



Journal of the William Jarvie Society

Volume 53, Spring 2010
Second Edition

Published by the William Jarvie Society
College of Dental Medicine
Columbia University
City of New York
www.dental.columbia.edu/jarvie

Birnberg Research Program
March 24-25, 2010

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“When apparently we have reached the limits of possibility, new avenues of progress and advancement are opened to our view and advances which shall make our knowledge of today seem in the light of the future to be but the densest ignorance.”

William Jarvie, 1905

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A Message from the Editors

Welcome to the 53rd edition of the Journal of the William Jarvie Society. This year's journal includes research spanning from bioengineering to public health, from the pre-doctoral to post-doctoral level, and from bench-based clinical research to analyzing surveys. We are so proud of the broad spectrum of research interests of the students and faculty represented in this journal.

We would like to thank our advisor, Dr. Richard Abbott, for his support, guidance, and help in putting together the journal. We also appreciate the support of the school's administration, especially Dean Ira Lamster, Dean Jeremy Mao, and Dean Letty Moss-Salentijn.

We could not have prepared the journal without the efforts of the Jarvie Board. The assistant editors, Thomas Chae, Ghowar Iravani, and Andy Wan, were all indispensable in the editing process. Thank you also to the rest of the Board: Eric Frank, Steven Nadler, Karin Herzog, Caitlin Magraw, and Stephen Boss.

We hope you enjoy the Jarvie Journal, and hope it inspires you to begin or continue your own research efforts.

Best Wishes,

Mariel Nortick & Zi Wang

Editors - in - Chief



March 9, 2010

Members of the Jarvie Society:

Research is the process of discovery, and is one of the three missions of the College of Dental Medicine (CDM). Dental student participation in research is an essential part of the research program at CDM, and our students' efforts in research have been recognized with awards at local, regional and national meetings.

The development of our research program is evidenced by the recent appointment of Dr. Jeremy Mao as Associate Dean for Research, the hiring of new faculty with outstanding research credentials, and the construction of new research laboratories on both PH-7 Center and VC-12. The building of new research space is a particularly important advance that should allow CDM to continue to expand our research mission, providing opportunities for faculty recruitment and student training.

All those participating in our student research day will agree that the process of discovery enhances your dental school or post-doctoral experience. It is our hope that you will take the lessons learned and apply them to all aspects of your professional life – be inquisitive, know the literature, and consider all problems from different perspectives.

I want to congratulate all of our Birnberg Day presenters. This event gives each of you an opportunity to demonstrate what you have accomplished.

Sincerely,

Ira B. Lamster, DDS, MMSc
Dean



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March 1, 2010

Dear Members of the Jarvie Society,

Congratulations on another, excellent year of student research at the College of Dental Medicine! It is a pleasure to count so many students with a genuine interest in research in our School. This reflects an understanding by the newer members of the profession of the importance of research in dentistry. Without the advances that come from well-planned and executed research projects, the profession will stagnate and lose its hard-earned standing among the health science professions.

It is generally understood that a failure to grow capital will lead inevitably to a reduction of its value. This simple reality applies equally to a profession, which needs to grow its scientific capital through research. This, and the need to engage students in research from the very beginning of their study of dentistry, is clearly understood at our College.

Research has been a proud part of our school's mission throughout its history. Student Research Day has evolved from student "table clinics", which used to be set up on clinic chairs, to the current poster sessions. The number of presenters has increased more than proportionally with the number of enrolled students, and the quality of the presentations appears to improve continuously each year.

This is an achievement to be proud of. I wish you a successful Student Research Day and look forward to meeting with you during the poster session.

Letty Moss-Salentijn, DDS, PhD
Robinson Professor of Dental Medicine
(in Anatomy and Cell Biology)
Senior Associate Dean for Academic Affairs

Columbia University Medical Center

History of the William Jarvie Society*

The William Jarvie Society for Dental Research was organized on December 16, 1920. At the invitation of Dr. William J. Gies, all the undergraduate students of dentistry at Columbia University conferred with him for the purpose of considering the desirability of organizing a society of students, teachers, and benefactors for the promotion of the spirit of research in the School of Dentistry.

After general discussion, it was unanimously voted to proceed with the proposed organization and Joseph Schroff, MD** was elected temporary chairman. Because of the important relation which Dr. William Jarvie bore to the establishment of the School of Dentistry, and because of high interest in the promotion of dental research, it was unanimously voted that the society be named the William Jarvie Society for Dental Research and that Dr. William Jarvie be elected an honorary member.

Dr. Schroff served ably as president during 1922. Dr. Monasch officiated during 1923, and in 1924, because of the amalgamation of the College of Dental and Oral Surgery with the School of Dentistry of Columbia University, interest in the organization diminished and the society ceased its activities in 1925. On February 7, 1929, the society resumed activity and elected officers. Interest revived, and the organization was again brought into prominent place in the extracurricular life of the school.

