite was increased on 10 animals, and molar teeth were extracted on 10 other animals. Frontal and lateral radiographs were taken on days 0, 7, 14, and 21. Distances from landmarks to a true vertical line were measured on both radiographs.

RESULTS: Repeated measures analysis showed statistically significant differences between the amount of the curvature at the cervical and thoracic spines on frontal and lateral radiographs over time (p<0.05 and p<0.0001). One-way ANOVA computed significant differences (p<0.05) at D14 at the cervical and thoracic spines on both increased and decreased vertical dimension.

CONCLUSION: Alterations in the dental occlusion affects the normal curvatures of the vertebral spine in rats.

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ORAL HEALTH RESEARCH

A Survey of Dentists’ Knowledge and Attitudes with Respect to the Treatment of Scleroderma Patients

David Leader, Athena Papas, and Matthew Finkelman

OBJECTIVE: Scleroderma or systemic sclerosis causes dry mouth, a major risk factor for tooth decay, and shrinks the mouth opening, complicating care. A 2011 survey determined that 28% of systemic sclerosis patients have difficulty finding dentists prepared to treat them, and 63% do not recommend their current dentist to other systemic sclerosis patients. We use a survey to gauge dentists’ knowledge and attitudes regarding the care of scleroderma patients.

METHODS: We conducted an Internet-based survey of all 4,465 members of the Massachusetts Dental Society to determine their knowledge and attitudes of treating systemic sclerosis patients. Data were analyzed using SPSS and Qualtrics research suite.

RESULTS: Surveys were accessed by 351 dentists and completed by 269. Responses were primarily from Eastern Massachusetts (80%), but represented the Boston area less than expected. Most dentists believed they have an ethical responsibility to treat patients who have scleroderma (93%). More than half of dentists believed that in not knowing about systemic sclerosis they might harm a patient (51%). If contacted by a patient who has scleroderma, 50% of dentists would gather information on the disease or the patient’s condition. Dentists who felt prepared (71%) were more likely to correctly answer questions related to diagnosis and classification of scleroderma than those who felt unprepared (p=0.004, Mann-Whitney U test).

CONCLUSION: Results indicate the potential value of creating a health communication effort targeting oral health providers to improve scleroderma patient satisfaction and access to care.

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Mycobacterial Pseudotumor of the Skin

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Inflammatory pseudotumors have a diverse etiology, mycobacterial pseudotumor (MP) being one of them. MP is a rare entity; it has been reported infrequently in various organs and is extremely rare in the skin. We report a cutaneous MP in an immunosuppressed liver transplant recipient. The lesion consisted mostly of spindle cells, with small numbers of lymphocytes. Conventional acid-fast bacilli (AFB) stain revealed a large number of acid-fast bacilli within spindled histiocytes and the presence of Mycobacterium avium was determined by polymerase chain reaction. Given that the patient had a prior history of cutaneous squamous-cell carcinoma resected and reconstructed in the same area, establishing the diagnosis was challenging. Immunohistochemical staining for lysosome-associated membrane protein was strongly positive, suggesting the presence of numerous mature lysosomes within infected spindle cells. Mycobacterial spindle cell pseudotumors can mimic malignant or benign neoplasms and should be considered in differential diagnosis of spindle-cell lesions, especially in immunocompromised patients. Further studies are needed to determine mechanisms that permit the survival of mycobacteria within the lesions and that cause this unusual manifestation of infection.

Effect of Sialagogue on Bleeding on Probing in Sjögren’s Syndrome

Mabi Singh and Athena Papas

BACKGROUND: Bleeding on probing (BOP) is a frequent observation in patients with Sjögren’s syndrome and a sialagogue is routinely prescribed for these patients.

OBJECTIVE: The objective of this study was to evaluate the effect of sialagogue (muscarinic cholinergic agonists) on BOP in patients with Sjögren’s syndrome.

MATERIALS AND METHODS: This observational study included 57 subjects. Study population was divided into two groups: subjects on sialagogue (n=32), and subjects not on sialagogue due to its side-effects (non-sialagogue, n=25). The number of sites with BOP was recorded on all teeth.

RESULTS: The subjects on sialagogue had a significantly lower mean (standard error) number of sites with BOP 22.97 (2.65) as compared with the non-sialagogue group 46.59 (6.20), p<0.001. After adjusting for the use of remineralizing rinse the subjects on sialagogue had a significantly lower number of sites with BOP (p<0.001).

CONCLUSION: In this observational study, treatment with sialagogue may prevent BOP in patients with Sjögren’s syndrome.


Use of Pre-operative Mouthwash in Dental Treatment: A Literature Review

Wael Yaghmoor,* Yumi Ogata, James Hanley, Matthew Finkelman, T. Kawai, and Yong Hur

OBJECTIVE: The aim of this study was to review and evaluate the use of pre-operative mouthwashes on reduction of bacterial count during different invasive dental procedures.

METHOD: PubMed/MEDLINE search and hand search for relevant articles were done from August 1960 through August 2013 to identify appropriate studies. A comprehensive search was designed and the studies were reviewed by 2 reviewers independently to evaluate the eligibility criteria. Clinical trials and randomized controlled clinical trials in English that evaluated the effect of pre-operative use of different mouthwashes on bacterial contamination during different dental procedures were selected. The total reduction of the bacterial load after the use of the mouthwashes was the primary outcome.

RESULT: A total of 10 out of 1,544 articles met the inclusion criteria and were included in the review. Chlorhexidine (CHX) was tested in 8 articles, povidone iodine in 3 articles, and Listerine® in 3 articles. After evaluating samples from saliva, CHX, Listerine, and povidone-iodine mouthwashes showed a significant reduction of aerobic and anaerobic bacteria (99.4%, 65.0%, 71.5% respectively) compared to control. CHX had the most persistent effect (up to 7 hours in one study). All three rinses showed a significant reduction of the incidence of bacteremia in blood samples following invasive dental procedures (e.g., scaling/root planing, intra-ligamental injections, and teeth extraction) as compared to control (55.0%, 90.1%, 72.5.0% respectively).

CONCLUSION: Studies showed varying amounts of reduction in bacterial load in both saliva and blood after rinsing with different mouth rinses. The limited number of the available studies about the pre-operative use and the heterogeneity of the studies and the products used made it difficult to come to a definite conclusion about the effect on bacterial counts. Additional clinical trials with various mouthwashes and studies to confirm the association between the quantitative oral flora counts and post-operative complications are recommended.

ORAL SURGERY RESEARCH

The Use of a Transcutaneous CO₂ Monitor during Moderate Sedation in Oral and Maxillofacial Surgery

Sanjeet Chaudhary,* Ruba Khader, Matthew Finkelman, Daniel Oreadi, Marcin Jarmoc, Roman Schumann, and Morton Rosenberg

PURPOSE: Continuous monitoring of end-tidal CO₂ (ETCO₂) is a requirement for deep sedation and general anesthesia during oral and maxillofacial surgery (OMFS) in 2014 and may be expanded to moderate sedation in the future. In intubated patients, the ETCO₂ measurement usually closely resembles the arterial partial pressure of CO₂ (PaCO₂). In non-intubated OMFS patients, ETCO₂ measurements are unreliable with respect to the PaCO₂ due to technical limitations in capturing exhaled gases. Transcutaneous CO₂ monitors measure the PtCO₂ with electrochemical technology independent of expired breaths. This technology closely reflects PaCO₂ and captures the end-result of clinical breathing patterns including respiratory efficiency in non-intubated patients by continuous PtCO₂ assessment and its trend during sedation. We conducted this pilot study to determine the possible clinical utility of a transcutaneous pCO₂ monitor during OMFS procedural sedation.