During 1932-33, several members of the faculty who had contributed greatly to research in dentistry and allied fields addressed the members of the society and their guests. Dr. Charles C. Bodecker, Professor of Oral Histology and Embryology, spoke on "Dental Caries and Allied Subjects" and illustrated his talk with a liberal number of lantern slides. Dr. Bodecker spoke of the various theories and the classification of dental caries and also explained the caries index for recording the extent of caries. He also briefly outlined the work done by various investigators in this field.

Dr. Byron Stookey, Associate Professor of Neurological Surgery, addressed the next open meeting, which was held as a feature of the alumni day activities. His topic was, "The Interpretation and Treatment of Painful Affections of the Trigeminal Nerve." In a most interesting and instructive lecture, Dr. Stookey showed the relationship of diseases of this nerve to dental diagnosis. He explained the past work done in this field and the newer methods of surgical treatment, illustrating his talk with many lantern slides. He also presented several patients to demonstrate the effectiveness of his surgical treatment of this disease.

The Jarvie Society recorded another year of activity and accomplishment. Student interest in the organization was never greater, and a long and vigorous future for the society seems assured. The future of dentistry lies in its research into the problems that beset it, and the Jarvie Society has done its share in stimulating interest in this long-neglected phase of our work.

*An excerpt from the *Dental Columbian*, 1933.

** Editor's Note: Dr. Joseph Schroff, MD, one of the first two students admitted to the dental school through the Columbia admissions process, became the first student to receive the Columbia DDS degree in 1922. Dr. Schroff subsequently joined the SDOS faculty, teaching Oral Surgery to generations of students until his retirement as head of Oral and Maxillofacial Surgery in the early 1950s.

The Birnberg Research Award

The Birnberg Research Award was established by the Alumni Association of the Columbia University School of Dental and Oral Surgery in the early 1950s to encourage dental research of excellence and to help stimulate public interest in support of dental research. The award is named in honor of Dr. Frederick Birnberg (1893-1968), class of 1915, who helped to establish a research fund.

The College of Dental Medicine faculty research committee, in conjunction with the school's Alumni Association, considers individuals who have made important contributions to dentistry through both research and mentoring for selection as Birnberg Lecturer and recipient of the Birnberg Award. Fifty-two outstanding scientists and teachers have been honored as the Birnberg Lecturer since the first Birnberg Award was presented in 1954.

Birnberg Lecturers and Award Recipients

1954	Dr. Charles F. Bodecker	1976	Dr. Jerome Schweitzer	1994	Dr. Ze'ev Davidovitch
1955	Dr. Joseph Appleton	1977	Dr. George Green	1995	Dr. Ivar Mjor
1956	Dr. Isaac Schour	1978	Dr. David Scott	1996	Dr. Lorne M. Golub
1957	Dr. Ralph Phillips	1979	Dr. Berge Hampar	1997	Dr. Bruce J. Baum
1958	Dr. Reider F. Soqnaes	1980	Dr. Barnet Levy	1998	Dr. Kenneth Anusavice
1959	Dr. John Knuston	1981	Dr. Ronald Dubner	1999	Dr. James D. Bader
1960	Dr. Maxwell Karshan	1982	Dr. Martin A. Taubman	2000	Dr. Lars Hammerström
1961	Dr. George Paffenbarger	1983	Dr. Louis T. Grossman	2001	Dr. David T. W. Wong
1962	Dr. Eli Goldsmith	1984	Dr. Solon A. Ellison	2002	Dr. Henning Birkedal-Hansen
1963	Dr. Edward V. Zegarelli	1985	Dr. Norton S. Taichman	2003	Dr. Barbara Dale-Boyan
1964	Dr. Francis A. Arnold	1986	Dr. Ronald J. Gibbons	2004	Dr. Paul B. Robertson
1965	Dr. Seymour Kreshover	1987	Dr. Robert J. Gorlin	2005	Dr. Bruce L. Pihlstrom
1966	Dr. Paul Goldhaber	1988	Dr. Enid A. Neidle	2006	Dr. Jeffrey D. Hillman
1968	Dr. Sholom Peariman	1989	Dr. David H. Pashley	2007	Dr. Ralph V. Katz
1970	Dr. Melvin Moss	1990	Dr. William H. Bowen	2008	Dr. Robert J. Genco
1971	Dr. Irwin Mandel	1991	Dr. Harold C. Slavkin	2009	Dr. Deborah Greenspan
1973	Dr. Lester Chan	1992	Dr. George R. Martin	2010	Dr. Sally J. Marshall
1975	Dr. Russell Ross	1993	Dr. Richard Skalak		

2010 Birnberg Lecturer

Sally J. Marshall, PhD

Sally J. Marshall, PhD, is Distinguished Professor at the University of California San Francisco and Professor, Biomaterials and Bioengineering, Preventive and Restorative Dental Sciences at the UCSF School of Dentistry. Dr. Marshall has served as president of the International Association for Dental Research, the American Association for Dental Research and the Academy of Dental Materials. She has also provided leadership for UCSF, serving as Vice-Provost, Academic Affairs since 2005 and currently also serving as UCSF Interim Executive Vice Chancellor and Provost. Dr. Marshall has served on the editorial boards of Dental Materials (1989-present); Arch. Oral Biology (2002-present); J. Oral Rehabilitation (Assoc Ed 2003-4); Mundo Odontologico (2000-present); and J. Dental Biomechanics (2008-present). Dr. Marshall has mentored many students (undergraduate, dental, graduate), postdoctoral researchers, and faculty in addition to the contributing of over 150 peer-reviewed publications, over 15 book chapters, and 4 patent disclosures to the scientific literature.