METHODS: Following IRB approval and written informed consent, we prospectively collected demographic, anesthetic, and outcome data in patients undergoing moderate Fentanyl and Midazolam sedation for third molar removal. All patients were monitored using a transcutaneous pCO₂ monitor (SenTec DMS, Therwil, Switzerland) that employs a simple earclip. A bispectral index (BIS) monitor (BIS™, Covidien, Mansfield, Massachusetts) assessed the depth of sedation. We correlated the sedation depth with the PtCO₂ using the Pearson correlation. A p<0.05 was significant.

RESULTS: Eighteen adult subjects completed the study. During moderate sedation the PtCO₂ increased with an increasing sedation level. PtCO₂ and level of sedation were negatively correlated (Pearson Correlation −0.3); however, this correlation was not statistically significantly different (p=0.072).

CONCLUSIONS: Transcutaneous CO₂ monitoring may be attractive during moderate sedation for OMFS procedures, because its location on the ear does not interfere with the surgical field and the CO₂ monitoring is not affected by the need to capture expiration. Our data show an inverse correlation between PtCO₂ and sedation level. This trend did not reach statistical significance in our small cohort. PtCO₂ monitoring may have a role as an additional safety monitor to reliably assess ventilation during sedation in non-intubated patients. A larger study with an increased variety of sedation techniques is warranted.

Abstract accepted for presentation at the Second Annual ACOMS Resident meeting (November 9–10, 2013) at the Jefferson Medical College in Philadelphia.

Prosthetic Dental Rehabilitation with Implants Status Post Segmental Resection of the Anterior Mandible

Sanjeet Chaudhary* and Daniel Oreadi

A 40-year-old female was referred to our Oral and Maxillofacial Surgery Department by her oral surgeon after a history of pain and swelling on the left parasymphyseal region. The patient’s past medical history is significant for anemia. She is allergic to penicillin and has a social history of smoking ½ PPD for 20 years. The patient underwent multiple surgical interventions including extraction of teeth #20 and #21, as well as an
incision and drainage of the affected area. She was refractory to medical and surgical therapy. After an extensive workup and biopsy of the affected area by her oral surgeon, the patient was diagnosed with acute suppurative osteomyelitis of the left anterior mandible. She was then referred to us for definitive treatment. The patient underwent segmental resection of the left anterior mandible with placement of a reconstruction plate and long-term antibiotics. Her post-operative healing period was uneventful. Four months after her initial surgery, the left mandibular defect was reconstructed with a posterior iliac crest bone graft with an interim period of four months for consolidation of the bone graft. The prosthodontic treatment plan includes restoration of mandibular dentition with a 4 implant over denture with placement of implants at areas # 20, 22, 29, and 31. Her remaining teeth 26, 27, and 28 remain periodontally stable. Due to the questionable restorability of the maxillary teeth and poor long-term prognosis, the remaining teeth in the maxilla were planned for extractions. The upper arch was planned for implant supported over denture utilizing 4 implants after adequate healing. The patient underwent IV sedation with extraction on all remaining maxillary teeth and placement of four implants on the mandible. The patient's follow-up was uneventful. A 4-month period will be given for the osseointegration of the mandibular implants, and future placement of maxillary implants on the upper arch for full mouth rehabilitation.

Abstract accepted for presentation at Robert Schoor Northeast Postgraduate Implant Symposium (October 3–4, 2013)

Immediate Mandibular Implants for Hybrid Prosthesis in a Patient Taking Bisphosphonates

Ghassan Darwish,* Andras Balint, and David-Joey Chang

A 64-year-old female presents to our clinic with a chief complaint: “I want new lower teeth.” She has a past medical history significant for depression, hypothyroidism, hypercholesterolemia, hypertension, GERD, osteoporosis, breast cancer, and kidney cancer. Her current medication list includes fluoxetine, budeprion, levothyroxine, simvastatin, atenolol, lisinopril, omeprazole, and vitamin D. She has no known drug allergies and quit smoking 30 years ago. She recalls taking alendronate for the past 2 years; however, she has been non-compliant with the medication for the past 6 months. She is fully edentulous on the maxilla with a complete maxillary denture and has remaining teeth 22–28 with significant periodontal disease. She was planned for extraction of her remaining teeth and a hybrid mandibular prosthesis. The patient underwent extraction of her remaining teeth with placement of 5 immediate implants in her anterior mandible and bone graft of labial bone under IV sedation. Her post-operative recovery was complicated by dehiscence of the soft tissue. After 5 months of healing, she returned with deficient bone over the labial alveolar ridge. In order to salvage the existing implants, she underwent additional bone grafting using demineralized freeze-dried bone allograft with a non-resorbable, titanium reinforced PTFE membrane under IV sedation. Extensive undermining of the periosteum was performed to facilitate closure without tension. Her postoperative recovery revealed appropriate healing with no evidence of soft-tissue dehiscence. After adequate healing, she will be ready for second-stage surgery followed by hybrid prosthetic reconstruction.

Adult Airway Evaluation in Oral Surgery

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Patients with a history of difficult intubation or with conditions associated with difficult airway should be approached with organized primary and secondary plans for airway management. When these potential problems are detected, patient safety may be improved with use of advanced airway management techniques and equipment. Additionally, patient referral for consultation and/or management at facilities where advanced airway management practitioners and equipment are available may be beneficial in some cases.


Management of Allergy and Anaphylaxis during Oral Surgery

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Minor and major allergic reactions occur during oral and maxillofacial treatment. Immediate diagnosis and pharmacologic intervention are imperative. Signs and symptoms may be variable. The early administration of epinephrine is critical.

ORTHODONTICS

Fully Customized Placement of Orthodontic Miniplates: A Novel Clinical Technique

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INTRODUCTION: The initial stability and survival rate of orthodontic mini-implants are highly dependent on the amount of cortical bone at their insertion site. In areas with limited bone availability, mini-plates are preferred to provide effective skeletal anchorage. The purpose of this paper was to present a new clinical technique for the insertion of mini-plates.

METHODS: In order to apply this new technique, a cone-beam image of the insertion area is required. Software (Galaxy Sirona, Bensheim, Germany) is used to construct a three-dimensional image of the scanned area and to virtually determine the exact location of the mini-plate as well as the position of the fixation screws. A stereolithographic model (STL) is then created by means of a three-dimensional scanner. Prior to its surgical insertion, the bone plate is adapted to the stereo-lithographic model. Finally, a custom transfer jig is fabricated in order to assist with accurate placement of the mini-plate intra-operatively.

RESULTS: The presented technique minimizes intra-operative decision making, because the final position of the bone plate is determined pre-surgically. This significantly reduces the duration of the surgical procedure and improves its outcome.

CONCLUSIONS: A novel method for surgical placement of orthodontic mini-plates is presented. The technique facilitates accurate adaptation of mini-plates and insertion of retaining surgical screws, thereby enabling clinicians to more confidently increase the use of bone plates, especially in anatomical areas where the success of non-osseointegrated mini-screws is less favorable.


Newly Defined Landmarks for a Three-Dimensionally Based Cephalometric Analysis: A Retrospective Cone-Beam Computed Tomography Scan Review

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OBJECTIVES: To identify two novel three-dimensional (3D) cephalometric landmarks and create a novel three-dimensionally based anteroposterior skeletal measurement that can be compared with traditional two-dimensional (2D) cephalometric measurements in patients with Class I and Class II skeletal patterns.

MATERIALS AND METHODS: Full head cone-beam computed tomography (CBCT) scans of 100 patients with all first molars in occlusion were obtained from a private practice. InvivoDental 3D (version 5.1.6, Anatomage, San Jose, California) was used to analyze the CBCT scans in the sagittal and axial planes to create new landmarks and a linear 3D analysis (M measurement) based on maxillary and mandibular centroids. An independent samples t-test was used to compare the mean M measurement to traditional 2D cephalometric
measurements, ANB, and APDI. Interexaminer and intraexaminer reliability were evaluated using 2D and 3D scatterplots.