Dr. Marshall's research interests center on understanding the relationship between structures, properties and mechanisms in materials. Her research utilizes atomic force microscopy and x-ray scattering by materials for the characterization of microstructural and mechanical properties. The nanostructure and properties of the interfaces (natural and artificial) are of great importance since failure occurs in the weakest area of this structure. Dr. Marshall's current research efforts are mainly focused in 2 areas: characterization and modification of calcified tissues (including interfaces) and the development of new implant systems.

Birnberg Research Program

WEDNESDAY, March 24, 2010, 2:00-5:00 P.M.

THURSDAY, March 25, 2010, 12:00-2:00 P.M.

WEDNESDAY, MARCH 24th, 2010

2:00-5:00 P.M.

Student Table Clinic and Research Poster Session

Riverview Lounge
Hammer Health Science Center, 4th Floor

THURSDAY, MARCH 25th, 2010

12:00-1:00 P.M.

Birnberg Lecture

Dr. Sally J. Marshall, 2010 Birnberg Award Recipient

Distinguished Professor, University of California San Francisco and
Professor, Biomaterials and Bioengineering, Preventive and
Restorative Dental Sciences, UCSF School of Dentistry
Vice-Provost, Academic Affairs, UCSF
Interim Executive Vice Chancellor and Provost, UCSF

Hammer Health Science Center, Room 301

“Remineralization of Dentin”

1:00-2:00 P.M.

Luncheon and Presentation of Awards
Riverview Lounge
Hammer Health Science Center, 4th Floor

A Message from the President of the William Jarvie Society

Throughout this school year, the William Jarvie Research Society has focused our efforts around a theme of “Community of Researchers.” We have tried to foster a collaborative environment where students from all classes participate as a community of student-researchers in order to teach and learn simultaneously. I would like to thank the board of The William Jarvie Society: Steven Nadler, Karin Herzog, Caitlin Magraw and Stephen Boss. The Society’s successes in reaching our goals and creating new programs have been due to their hard work and dedication.

We began the monthly Jarvie Journal Club this year, a comfortable setting where members meet to discuss recent publications in the dental research world. At our JJC meetings, we share our knowledge and opinions on topics ranging from healthcare reform to laser-induction of orthodontic tooth movement and more. The JJC offers members a fun opportunity to prepare for similar journal clubs in research labs and residency programs in our future.

We created the Student-researcher Resource Network, which facilitated interaction and discussion among dental students in different classes. Experienced student-researchers declared areas of interest or familiarity and joined together to become the SRN. First and second year members reached out to the SRN to learn about the many fields of dental research and what it means to be a student researcher. We convened multiple event-oriented student panels to allow upperclassmen to share their experiences in various research related activities with their successors.

The capstone to The Society’s activities each year is the Birnberg Research Program. During the student poster session dental student-researchers have the unique opportunity to present, share and discuss their research experience and accomplishments with their peers and faculty.

Dr. Richard Abbott deserves special recognition for his constant interest and guidance regarding The Society’s goals and activities. I would also like to thank Assoc. Dean Jeremy Mao, Assoc. Dean Martin Davis, Sr. Assoc. Dean Letty Moss-Salentijn and Dean Ira Lamster for their continued support and always having their door open for much needed advice. Jarvie could not be what it is without you! Co-Editor-in-Chiefs Mariel Nortick and Zi Wang have worked incredibly hard to make the 2010 Journal a success, and they, along with assistant editors Andy Wan, Thomas Chae and Gowhar Irvani have succeeded spectacularly, Congratulations!

Last but not least, I want to thank all of the members of Jarvie for this opportunity and their enthusiasm. It has been an honor and a pleasure to serve as President this year!

Eric Frank

CDM class of 2011

2010 William Jarvie Society Membership

Officers:

Editors-in-Chief	Mariel Nortick '10 Zi Wang '10
President:	Eric Frank
Vice President:	Steven Nadler '11
Secretary:	Caitlin Magraw '12
Treasurer:	Karin Herzog '12
Research Liaison:	Stephen Boss '13
Associate Editors:	Thomas Chae '12 Gowhar Iravani '11 Andy Wan '11

Advisors:

Dr. Richard Abbott
Dr. Jeremy Mao, Associate Dean for Research

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Scott Bryant	Jeremy Katz	Mariel Nortick
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Matthew Cozin	Hyun Ji Kim	Erica Phillips
Stephen Dadaian	Karen Kleiman	Cassie Pogel Sussman
Rohini Dhar	Jessica Lee	Liz Scott
Hoa Do	Theodore Lee	Safiyah Smith
Shlomo Eisenberg	Aimee Leibowitz	Christopher Stewart
Eric Frank	Caitlin Magraw	Marcus Sur
Robert Geiman	Ryan Maneevese	Shakil Syed
Jaifeng Gu	Camille Marquis	Lisa Van Eyndhoven
Bridget Henn	Ted Mehalic	Andy Wan
Karin Herzog	David Moisa	Catherine Woo
Matt Hickin	Aaron Myers	Michael K Yang
Gowhar Iravani	Yoni Moskowitz	Katie Yoo

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Pre-Doctoral Student Abstracts

Matrix Metalloproteinase MT1-MMP is Essential for Mechanosensitivity of Osteocytes in Murine Long Bone

Thomas D. Chae¹, Elisabeth Gruber², Rishikesh Kulkarni³, Jenneke Klein-Nulend^{3*}, Letty Moss-Salentijn^{1*}

¹College of Dental Medicine, Columbia University, NY, NY;

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³Department for Oral Cell Biology, ACTA-University of Amsterdam and VU University, Research Institute MOVE, Amsterdam, the Netherlands

*Faculty Mentor

Introduction: Matrix strains due to external loading are different in the diaphyses and metaphyses of long bone, and are likely sensed by osteocytes, the putative bone mechanosensors, which play a pivotal role in the bone remodeling process. External mechanical forces on cells influence their shape and hence osteocyte morphology is related to its mechanosensitivity. MT1-MMP is a membrane-bound matrix metalloproteinase capable of mediating pericellular proteolysis of extracellular matrix components. MT1-MMP is therefore thought to be an important molecular tool for cellular remodeling of the surrounding matrix. Osteocyte morphology and formation of osteocyte processes are highly dependent on continuous cleavage of type I collagen in its immediate environment by matrix metalloproteinase activity. To establish the role of MT1-MMP in osteocyte mechanosensing, we investigated the effect of MT1-MMP deficiency on osteocyte morphology in bone exhibiting different matrix strains after mechanical loading, i.e. the diaphyses and metaphyses of long bone.

Objective: We are testing the hypothesis that MT1-MMP deficient osteocytes will be less efficient in detecting size and direction of load than their wildtype counterparts. In other words, they will be less mechanosensitive or unable to adjust their architectural shape. As a result, it is predicted that MT1-MMP deficient osteocytes will be less able to adjust to loading of bone.

Materials and Methods: Double null (-/-) mutants and their wild-type (+/- and +/+) littermates were killed, 14, 43 and 50 days after birth. Long bones were harvested and histological sections cut parallel to the longitudinal axis. In these sections two areas of interest were distinguished, 1) the diaphysis, and 2) the metaphysis of the long bone. Histomorphometric analysis was performed to determine osteocyte parameters, i.e. number, empty lacunae, length, width, and area.

Results and Conclusions: The orientation of osteocytes is structured parallel to the direction of loading. In some of the knock-out mice the structured orientation is lost and the osteocytes are more randomly spread at the diaphysis and metaphysis. This random spread and orientation of osteocytes was clearly evident in the metaphysis compared to osteocytes in the diaphysis. Looking at the l/w ratio, osteocytes near the metaphysis were morphologically rounder compared to osteocytes located at the diaphysis. We have demonstrated that targeted disruption of the MT1-MMP gene in mice results in significant differences in osteocyte morphology and osteocyte alignment in long bone i.e diaphysis and metaphysis. These differences suggest that MT1-MMP deficient cells are less able to directly sense matrix strain and as a result have lost efficacy in their response to loading.

Discussion: It can be noted that histomorphometry presents an inherent weakness with only 2-D images. 3-D SEM studies indicate that it is impossible to identify the orientation of a particular lacuna within an osteon that may be traveling longitudinally or diverging transversely. Osteons themselves are subject to directional change from loading and one must use caution when comparing results obtained with single osteons as a 2-D image and those provided by studies at a macroscopic level.

Thomas Chae was supported by the Moss Scholarship

The Interaction of Kindlins with $\beta 6$ Integrin

Ray Cheng¹, Sean Kim², Aditi Bandyopadhyay³, Srikala Raghavan^{3*}

¹College of Dental Medicine, Columbia University, NY, NY; ²Columbia College, Columbia University,

³Department of Oral Surgery & Department of Dermatology, Columbia University, NY, NY

*Faculty Mentor

Introduction: Integrins are cell surface receptors that interact with the extracellular matrix (ECM), and mediate intracellular signaling. Integrin signaling controls cell adhesion, migration, and cell proliferation. Previous studies have identified several intracellular proteins that interact with the cytoplasmic domain of $\beta 1$, however, little is known about the proteins that interact with the cytoplasmic domain of $\beta 6$. Understanding the biology of $\beta 6$ integrin is important, as it is highly expressed in cancers of various origins including the oral mucosa, lung, breast, pancreas, ovary, and skin. Kindlins are a novel family of adaptor proteins that are recruited to integrin-containing adhesion sites, termed focal adhesion.¹ Kindlin-1 is the founding member of the Kindlin family. Mutations in the Kindlin-1 gene lead to Kindler syndrome in humans, which is characterized by skin blistering.² Kindlin-2 is required for integrin outside-in signaling to enable firm adhesion and spreading.²

Objective: The objective of the study is to try to understand interaction of kindlins with $\beta 6$ integrin.

Materials and Methods: GST Pull-down assay was performed to identify the interaction of kindlins with $\beta 6$ integrin. Tissue and cell antibody staining were performed to localize kindlin expression in the epidermis as well as WT and KO keratinocytes.

Results and Conclusion: GST Pull-down assay show that kindlin1 was pulled down equally well by GST- $\beta 1$ and GST- $\beta 6$ whereas only $\beta 1$ -GST and not GST- $\beta 6$ was able to pull down kindlin2, a protein that is critical for integrin activation. Tissue antibody staining show that kindlin 1 and $\beta 1$ are co-localized to the basal cells of the epidermis in the WT epidermis and kindlin 1 is expressed in the basal cells in the KO epidermis. On the other hand, kindlin 2 has a much broader expression pattern than kindlin 1 with expression both in the epidermis and dermis of the WT skin. The expression of kindlin 2 is lost from the KO epidermis, but retained in the dermis (which still expresses $\beta 1$). The expression of kindlin 2 was much weaker in the KO cells in comparison to the WT cells.

Discussion: Kindlin2 plays a key role in integrin activation along with talin. The Kindlin2 KO mice are lethal at the peri-implantation stage and the kindlin2 *-/-* ESCs show impaired binding to ECM substrates like laminin and fibronectin. Interestingly these phenotypes are very similar to the $\beta 1$ KO embryonic phenotype suggesting that Kindlin 2 is an important mediator of signaling through integrin $\beta 1$. In the $\beta 1$ KO skin epidermis, the BM phenotype was not rescued by *denovo* expression of beta6 integrin in the KO epidermis. Our data suggests that the likely reason for the inability of beta6 integrin to rescue the $\beta 1$ KO phenotype may be due to its inability to effectively bind and interact with kindlin2 and mediate the downstream signaling that may be important for the maintenance of the BM organization.

References: 1. E. Montanez, S. Ussar, M. Schifferer, M. Bosl, R. Zent, M. Moser, and R. Fässler et al 2008. Kindlin-2 controls bidirectional signaling of integrins. *Genes & Development* 22: 1325-1330.

2. JE. Lai-Cheong, S. Ussar, K. Arita, IR. Hart, and JA. McGrath et al 2008. Colocalization of Kindlin-1, Kindlin-2, and Migfilin at Keratinocyte Focal Adhesion and relevance to the Pathophysiology of Kindler Syndrome. *Journal of Investigative Dermatology* 128.

Ray Cheng was supported by the Columbia University College of Dental Medicine Research Assistantship 2009-10

Tissue Regeneration by Modulating the Inhibitors: Forward Differentiation of Adipose Stem Cells Upon Exposure to Hematopoietic Stem Cells

Hai Do¹, Bhranti S. Shah¹, Eduardo Moioli¹, Gang Yu², Mo Chen¹, Jeffrey Gimble², Jeremy Mao¹

¹*Columbia University, New York, NY, USA;*

²*Pennington Biomedical Research Center, Baton Rouge, LA, USA*

**Faculty Mentor*

Introduction: Although adipose tissue contains cells with capacity to propagate and differentiate into multiple lineages, little is known about the interactions of adipose stem cells (ASCs) with other cell types. In our prior work, ASCs were able to propagate for multiple passages, and differentiate into several mesenchymal lineages such as osteoblasts, chondrocytes and myocytes. EGFR is a cell surface receptor that may play a role in the adipogenesis of ASCs. Dimerization of EGFR leads to downstream activation of modulators of cell migration, adhesion, and proliferation. Our current project explores the differentiation of ASCs in relation to HSCs and EGFR antagonists.

Objective: The objectives of the present study are 1) to determine whether the differentiation of ASCs can be attenuated when co-cultured with HSCs and 2) to determine the role that EGFR antagonists play in adipogenesis of ASCs.

Material and Methods: In the present study, we first isolated ASCs from lipectomy aspirates and hematopoietic stem cells (HSCs) from bone marrow samples, both from multiple human donors. Upon treatment in chemically defined medium, ASCs readily differentiated into adipogenic cells, and when implanted in vivo, yielded adipose tissue. EGFR antagonists were administered and followed. Delivery was at an optimized concentration of 10 microM.