RESULTS: The M measurement, ANB, and APDI could statistically differentiate between patients with Class I and Class II skeletal patterns (p<0.001). The M measurement exhibited a correlation coefficient (r) of −0.79 and 0.88 with APDI and ANB, respectively.

CONCLUSIONS: The overall centroid landmarks and the M measurement combine 2D and 3D methods of imaging; the measurement itself can distinguish between patients with Class I and Class II skeletal patterns and can serve as a potential substitute for ANB and APDI. The new three-dimensionally based landmarks and measurements are reliable, and there is great potential for future use of 3D analyses for diagnosis and research.

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The Effects of Lip Revision Surgery on Nasolabial Esthetics in Patients with Cleft Lip

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OBJECTIVES: 1) To determine the concordance among surgeons on subjective assessments of nasolabial esthetics in children with repaired cleft lip; and 2) to evaluate longitudinal changes in nasolabial esthetics in relation to cleft lip revision surgery.

SETTING AND SAMPLE POPULATION: School of Dentistry at University of North Carolina, Chapel Hill. Children with repaired unilateral cleft lip: 32 had lip revision surgery and 27 did not have surgery.

MATERIALS AND METHODS: Retrospective observational study from a non-randomized clinical trial. Ratings of nasolabial esthetics performed by 6 surgeons using the Asher-McDade scale at baseline and 12-month follow-up.

RESULTS: Concordance among surgeons ranged from poor to acceptable. Nasolabial ratings at follow-up were better in the revision group than in the non-revision group, although differences were small. The most prevalent change in the revision group was improvement in one or more units on the scale, while “no change” was most prevalent in the non-revision group. Participants in the revision group were more likely to receive a “no” in relation to the need for lip or nose revision at the follow-up visit.

CONCLUSION: There were mild esthetic improvements observed in relation to lip revision surgery, which should be interpreted with caution given the subjectivity of the rating method used.


Influence of Objective Three-Dimensional Measures and Movement Images on Surgeon Treatment Planning for Lip Revision Surgery

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OBJECTIVE: To determine whether a systematic evaluation of facial soft tissues of patients with cleft lip and palate, using facial video images and objective three-dimensional measurements of movement, change surgeons’
Orthodontics

treatment plans for lip revision surgery.

**DESIGN:** Prospective longitudinal study.

**SETTING:** The University of North Carolina School of Dentistry.

**PATIENTS, PARTICIPANTS:** A group of patients with repaired cleft lip and palate (n=21), a noncleft control group (n=37), and surgeons experienced in cleft care.

**INTERVENTIONS:** Lip revision.

**MAIN OUTCOME MEASURES:** (1) facial photographic images; (2) facial video images during animations; (3) objective three-dimensional measurements of upper lip movement based on z scores; and (4) objective dynamic and visual three-dimensional measurement of facial soft tissue movement.

**RESULTS:** With the use of the video images plus objective three-dimensional measures, the operating surgeon changed the problem list of the surgical treatment plan for 86% of the patients (95% confidence interval, 0.64 to 0.97) and the surgical goals for 71% of the patients (95% confidence interval, 0.48 to 0.89). The surgeon group varied in the percentage of patients for whom the problem list was modified, ranging from 24% (95% confidence interval, 8% to 47%) to 48% (95% confidence interval, 26% to 70%) of patients, and the percentage for whom the surgical goals were modified, ranging from 14% (94% confidence interval, 3% to 36%) to 48% (95% confidence interval, 26% to 70%) of patients.

**CONCLUSIONS:** For all surgeons, the additional assessment components of the systematic valuation resulted in a change in clinical decision making for some patients.


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**The Role of Mandibular Third Molars on Lower Anterior Teeth Crowding and Relapse after Orthodontic Treatment: A Systematic Review**

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**AIMS:** To evaluate the role of third molars in the development of crowding or relapse after orthodontic treatment in the anterior segment of the dental arch.

**METHODS:** PubMed search of the literature was performed selecting all the articles relevant to the topic and limiting the studies to controlled trials on humans and written in English. Systematic review was conducted according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement.

**RESULTS:** A total of 12 clinical studies were included in the review. A high risk of bias was found in most of the articles, either because the relative items assessed were inadequate or because they were unclearly described. The third molars were not correlated with more severe anterior tooth crowding in most of the studies. However, four of them described a different outcome.

**CONCLUSION:** Definitive conclusions on the role of the third molars in the development of anterior tooth crowding cannot be drawn. A high risk of bias was found in most of the trials, and the outcomes were not consistent. However, most of the studies do not support a cause-and-effect relationship; therefore, third molar extraction to prevent anterior tooth crowding or postorthodontic relapse is not justified.

PEDIATRIC DENTISTRY RESEARCH

Effect of the DentalVibe Injection System on Pain during Local Anesthesia Injections in Adolescent Patients

David Ching, Matthew Finkelman, and Cheen Loo

PURPOSE: The purpose of this study was to compare the pain rating scale measurements from an exposure group (injections with the aid of DentalVibe Injection Comfort System) and control group (traditional injection without the aid of the DentalVibe) in adolescent patients using self-reported pain during administration of local anesthetic injections.

METHODS: This was a randomized, controlled study. Subjects consisted of 36 10- to 17-year-old patients who required local anesthesia for dental treatment on both sides of the maxilla or mandible. All subjects received a conventional injection (control) and an injection using DentalVibe (experimental). A pain rating for each injection was obtained from subjects using the Wong-Baker FACES Pain Rating Scale.

RESULTS: Statistical analysis using a Wilcoxon signed rank test found a significant reduction in pain ratings for injections with the DentalVibe when compared to control injections. There was a positive correlation between the pain rating for control injection and the difference between the two types of injection, indicating that subjects who reported a higher pain score with the control injection had a greater reduction when DentalVibe was used.

CONCLUSION: When compared to a conventional approach, DentalVibe significantly lowered self-reported pain during local anesthesia injection for adolescent subjects in this study.

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PERIODONTAL RESEARCH

Recent Systematic Reviews Comparing Growth Factors in Periodontal Regeneration

Shatha Al Harthi, Yong Hur, Rory O’Neill, Andreas Paraschis, and Yumi Ogata

OBJECTIVE: A systematic review was performed to reveal the current consensus in the field of dentistry regarding which of the following treatment modalities is associated with the greatest periodontal regeneration (as measured by clinical attachment level, CAL) in patients with intrabony defects: plasma-rich platelets (PRP), platelet-derived growth factors (PDGF), or enamel-matrix derivative (EMD).

METHOD: Electronic search was conducted on PubMed, Google Scholar, and OVID for “systematic review,” “periodontal,” “clinical attachment level,” “plasma-rich platelets,” “platelet-derived growth factors,” and “enamel-matrix derivative.” Articles were included if they were recent (since 2008), were a systematic review or a meta-analysis, focused on intrabony defects in periodontal disease, reviewed PRP, PDGF or EMD, and compared CAL.

RESULT: Eight articles meeting criteria were identified. In 2008–2009, only 3 articles met criteria, and these focused on PRP only. For the other 5 articles, 2 focused exclusively on EMD, 1 on PRP, 1 on PDGF, and 1 on both PRP and PDGF. Regardless of timeframe, authors were hesitant to declare PRP better than placebo or competing treatments with respect to CAL gain in treatment of intrabony defects in periodontal patients. PDGF and EMD were reviewed more favorably vs. placebo as well as competing treatments, but the paucity and heterogeneity of studies prevented the authors from declaring superiority of these treatments.

CONCLUSION: There is no consensus on the superiority of PRP, PDGF, or EMD in periodontal regeneration in periodontal patients with intrabony defects. Few studies exist focusing on PDGF or EMD, and those reported have mixed results depending upon the comparison group. More studies exist on PRP, but the results suggest either no effect to a slight superiority in efficacy. Future studies on PDGF and EMD could shed light on whether, on balance, these treatments are superior to PRP or placebo.


A Survey: How Periodontists and Other Dental Professionals View the Scope of Periodontics

Peter Chang, Joshua Hall, Matthew Finkelman, Angel Park, and Paul Levi Jr.

BACKGROUND: How do periodontists think of themselves when they define their practices? How do other dental professionals view the scope of the specialty of periodontology? A strong component of periodontal residency programs is extracting teeth and preserving or building bony ridges for the eventual placement of implants. Has the discipline of periodontology moved away from retaining and treating the natural dentition? By the use of a rank-order survey, the practice of periodontology was defined by periodontists and other dental professionals.

METHODS: In a pilot study, respondents were asked to list the answers to the question, “What is a periodontist?” The results were consolidated into eight statements. The eight statements were placed into an anonymous rank-order survey, and more than 1,200 responses were returned. The responses primarily came from periodontists, hygienists, general practitioners, dental students, and dental hygiene students.
RESULTS: “Periodontists surgically treat advanced gum and bone infection problems” was considered the most important statement in all of the cohorts. The least important statement considered by all was, “Periodontists are educators promoting health.” Non-periodontist dentists (NPDs) ranked the statement, “Periodontists perform dental implants and related procedures” less importantly (p<0.001) than the periodontists. The non-periodontist cohort (NPC), which includes NPDs and dental hygienists, ranked the statement, “Periodontists’ treatments help general dentists and other specialists increase successful therapeutic outcomes” as second most important.

CONCLUSIONS: The results of this survey indicate that periodontists ranked the placement of implants and their related procedures higher than the NPC. NPDs appear to value periodontists in treating the natural dentition for their patients. The NPC appreciates that periodontal therapy done by periodontists increases their therapeutic success for their patients.

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Growth Factor-Mediated Vertical Mandibular Ridge Augmentation: A Case Report

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Posterior vertical alveolar ridge deficiencies are challenging defects to treat predictably and often require autogenous bone-harvesting procedures. Traditional treatment modalities (e.g., guided bone regeneration, distraction osteogenesis, and autogenous grafts) present with a number of potential complications and limited success when used to restore vertical ridge height. Recent advances in recombinant growth factor technology may provide viable, alternative therapies for the treatment of significant alveolar ridge deficiencies. This proof-of-principle case report examines the utility and effectiveness of using a composite graft of freeze-dried bone allograft and recombinant human platelet-derived growth factor BB in conjunction with an overlying titanium mesh to regenerate well-vascularized bone in a significant posterior mandibular ridge defect prior to implant placement. The important role of the overlying periosteum as a possible key source of osteogenic cells during growth factor-enhanced regenerative procedures is emphasized.


Modified Periosteal Releasing Incision for Flap Advancement: A Practical Technique for Tensionless Closure

Yong Hur, Minh Bui, Terrence Griffin, and Yumi Ogata

INTRODUCTION: Primary closure of a tensionless flap advancement is required following a guided bone regeneration (GBR) procedure. The periosteal releasing incision (PRI) is a commonly used technique for flap advancement. However, excessive use of the PRI technique to gain major flap advancement has consequences, such as swelling, paresthesia, bleeding, and patient discomfort. This article describes a novel technique with a shallow incision and lateral stretching approach, modified periosteal releasing incision (MPRI), for flap advancement.

CASE PRESENTATION: A 63-year-old nonsmoking Caucasian male presented for implant placement in the posterior mandibular area. Vertical and horizontal bone augmentation using GBR technique was planned prior
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to implant placement due to ridge deficiency. MPRI was utilized for flap advancement. The flap advancement achieved was greater than 10 mm. Using this technique, a major flap advancement was possible without mental nerve complications.

CONCLUSION: MPRI technique introduced in this case report has been used successfully where major flap advancement was needed to gain primary closure. The technique can be an alternative to the PRI technique where there is a possibility of damaging the nerve or when flap advancement made by PRI is inadequate, particularly around the mental foramen.


Popularity of Suture Materials among Residents and Faculty Members of Postdoctoral Periodontology Program

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The aim of the present study was to determine the favoritism of suture materials among a group of clinicians at a teaching institution. The surveys included 11 absorbable and 9 non-absorbable sutures. The surveyor was asked to select his or her suture preferences when it comes to using it in 13 different, commonly-performed surgical procedures. The surveys showed overall preferences for non-absorbable versus absorbable sutures. Chromic gut with a 4–0 diameter thread reverse cutting FS2 needle was the most favored suture. For periodontal bone grafts and hard tissue ridge augmentation, polytetrafluoroethylene with a 4–0 thread and FS2 needle was preferred. For autogenous gingival grafts, gingival allografts, connective tissue grafts, frenectomy, and frenoplasty, chromic gut with 5–0 diameter thread reverse cutting P3 needle was favored. For extraction socket preservation, soft tissue canine exposure, ridge augmentation, and dental implants, chromic gut with 4–0 diameter thread reverse cutting FS2 needle was preferred, and for sinus augmentation, vicryl with a 4–0 diameter thread reverse cutting FS2 needle was favored. Absorbable sutures were preferred in the majority of periodontal procedures; however, non-absorbable sutures were favored in procedures that required longer healing or better stability of the flap edges in cases of periodontal and ridge augmentation.


Restoration of Gingival and Esthetic Deformities following Flap Advancement: The Physiologically Pigmented Gingival Graft, A Case Report

Eduardo Marcuschamer, T. Tsukiyama, H. Moroi, Charles Hawley, and Terrence Griffin

The coronal advancement of surgical flaps and subsequent shift of the mucogingival junction during bone augmentation procedures are common. These mucogingival alterations may become a challenge to manage in the maxillary anterior region among patients with a high lip line upon smiling or high esthetic demands. To further complicate matters, the presence of physiologic gingival pigmentation in the esthetic zone creates challenges of its own. In this case, a free gingival graft from the buccal gingiva of the maxillary molars was used to correct the mucogingival deformity created from a guided bone regeneration procedure.

Bio-Absorbable and Non-Absorbable Membrane in Lateral GBR: A Literature Review

Lorenzo Mordini, Yumi Ogata, Hans-Peter Weber, Paul Stark, and Yong Hur

OBJECTIVE: Lateral guided bone regeneration (GBR) is a surgical procedure that utilizes absorbable and non-absorbable barrier membranes for bone augmentation. It has been proven to be a reliable and predictable procedure to augment bone in a horizontal direction at sites exhibiting insufficient bone volume for implant placement. The aim of this study is to review literature to obtain evidence-based criteria that helps to elect one of the two techniques currently used for lateral GBR.

METHOD: An electronic search on MEDLINE was conducted up to September 2013, supplemented by cross-checking bibliographies of relevant review articles. The following keywords were used: “alveolar ridge augmentation,” “lateral ridge augmentation,” “regeneration,” “bone regeneration,” “guided bone regeneration,” “barrier membranes,” “membranes,” “graft,” “bone grafts,” “bone substitutes.” Only articles in English language were selected. Animal studies were excluded.

RESULT: A total of 28 articles met the requirements for the study objectives (oldest from 1965 and the most recent 2012). Non-absorbable membrane showed different advantages towards the bio-absorbables. They generally provided better time of barrier function and controlled resorption. Bone formation was usually more favorable in situations of no membrane exposures. Human histologic studies confirmed these findings. However, some authors have reported opposite results. Non-resorbable membranes resist to breakdown processes and can maintain adequate defect space by not collapsing. However, they produce frequent post-operative complications (membrane exposure, infection, and soft-tissue dehiscence).

CONCLUSION: Non-absorbable membranes are considered the gold standard in bone augmentation procedures. Choosing the right material for GBR procedures is crucial. However, the choice of membrane is still a matter of personal choice based on experience and expert advice with limited scientific evidence. This literature review failed to identify articles with evidence-based criteria to help in the selection of bio-absorbable or non-absorbable membrane used for lateral GBR procedures in pristine edentulous areas.