Results and Conclusions: In the present work, we discovered that an otherwise robust adipogenesis was attenuated in vitro when ASCs were co-cultured with HSCs. We further followed up on potential interactions between ASCs and HSCs through epidermal growth factor receptors (EGFR), because EGFR has been shown to play important role in adipogenesis. Delivery of EGFR antagonists, Secretase inhibitor at an optimized concentration of 10 microM within 3 days resulted in robust adipogenesis of ASCs, with up to 10-fold increases in the expression of adipogenic specific markers such as PPAR2, Glut4 and accelerated expression of LEPR. Quantitatively, after 4 wks, glycerol and leptin contents of ASCs treated with EGFR antagonists were significantly higher than without EGFR antagonists. Together, the adipogenic differentiation capacity of ASCs was restored to a higher level to without HSC co-culture. Consequently, addition of endogenous EGF at a concentration of 50 ng/mL to the adipogenic medium further inhibited adipogenesis.

Discussion: The present data suggest that adipogenesis can be enhanced by attenuating the inhibitors, in this case EGF receptors that are abundant in hematopoietic stem cells whose co-culture were found to inhibit adipogenesis. Potential significance of the present study is that bioengineered adipogenesis is probable for the restoration of soft tissue defects such as facial defects or breast cancer defects.

Hai Do was supported by a College of Dental Medicine Research Assistantship
Funded by NIH grant R01EB006261 (J.J.M)

Immunostaining of PKC-gamma, Glycine, and Glycine Transporters in Mouse Dorsal Horns Using Confocal Microscopy

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Introduction: Allodynia is the perception of a non-noxious stimulus as pain. One possible mechanism of allodynia is loss of inhibition at the connection between afferent neurons and pain projection neurons in the spinal cord dorsal horn. This can occur after a peripheral nerve or spinal cord injury. The specific pathway has not been determined but previous research has shown that in addition to the inhibitory interneurons, excitatory interneurons that express protein kinase C gamma (PKC-gamma) play an integral role. One theory is that the loss of glycinergic inhibition of these PKC-gamma positive neurons is responsible for the development of allodynia.

Objective: The overall goal of this research project was to determine if the inhibitory neurotransmitter glycine and its transporters GlyT1 and GlyT2 co-localize with the PKC-gamma neurons. If so, this would be compared to results of electrophysiological experiments designed to test a role for glycine inhibition of these neurons. Glycine transporter 1 has been found to be located on glial cells and works to modulate the extracellular glycine concentration. Glycine transporter 2 is located at presynaptic terminals and acts to uptake glycine and load it into synaptic vesicles. This project aimed to optimize the immunostaining procedure of PKC-gamma, glycine and its transporter. There was also an attempt to determine if PKC-gamma was present in early developmental ages.

Materials and Methods: The mice used were genetically modified so that the enzyme for GABA synthesis, GAD67, was linked to GFP. About 1/3 of GABAergic neurons are GFP positive. The ages of mice used were between 16 and 32 days postnatal. The mice were perfused and fixed with paraformaldehyde. Spinal cords were sectioned with a vibrotome into 50 µm sections. Sections from L1-L5 were immunostained with antibodies for PKC-gamma, GABA, glycine, glycine transporters 1 and 2. Finally, imaging was performed with confocal microscopy.

Results and Conclusions: The immunostaining procedure for PKC-gamma was optimized and the proper antibody concentrations determined. This study was inconclusive as to whether glycine and its transporters were present and co-localized on PKC-gamma positive neurons. The developmental study showed that there was clear expression of PKC-gamma in a subpopulation of dorsal horn neurons in mice at the relatively early post-natal ages P16 and P18.

Discussion: Immunostaining of PKC-gamma and glycine, in conjunction with electrophysiological experiments, is expected to demonstrate the role of glycine in the development of allodynia. Subsequent studies have been able to co-localize the expression of these markers. Expression of PKC-gamma at such early ages suggests that even early in development an animal is able to develop chronic pain.

Lisa Van Eyndhoven was supported by a College of Dental Medicine Predoctoral Summer Research Fellowship

Stem Cell Homing and Concurrent Chondrogenesis In Vitro for TMJ Regeneration

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Introduction: Cartilage regeneration is an emerging concept as a potentially revolutionary therapeutic modality in the treatment of osteochondral defects and temporomandibular joint disorders (TMD). TMD may be the result of anatomic anomalies, malocclusion, trauma, arthritis or tumor resection and is a chronic health problem with limited ability to heal. Current research invariably involves cell transplantation, which is confronted with critical drawbacks of cell availability, donor-site morbidity, and excessive cost. Stem cell homing may circumvent the need for cell transplantation by recruiting endogenous stem cells. A cytokine delivery system was devised to recruit surrounding stem/progenitor cells and differentiate them into chondrocytes. Prevalent cell types adjacent to an articular cartilage defect include: bone marrow derived mesenchymal stem cells (MSCs), adipose derived stem cells (ASCs) from nearby fat pads, synovial cells, and native chondrocytes. Of these human cell types, ASCs, MSCs and Synovial Cells (SYN) are being studied for their recruitment by controlled release of cytokines. Stromal Derived Factor-1 (SDF1) was chosen for its potential ability to recruit progenitor cells. Transforming Growth Factor- β 3 (TGF β 3) has previously been proven to aid in the differentiation process of stem cells into chondrocyte-like cells.