Factors Associated with Tooth Loss following Periodontal Regenerative Therapy

Yumi Ogata, Minh Bui, Zuhair Natto, James Hanley, and Yong Hur

OBJECTIVES: The efficacy of periodontal regenerative therapies has been proven by many animal and human clinical studies. However, there is little evidence available to support long-term (greater than 5 years) success of periodontal regenerative therapy. Past studies have demonstrated some patient factors adversely affecting the outcome of periodontal therapy. The objective of this study was to systemically investigate factors associated with tooth loss following periodontal regenerative therapy by a retrospective study using a dataset from the electronic health records (EHR) of patients at Tufts University School of Dental Medicine (TUSDM).

METHODS: Patients who have EHR and received periodontal regenerative therapy, including guided tissue regeneration (GTR), bone replacement graft (BRG), enamel matrix derivative (EMD), and combinations of these therapies, in the Department of Periodontology at TUSDM from July 2006 to June 2008 were identified by record review and included in the study. Information regarding patient variables (demographic, systemic,
behavioral, dental, and surgical variables) were extracted from EHR for each patient and used as independent variables for the analysis. Dental variables include furcation involvement and the numbers of walls of the bony defects. Surgical variables include the type of membrane, bone graft and EMD used in the surgery.

**RESULTS:** In the study, 64 teeth (59 patients) were available for data analysis. Results demonstrated that 5-year survival rate of the periodontal regenerative therapy is 91.2%. Defect types (p=0.0003) and furcation involvement (p=0.002) were significantly related with tooth loss. Gender, location of the tooth, types of bone graft materials, and types of barrier membrane (PLA/PGA membrane, collagen membrane, or non-resorbable membrane) were not associated with the outcome.

**CONCLUSIONS:** The result of the study showed high long-term survival rate of periodontal regenerative therapy. There are factors associated with tooth loss following the procedures.


**Use of Polyphenols in Periodontal Inflammation**

*Iro Palaska, Evangelos Papathanasiou, and Theoharis Theoharides*

Periodontitis is an oral inflammatory disease of polymicrobial origin that causes the destruction of gingival connective tissue and the alveolar bone supporting the teeth. Host immune and inflammatory responses due to specific periodontopathogens and their metabolic products mediate local tissue destruction. Periodontal disease affects as many as 30% of adults and it is one of the most common chronic human diseases. However, traditional therapeutic modalities for periodontitis, including non-surgical or surgical periodontal therapy and occasional adjunctive antimicrobial therapy, have been only partially successful. Moreover, the widespread development of antibiotic resistance in pathogenic bacteria and unwanted effects on the gut flora necessitates new strategies to better control periodontal inflammation. Recently, natural compounds capable of modulating the host inflammatory response have received considerable attention. Here we review (Pubmed 1997 to 2013) the orally-related anti-bacterial and anti-inflammatory actions of polyphenols, naturally occurring molecules, capable of modulating the host inflammatory response. Of these, certain flavonoids appear to stand out because of their beneficial profile and clinical evidence. Unique formulations of novel flavonoids may be useful for further development as possible therapeutic agents for periodontal inflammation.


**Stress Hormones Regulate Periodontal Inflammation**

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Periodontal disease involves inflammation of the gingival tissues, caused by microbial pathogens. Recent papers suggest that emotional stress worsens periodontal disease. Here we review the literature and propose that corticotropin-releasing hormone (CRH) secreted under stress stimulates gingival mast cells together with other neuropeptides and cytokines to secrete pro-inflammatory molecules that contribute to periodontal pathology. Stress reduction and/or mast cell inhibition may provide additional therapeutic approaches.

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**Centipeda periodontii in Human Periodontitis**

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This study assessed the subgingival occurrence of the flagellated, gram-negative, anaerobic rod *Centipeda periodontii* in chronic periodontitis and periodontal health/gingivitis with species-specific nucleic acid probes, and evaluated the *in vitro* resistance of subgingival isolates to therapeutic levels of amoxicillin, metronidazole, and doxycycline. Subgingival plaque biofilm specimens from 307 adults with chronic periodontitis and 48 adults with periodontal health/localized gingivitis were evaluated with digoxigenin-labeled, whole-chromosomal, DNA probes to *C. periodontii* ATCC 35019 possessing a 104 cell detection threshold. Fifty-two *C. periodontii* subgingival culture isolates were assessed on antibiotic-supplemented enriched Brucella blood agar for *in vitro* resistance to either amoxicillin at 2 µg/ml, metronidazole at 4 µg/ml, or doxycycline at 2 µg/ml. A significantly greater subgingival occurrence of *C. periodontii* was found in chronic periodontitis subjects as compared to individuals with periodontal health/gingivitis (13.4 vs. 0%, p<0.003), although high subgingival counts of the organism (≥106 cells) were rarely detected (1.3% of chronic periodontitis subjects). *In vitro* resistance was not found to amoxicillin or metronidazole, and to doxycycline in only 2 (3.9%) of the 52 *C. periodontii* clinical isolates studied. These findings indicate that *C. periodontii* is not a major constituent of the subgingival microbiome in chronic periodontitis or periodontal health/gingivitis. The potential contribution of *C. periodontii* to periodontal breakdown in the few chronic periodontitis subjects who yielded high subgingival levels of the organism remains to be delineated. *C. periodontii* clinical isolates were susceptible *in vitro* to therapeutic concentrations of three antibiotics frequently used in treatment of human periodontitis.

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**Negotiating the Severely Resorbed Extraction Site: A Clinical Case Report with Histologic Sample**

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The treatment of an infected socket with a severe facial dehiscence/fenestration defect presents a therapeutic dilemma to the dental team. Both implant-supported restoration and fixed partial denture are viable options to restore function and occlusion, each with its benefits and disadvantages. In the present case report, a multi-stage regenerative approach was selected to enable implant-supported single crown. The first phase of the treatment after extraction of the maxillary central incisor was the stabilization of the blood clot with a collagen plug. After 6 weeks, the surgical site was re-entered and the socket was grafted with biphasic calcium sulfate (BCS). After 6 months, a dental implant was placed and a core biopsy taken. However, the central portion of the facial defect demonstrated only partial regeneration, resulting in exposure of 6 implant threads. Freeze-dried bone allograft (FDBA) and a collagen membrane were utilized to augment the ridge and cover the exposed threads. The histology of the bone core showed a complete resorption of the grafted material with the presence of new woven bone throughout the specimen. Clinically, complete defect regeneration and augmentation of the alveolar ridge were attained after 4 months. Thus, the clinician should consider the pros and cons of this regenerative approach along with other more conservative treatment alternatives when dealing with similar cases.

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Adiponectin Ameliorates Experimental Periodontitis in Diet-Induced Obesity Mice

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Adiponectin is an adipokine that sensitizes the body to insulin. Low levels of adiponectin have been reported in obesity, diabetes, and periodontitis. In this study we established experimental periodontitis in male adiponectin knockout and diet-induced obesity mice, a model of obesity and type 2 diabetes, and aimed at evaluating the therapeutic potential of adiponectin. We found that systemic adiponectin infusion reduced alveolar bone loss, osteoclast activity, and infiltration of inflammatory cells in both periodontitis mouse models. Furthermore, adiponectin treatment decreased the levels of pro-inflammatory cytokines in white adipose tissue of diet-induced obesity mice with experimental periodontitis. Our in vitro studies also revealed that forkhead box O1, a key transcriptional regulator of energy metabolism, played an important role in the direct signaling of adiponectin in osteoclasts. Thus, adiponectin increased forkhead box O1 mRNA expression and its nuclear protein level in osteoclast-precursor cells undergoing differentiation. Inhibition of c-Jun N-terminal kinase signaling decreased nuclear protein levels of forkhead box O1. Furthermore, over-expression of forkhead box O1 inhibited osteoclastogenesis and led to decreased nuclear levels of nuclear factor of activated T cells c1. Taken together, this study suggests that systemic adiponectin application may constitute a potential intervention therapy to ameliorate type 2 diabetes-associated periodontitis. It also proposes that adiponectin inhibition of osteoclastogenesis involves forkhead box O1.