Objective: This study aims to develop a novel cartilage regeneration technique that bypasses stem cell transplantation by 1) homing stem cells into an acellular scaffold, and 2) inducing concurrent chondrogenesis of the homed cells. This specific study builds on previously reported research and attempts to further verify successful chondrogenesis within the acellular scaffold.

Materials and methods: Gelatin microspheres were fabricated using a water-in-oil emulsion technique and loaded with 100ng/mL SDF1, 300ng/mL TGF β 3 or PBS. Four conditions were tested: TGF β 3 alone, SDF1 alone, SDF1+TGF β 3 and cytokine free. Acellular scaffolds were fabricated with two separate but integrated layers consisting of a layer of cross-linked 4% (w/v) calcium alginate containing microspheres and an underlying collagen sponge. Human bone marrow MSCs, human ASCs, and human SYNs were seeded in 6-well plates (100,000 cells per well). Each scaffold was placed in the center of the well. Scaffolds were harvested after 3 hours, 1 week, 3 weeks and 6 weeks, fixed in formalin, embedded in paraffin and sectioned. H&E staining was employed to evaluate tissue morphology, toluidine blue to assess chondrogenesis and immunohistochemistry (IHC) for aggrecan and type II collagen were used to definitively characterize the engineered tissue.

Results and conclusions: H&E staining confirmed that significant quantities of MSCs, ASCs and SYNs were homed into the scaffold. A layer of glistening white tissue was visible in the collagen portion of the scaffolds following 6 wks of cell homing. After 3 wks of cell homing, SDF1+TGF β 3 recruited significantly more MSCs and SYNs than the other groups and TGF β 3 recruited the most ASCs. Upon 6 wks of cell homing, delivery of TGF β 3 was most effective to recruit ASCs, MSCs and SYNs into the scaffolds, generating qualitatively greater cell numbers than the other three conditions. Toluidine blue revealed positive staining in TGF β 3 alone and SDF1+TGF β 3 conditions after 6 wks cell homing among all cell types, as well as SDF1 for MSCs. In contrast, there was minimal positive staining for cytokine-free or most SDF1 alone conditions. IHC for aggrecan revealed significant chondrogenesis under the influence of TGF β 3 alone and SDF1+TGF β 3 conditions after 6 wks. IHC for type II collagen also revealed positive staining for these groups, but with a lower intensity. This is not surprising as some studies have shown that differentiated stem cells have difficulty forming type II collagen *in vitro*.

Discussion: This research confirmed that stem cells are not only homed by the specific cytokines, but also proved the induction of chondrogenesis *in vitro*. While SDF1 was able to home ASCs, MSCs and SYNs, its action alone did not seem to be sufficient for inducing chondrogenesis. In contrast, TGF β 3 showed moderate cell homing effects, but was capable of inducing chondrogenic differentiation. Chondrogenesis was proven with toluidine blue and IHC staining. MSCs, ASCs and SYNs, along with other endogenous progenitor cells, may act synergistically *in vivo*. Future experiments will explore *in vivo* cartilage regeneration and modifications to the scaffold to improve mechanical properties of the engineered tissue.

Research support by NIH grant R01-EB02332 (J.J. Mao) and a Columbia College of Dental Medicine Research Assitanship to Eric Frank is gratefully acknowledged

Reprogramming Dental Pulp Stem Cells with Oct-4 and c-Myc Enhances Neural Differentiation

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Introduction: Dental pulp stem cells (DPSCs) are found in the cell-rich zone of dental pulp, and when exposed to certain stimuli, these cells differentiate into odontoblasts to produce tertiary dentin. In recent years, a great deal of effort has been devoted to using DPSCs in stem cell therapy to regenerate tissues lost due to disease or injury. Much of this interest stems from the fact that DPSCs can be harvested from exfoliated or extracted teeth with minimal morbidity to the patient. In order to characterize DPSCs, many groups have investigated the multi-lineage differentiation capacity of these cells to fates including osteogenic, chondrogenic, adipogenic, myogenic, and neurogenic lineages. A critical aspect of neural regeneration from stem cells, including DPSCs, is the yield of neurospheres, the free-floating aggregates of heterogeneous neural stem cells formed in vitro. In our preliminary experiments and published data, the yield of neurosphere formation is low, and this hinders the success rate of differentiating DPSCs into neurons, astrocytes, or oligodendrocytes. To consider DPSCs as a practical source of stem cells for neural regeneration, this yield must be improved.

Objective: To improve the yield of neurosphere formation and neural differentiation by reprogramming DPSCs.

Materials and Methods: Extracted human deciduous teeth were collected from patients age 6-12 with IRB approval. Pulp tissue was isolated and enzyme digested. Adherent cells were then cultured in DMEM. Passage 2 DPSCs were infected with lentiviral vectors expressing Oct-4 and c-Myc for 2 days. Reprogrammed DPSCs were subsequently transferred to 10cm culture dishes containing ES medium and MEF feeder cells for 14 days of growth. Neurosphere formation was achieved by culturing cells on HydroCell low attachment plates coated with poly-L-lysine and laminin, and containing DMEM/F-12 with EGF, bFGF, and B-27 supplement. Neural differentiation was achieved by culturing cells in DMEM/F-12 with EGF, bFGF, and B-27 supplement. Phase contrast microscopy and immunofluorescence were used to confirm differentiation.