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PHARMACOLOGY, THERAPEUTICS, AND TOXICOLOGY

Benefits of Thrombolytics in Prolonged Cardiac Arrest and Hypothermia over Its Bleeding Risk

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A 52-year-old non-smoking Caucasian male, who was admitted to our emergency room after he was found unconscious in a bathroom, went into cardiac arrest requiring prolonged cardiopulmonary resuscitation (CPR) and hypothermia therapy. Cardiac catheterization showed non-obstructive coronary arteries, and further bedside echocardiogram suggested probable pulmonary embolism (PE) as an underlying cause of cardiac arrest. Although thrombolytic therapy is an effective therapy for PE, it is not routinely given during prolonged CPR for its life-threatening bleeding complications. Many reported cases have suggested a beneficial effect of empiric thrombolytic in cardiac arrest, but unrelated to duration of resuscitation and adjuvant treatments that imposes bleeding risk. We suspect that tissue plasminogen activator (tPA) should be promptly given to prolonged cardiac arrest patients, even when bleeding risk is high with the concurrent hypothermia treatment, keeping the benefits over risk strategy. Our patient received thrombolytic, tPA and showed remarkable clinical, physiological and radiographical improvement.

PROSTHODONTICS RESEARCH

An In Vitro Comparison of Fracture Load of Zirconia Custom Abutments with Internal Connection and Different Angulations and Thickness: Part I
Abdalah Albosefi, Matthew Finkelman, and Roya Zandparsa

PURPOSE: The purpose of this in vitro study was to compare the fracture load of one-piece zirconia custom abutments with different thicknesses and angulations.

MATERIALS AND METHODS: Forty zirconia custom abutments were divided into 4 groups. Group A-1 and group B-1 simulated a clinical situation with an ideal implant position, which allows for the use of straight zirconia custom abutments with two thicknesses (0.7 and 1 mm). Groups A-2 and B-2 simulated a situation with a compromised implant position requiring 15° angulated abutments with different thicknesses (0.7 and 1 mm). Implant replicas were mounted in self-cure acrylic jigs to support the abutments in all groups. The zirconia custom abutments were engaged in the implant replicas using a manual torque wrench. Each jig was secured and mounted in a metallic vice 30° relative to a mechanical indenter. All groups were subjected to shear stress until failure using a universal testing machine with a 0.5 mm/min crosshead speed with the force transferred to the lingual surface of the zirconia custom abutments 2 mm below the top surface. The universal testing machine was controlled via a computer software system that also completed the stress-strain diagram and recorded the breaking fracture load. The fracture loads were recorded for comparison among the groups and subjected to statistical analysis (two-way ANOVA).

RESULTS: The mean fracture load of zirconia custom abutments across the groups (A-1 through B-2) ranged from 160±60 to 230±95 N. The straight zirconia custom abutment exhibited the highest fracture load among the groups (p=0.009); however, the thickness of the zirconia custom abutment had no influence on the strength of any of the specimens (p=0.827).

CONCLUSIONS: There was no statistically significant difference in fracture strength between the 0.7 and 1.0 mm groups; however, angulated zirconia custom abutments had the lowest fracture load.

CLINICAL IMPLICATION: The results of this in vitro study will help dental practitioners with their decision-making process in selecting the type of custom abutment to be used clinically.

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The Effect of Variations in Translucency and Background on Color Differences in CAD/CAM Lithium Disilicate Glass Ceramics
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PURPOSE: The purpose of this study was to compare the effect of variations in translucency and background on color differences (ΔE) for different shades of computer-aided design and computer-aided manufacturing (CAD/CAM) lithium disilicate glass ceramics.

MATERIALS AND METHODS: A pilot study suggested n=10 as an appropriate sample size for the number of lithium disilicate glass ceramic cylinders per group. High-transparency (HT) and low-transparency (LT) cylinders (diameter, 12 mm; length, 13 mm) were fabricated in 3 ceramic shades (BL1, A2, C3) using CAD/CAM technology and were cut into specimen disks (thickness, 1.2 mm; diameter, 12 mm) for placement on natural
die (ND1 and ND4) backgrounds. Four combinations of translucency and background color were evaluated in terms of color differences for the 3 ceramic shades: group 1 (HT ND1, reference); group 2 (HT ND4); group 3 (LT ND1); and group 4 (LT ND4). A spectrophotometer was used to measure the color differences. Nonparametric tests (Kruskal-Wallis tests) were used to evaluate the color differences among the tested groups, and Mann-Whitney U tests with Bonferroni correction were used as post hoc tests. Furthermore, for each ceramic shade, the HT groups were compared to the LT groups using the Mann-Whitney U test.

RESULTS: Significant differences were present among the tested groups of the same ceramic shade (p<0.001). The highest ΔE values were observed in the HT ND4 group for BL1, while the lowest ΔE values were found in the LT ND1 group for both A2 and C3. Further, the HT groups and the groups with a darker background (ND4) showed increased ΔE values compared with the other groups (p<0.001).

CONCLUSIONS: Within the limitations of this study, the results suggested that the translucency and background color significantly influenced the lithium disilicate glass ceramic color among the BL1, A2, and C3 ceramic shades. Changing the underlying color from a lighter background to a darker background resulted in increased color differences.

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An In Vitro Comparison of the Shear Bond Strengths of Two Different Gingiva-Colored Materials Bonded to Commercially Pure Titanium and Acrylic Artificial Teeth

Yahya Elzarug, Roger Galburt, Matthew Finkelman, and Hamasat Gheddaf Dam

PURPOSE: The purpose of this study was to compare shear bond strengths between two different gingiva-colored materials bonded to titanium alloy discs and acrylic resin artificial teeth.

MATERIALS AND METHODS: For the first part of this study, 30 titanium alloy disc specimens were embedded in autopolymerizing resin. These discs were then divided randomly into two groups: heat cure (HT1) and pink composite (CT1). The discs were sandblasted with 100 μm aluminum oxide particles. For the HT1 group using silicone molds, a wax-up was performed. After the wax removal step, heat-cured acrylic resin was applied and processed according to the manufacturer’s recommendations. For the CT1 group using silicone molds, metal primer II and gum opaque were applied and light cured; pink composite was then applied and light cured. For the second part of the study, 30 artificial resin first molar teeth were completely embedded in autopolymerizing resin. Teeth were then divided randomly into two groups: heat cure (HT2) and pink composite (CT2). For the HT2 group using silicone molds, wax-up was performed. Specimens were then transferred to be processed in the heat-cured acrylic resin according to the manufacturer’s recommendations. For the CT2 group using silicone molds, composite primer followed by pink composite were applied and light cured. Shear bond tests were performed using an Instron 3345 universal testing machine. The shear load at the point of failure was recorded in Newtons. The force was calculated in MPa by calculating the failure load divided by the surface area. Two independent-samples t-tests were performed. A significance level of p<0.05 was used for comparison.

RESULTS: This study revealed that the difference in the shear bond strengths of two different gingiva-colored materials bonded to titanium discs was statistically significant (p=0.012). The difference in the shear bond strengths of two different gingiva-colored materials bonded to acrylic teeth was statistically significant (p<0.001).

CONCLUSION: In this in vitro study, heat-cured acrylic resins exhibited higher bonding strengths when bonded to titanium discs or acrylic artificial teeth in comparison to pink composite resins.

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Implant placement and immediate placement of an interim restoration can be a safe therapeutic approach with high survival rates. The technique is often used in the anterior esthetic area because of the better preservation of the peri-implant soft tissue contours. Traditionally this procedure involves the fabrication of an acrylic resin implant-supported interim restoration. This clinical report describes the modification of an existing metal ceramic crown to be used as an implant-supported interim restoration for immediate nonfunctional loading to achieve an improved esthetic result and optimal support of the adjacent soft tissues.


Immediate Provisionalization and Nonfunctional Loading of a Single Implant in the Maxillary Esthetic Zone: A Clinical Presentation and Parameters for Consideration

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Restoration of single tooth loss with implant supported prosthesis is now considered a highly predictable treatment. However, the maxillary anterior region still presents a challenge for both the prosthodontist and the periodontist because of the inherent difficulties encountered in the provisionalization and harmonic incorporation of the definitive prosthesis into patient's dentogingival complex. This paper presents a clinical case of a single implant placed immediately after the extraction of a maxillary central incisor, followed by immediate provisionalization and nonfunctional loading. The surgical and the restorative techniques are described, and the parameters of consideration for this approach are presented.


Marginal Adaptation of Four Inlay Casting Waxes on Stone, Titanium, and Zirconia Dies

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STATEMENT OF PROBLEM: Different inlay casting waxes do not produce copings with satisfactory marginal accuracy when used on different die materials.

PURPOSE: The purpose of this study was to evaluate the marginal accuracy of 4 inlay casting waxes on stone dies and titanium and zirconia abutments and to correlate the findings with the degree of wetting between the die specimens and the inlay casting waxes.
MATERIAL AND METHODS: The inlay casting waxes tested were Starwax (Dentaurum), Unterziehwachs (Bredent), SU Esthetic wax (Schuler), and Sculpturing wax (Renfert). The marginal opening of the waxes was measured with a stereomicroscope on high-strength stone dies and on titanium and zirconia abutments. Photographic images were obtained, and the mean marginal opening for each specimen was calculated. A total of 1,440 measurements were made. Wetting between die materials and waxes was determined after fabricating stone, titanium, and zirconia rectangular specimens. A calibrated pipette was used to place a drop of molten wax onto each specimen. The contact angle was calculated with software after an image of each specimen had been made with a digital camera. Collected data were subjected to a two-way ANOVA ($\alpha=0.05$). Any association between marginal accuracy and wetting of different materials was found by using the Pearson correlation.

RESULTS: The wax factor had a statistically significant effect both on the marginal discrepancy ($f=158.31$, $p<0.001$) and contact-angle values ($f=68.09$, $p<0.001$). A statistically significant effect of the die material factor both on the marginal adaptation ($f=503.47$, $p<0.001$) and contact-angle values ($f=585.02$, $p<0.001$) was detected. A significant correlation between the marginal accuracy and the contact-angle values (Pearson=0.881, $p=0.01$) was also found.

CONCLUSIONS: Stone dies provided wax copings with the best marginal integrity, followed by titanium and zirconia abutments. Unterziehwachs (Bredent) wax produced the best marginal adaptation on different die materials. A significant correlation was found between the marginal accuracy and the contact-angle values. As the contact-angle value became smaller, the marginal accuracy improved. All combinations of waxes and stone and titanium dies presented a high wettability.


Marginal and Internal Adaptation of Ceramic Crown Restorations Fabricated with CAD/CAM Technology and the Heat-Press Technique

Hisham Mously, Matthew Finkelman, Roya Zandparsa, and Hiroshi Hirayama

STATEMENT OF PROBLEM: The accuracy of chairside computer-aided design and computer-aided manufacturing (CAD/CAM) restorations is questionable, and the effect of the die spacer settings is not well stated in the literature.

PURPOSE: The purpose of the study was to evaluate the marginal and internal adaptation of E4D crowns fabricated with different spacer thicknesses and to compare these crowns with those fabricated with the heat-press technique.

MATERIAL AND METHODS: The E4D system was used to fabricate 30 crowns for the first 3 groups, with different spacer thickness settings: 30 $\mu$m, 60 $\mu$m, and 100 $\mu$m. In the fourth group, 10 lithium disilicate crowns were fabricated with the heat-press technique. The occlusal gap, axial gap, vertical marginal gap, and absolute marginal discrepancy were evaluated by x-ray microtomography. Statistical significance was assessed with the Kruskal-Wallis test ($\alpha=0.05$). For post hoc analyses, the Mann-Whitney $U$ test was used alongside the Bonferroni correction for multiple comparisons ($\alpha=0.008$).

RESULTS: Within the CAD/CAM groups, the 30-$\mu$m spacer thickness resulted in the lowest median axial gap (90.04 $\mu$m), whereas the 60-$\mu$m spacer thickness resulted in the lowest median occlusal gap (152.39 $\mu$m). The median marginal gap values of the CAD/CAM-60 group (49.35 $\mu$m) and CAD/CAM-100 group (46.65 $\mu$m) were lower than those of the CAD/CAM-30 group (55.18 $\mu$m). No significant differences among the CAD/CAM groups were observed for absolute marginal discrepancy. The heat-press group had significantly different values than those of the CAD/CAM groups.
CONCLUSION: The spacer thickness and fabrication technique affected the adaptation of ceramic crowns. The heat-press group yielded the best marginal and internal crown adaptation results. The 30- or 60-µm spacer settings are recommended for the E4D CAD/CAM system.


Influence of Coping Design on the Cervical Color of Ceramic Crowns
Gianluca Paniz, Kiho Kang, Yong Jeong Kim, Naota Kumagai, and Hiroshi Hirayama

STATEMENT OF PROBLEM: The replication of natural teeth, especially with single-tooth restorations, represents a challenge. Similar to metal ceramic crowns, different designs of zirconia substructures have been suggested to improve the esthetic results of zirconia ceramic crowns.

PURPOSE OF STUDY: The purpose of the study was to analyze the color of the cervical portion of single zirconia ceramic crowns fabricated with different zirconia coping designs.

MATERIAL AND METHODS: The color, measured on the CIELAB color scale, of 3 different groups of restorations (n=10) fabricated with zirconia coping (Lava) and feldspathic porcelain (Noritake Super Porcelain) was analyzed with a spectrophotometer. Conventional zirconia crowns with zirconia facial margins were compared with ceramic crowns with porcelain facial margins and either a horizontal reduction of the zirconia coping (1.0 mm reduction) or an additional vertical reduction (1.0 mm additional reduction). The 3 groups, each with a different coping extension, were examined with a one-way ANOVA and the Fisher exact test, and the differences of the groups were evaluated by applying ΔE thresholds (α=0.05).

RESULTS: The mean color difference among all the groups was not clinically significant (ΔE<3.7). Reduced color differences were present between the 2 porcelain butt margin groups of crowns (ΔE=1.06, between group H and V). Increased differences were present between the zirconia margin group and the porcelain butt margin group (ΔE=2.54 between group C and H; ΔE=2.41 between group C and V). L*a*b* values were examined in all the groups of crowns to determine the clinical implications.

CONCLUSIONS: Within the limitation of the study, no significant differences were present among the tested groups of crowns. Nevertheless, although some differences were present between the zirconia margin group and the porcelain butt margin group, reduced differences were present between the 2 different cutback designs.


Transition from Failing Dentition to Complete-Arch Implant Rehabilitation with a Staged Approach: A Three-Year Clinical Report
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The transition of patients from failing dentition to complete-arch implant rehabilitation often means that the patient is rendered edentulous and has to wear a removable complete denture for a time. Many patients find this objectionable. A staged-treatment approach provides a fixed interim prosthesis for use throughout the rehabilitation process, allowing patient comfort and prosthodontic control. This clinical report describes a staged-approach protocol with a new type of interim prosthesis. The prosthesis is supported by hopeless
teeth and the soft tissues of the maxillary tuberosities and mandibular retromolar pads for the complete-arch implant rehabilitation of a patient with failing dentition. This protocol allows for a fixed interim prosthesis with combined tooth and mucosa or implant support during the entire rehabilitation process, thus avoiding the use of complete dentures. The implants and prostheses were functioning successfully after 3 years of clinical service.


An In Vitro Comparison of Shear Bond Strength of Zirconia to Enamel Using Different Surface Treatments

Roya Zandparsa, Nayrouz Talua, Matthew Finkelman, and Scott Schaus

PURPOSE: The purpose of this in vitro study was to compare the shear bond strength of an airborne-particle abraded zirconia, an acid-etched zirconia (piranha solution), an alloy primer-treated zirconia, and a silaned zirconia to enamel, all bonded with a phosphate-methacrylate resin luting agent.

MATERIALS AND METHODS: Seventy extracted intact human molars were collected, cleaned, and mounted in autopolymerizing acrylic resin, with the experimental surface of the teeth exposed. The specimens were randomly divided into seven groups of zirconia specimens (4 mm diameter, 2 mm thick): group 1, airborne-particle abrasion; group 2, airborne-particle abrasion and Z-PRIME Plus; group 3, airborne-particle abrasion and alloy primer; group 4, piranha solution 7:1; group 5, piranha solution 7:1 and Z-PRIME Plus; group 6, piranha solution 7:1 and alloy primer; group 7, CoJet and silane. All specimens were luted with a phosphate-methacrylate resin luting agent (Panavia F2.0) and stored in distilled water for 1 day, then thermocycled (5°C and 55°C) for 500 cycles and tested for shear bond strength (SBS), measured in MPa, with a universal testing machine at a 0.55 mm/min crosshead speed. All specimens were inspected under a scanning electron microscope to determine mode of failure. The mean values and standard deviations of all specimens were calculated for each group. A one-way ANOVA was performed, and multiple pairwise comparisons were then completed with post hoc Tukey test (α = 0.05).

RESULTS: The airborne-particle abrasion and Z-PRIME Plus group resulted in a significantly higher SBS than the other groups (21.11±6.32 MPa) (p<0.001). The CoJet and silane group (15.99±8.92 MPa) and airborne-particle abrasion and alloy primer group (11.07±4.34 MPa) showed high shear bond strength but not statistically significant from the airborne-particle abrasion group (14.23±5.68 MPa). Failure mode was predominately mixed in groups 1, 2, 3, and 7 with islands of retained resin on the zirconia and enamel surfaces; however, groups 4, 5, and 6 showed mostly adhesive failures, which left the zirconia surface free of the adhesive materials. No cohesive failures of the substrates (ceramic, resin, or enamel) were observed.

CONCLUSION: Airborne-particle abrasion followed by the application of a zirconia primer produced the highest bond strength to enamel. Therefore, it can be recommended as a promising surface treatment method to achieve a durable bond to densely sintered zirconia ceramics.

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SALIVARY AND LACRIMAL GLAND RESEARCH

Salivary Cortisol, Salivary Alpha Amylase, and the Dental Anxiety Scale

Hana Sadi, Matthew Finkelman, and Morton Rosenberg

The aim of this study was to investigate the correlation between dental anxiety, salivary cortisol, and salivary alpha amylase (sAA) levels. Furthermore, the aim was to look into individual differences such as age, race, gender, and any existing pain or traumatic dental experience and their effect on dental anxiety. This study followed a cross-sectional design and included a convenience sample of 46. Every patient was asked to complete the dental anxiety scale (DAS) and a basic demographic/dental history questionnaire. A saliva sample, utilizing the method of passive drooling, was then collected in 2-mL cryovials. Samples were analyzed for salivary cortisol and sAA levels by Salimetrics. Significant associations were observed between DAS scores and presence of pain and history of traumatic dental experience. However, no significant correlations were observed between DAS, cortisol, and sAA levels. Our study reconfirms that dental anxiety is associated with presence of pain and a history of traumatic dental experience. On the other hand, our study was the first to our knowledge to test the correlation between the DAS and sAA; nevertheless, our results failed to show any significant correlation between dental anxiety, cortisol, and sAA levels.

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STATISTICS RESEARCH

Shortening the Current Opioid Misuse Measure via Computer-Based Testing: A Retrospective Proof-of-Concept Study

Matthew Finkelman, Ronald Kulich, Driss Zoukhri, Niels Smits, and Stephen Butler

BACKGROUND: The Current Opioid Misuse Measure (COMM) is a self-report questionnaire designed to help identify aberrant drug-related behavior in respondents who have been prescribed opioids for chronic pain. The full-length form of the COMM consists of 17 items. Some individuals, especially compromised individuals, may be deterred from taking the full questionnaire due to its length. This study examined the use of curtailment and stochastic curtailment, two computer-based testing approaches that sequentially determine the test length for each individual, to reduce the respondent burden of the COMM without compromising sensitivity and specificity.

METHODS: Existing data from n=415 participants, all of whom had taken the full-length COMM and had been classified via the Aberrant Drug Behavior Index (ADBI), were divided into training (n=214) and test (n=201) sets. Post-hoc analysis of the test set was performed to evaluate the screening results and test lengths that would have been obtained if curtailment or stochastic curtailment had been used. Sensitivity, specificity, and average test length were calculated for each method and compared with the corresponding values of the full-length test.

RESULTS: The full-length COMM had a sensitivity of 0.703 and a specificity of 0.701 for predicting the ADBI. Curtailment reduced the average test length by 22% while maintaining the same sensitivity and specificity as the full-length COMM. Stochastic curtailment reduced the average test length by as much as 59% while always obtaining a sensitivity of at least 0.688 and a specificity of at least 0.701 for predicting the ADBI.

CONCLUSIONS: Curtailment and stochastic curtailment have the potential to achieve substantial reductions in respondent burden without compromising sensitivity and specificity. The two sequential methods should be considered for future computer-based administrations of the COMM.

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Curtailment: A Method to Reduce the Length of Self-Report Questionnaires While Maintaining Diagnostic Accuracy

Marjolein Fokkema, Niels Smits, Matthew Finkelman, Henk Kelderman, and Pim Cuijpers

Minimizing the respondent burden and maximizing the classification accuracy of tests is essential for efficacious screening for common mental health disorders. In previous studies, curtailment of tests has been shown to reduce average test length considerably without loss of accuracy. In the current study, we simulate deterministic (DC) and stochastic (SC) curtailment for 3 self-report questionnaires for common mental health disorders, to study the potential gains in efficiency that can be obtained in screening for these disorders. The curtailment algorithms were applied in an existing dataset of item scores of 502 help-seeking participants. Results indicate that DC reduces test length by up to 37% and SC reduces test length by up to 46%, with only very slight decreases in diagnostic accuracy. Compared to an item response theory based adaptive test with similar test length, SC provided better diagnostic accuracy. Consequently, curtailment may be useful in improving the efficiency of mental health self-report questionnaires.

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Variable Length Testing Using the Ordinal Regression Model

Niels Smits and Matthew Finkelman

Health questionnaires are often built up from sets of questions that are totaled to obtain a sum score. An important consideration in designing questionnaires is to minimize respondent burden. An increasingly popular method for efficient measurement is computerized adaptive testing; unfortunately, many health questionnaires do not meet the requirements for this method. In this paper, a new sequential method for efficiently obtaining sum scores via the computer is introduced that does not have such requirements and is based on the ordinal regression model. In the assessment, future scores are predicted from past responses and when an acceptable level of uncertainty is achieved, the procedure is terminated. Two simulation studies were performed to illustrate the usefulness of the procedure. The first used artificially generated symptom scores, and the second was a post-hoc simulation using real responses on the Center for Epidemiologic Studies Depression scale. In both studies, the sequential method substantially reduced the respondent burden while maintaining a high sum score quality. Benefits and limitations of this new methodology are discussed.

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