Results and Conclusion: DPSCs reprogrammed with Oct-4 and c-Myc showed different characteristics than wild type DPSCs. Morphology of the reprogrammed DPSCs is more akin to that of neural stem cells than the conventional fibroblast-like appearance of wild type DPSCs as demonstrated by phase contrast microscopy. Reprogrammed DPSCs showed significantly higher expressions of Sox2 and nestin, a stem cell marker and a neural progenitor marker, respectively. Compared to wild type DPSCs, the reprogrammed DPSCs showed more pronounced neurosphere formation as well as neural differentiation, confirmed by morphology studies and immunofluorescence staining of neural markers.

Discussion: Regeneration of disrupted human nervous system from disease or trauma is a challenge for stem cell-based therapy. Due to the low prevalence of neural stem cells, adult stem cell populations derived from the neural crest may possess a greater propensity for neuronal differentiation. DPSCs arise from the neural crest and are capable of differentiating into neurons, albeit with low yield. In the present study, we demonstrate that DPSCs reprogrammed with Oct-4 and c-Myc, key transcription factors involved in maintaining stem cell pluripotency, significantly improved the yield of neurosphere formation and neural differentiation. These data suggest that reprogrammed DPSCs have a robust neural differentiation potential for stem cell therapy of neurological diseases and injury.

This research was supported by NIH/NIDCR grant 5RC2DE020767 to J.J.M.
Michael Huang was supported by a College of Dental Medicine Research Assistantship

Multi-step Differentiation of Mesenchymal Stem Cells into Myofibroblasts: The Roles of CTGF/CCN2 and TGF β 1

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Introduction: Fibroblasts and their progeny, myofibroblasts, play essential roles in repair and remodeling of wound, and scarring. Myofibroblasts, featured by the expression of alpha smooth muscle actin (α SMA), are primarily responsible for wound contraction and scarring. In normal wound healing, myofibroblasts undergo apoptosis following wound closure and remodeling, but persistence of myofibroblasts leads to formation of chronic inflammation or fibrosis. Dysregulation of transforming growth factor beta 1 (TGF β 1) and its downstream mediator, connective tissue growth factor (CTGF/CCN2), are considered responsible for scarring and/or fibrosis. Both TGF β 1 and CTGF/CCN2 are highly expressed in hyperthropic scars and organ fibrosis. However, the roles of TGF β 1 and CTGF/CCN2 in myofibroblastic differentiation from stem/progenitor cells are poorly understood. Here, we investigated the roles of TGF β 1 and CTGF/CCN2 in human bone marrow derived mesenchymal stem cells (hMSCs) a putative source of myofibroblasts.

Objective: The main purpose of this study is to delineate step-wise roles of TGF β 1 and CTGF/CCN2 on differentiation of hMSCs into myofibroblasts. Comparative studies with human dermal fibroblasts (hDFb) and rat ligament fibroblasts (rLFb) are also included.

Materials and Methods: MSCs isolated from human bone marrow were treated with 100 ng/mL of CTGF for 4 weeks, followed by treatment with 5 ng/mL TGF β 1 for 1 week. Immunofluorescence and flow cytometry were performed to identify α SMA⁺ cells. Contractility of the derived myofibroblasts was assayed in 3D collagen lattice. To investigate the role of CTGF in TGF β 1-induced myofibroblastic differentiation, hDFb, rLFb and hMSCs were treated by CTGF, TGF β 1, or TGF β 1 with CTGF antibody. After 24-hr, mRNA expression of α SMA was quantified using real time RT-PCR.

Results and Discussion: The treatment of MSCs with CTGF/CCN2 for 4 weeks led to little α SMA expression. However, 5 ng/mL TGF β 1 treatment of CTGF/CCN2-treated MSCs readily induced α SMA expression. Flow cytometry showed that 31.9% of CTGF/CCN2-treated MSCs gained α SMA⁺ myofibroblastic phenotype upon TGF β 1 treatment. Only 1.8% of MSCs without prior CTGF/CCN2 treatment gained α SMA phenotype after TGF β 1 stimulation, suggesting that MSCs, without fibroblastic differentiation, have certain innate ability to resist the acquisition of α SMA phenotype, in comparison to CTGF/CCN2-treated MSCs. In addition, MSCs treated with sequential CTGF/CCN2 and TGF β 1 showed the most significant contraction of the collagen gels. In hDFb, rLFb, and hMSCs, TGF β 1 induced CTGF production within 24 hrs, whereas CTGF alone failed to increase TGF β 1 expression. Interestingly, addition of CTGF antibody in TGF β 1-treated cells attenuated or inhibited α SMA expression.

Conclusion: The present findings suggest that the axis of CCN2/CTGF and TGF β 1 seems to specify distinctive, stepwise processes of fibroblast commitment, fibrogenesis and potentially fibrosis. Furthermore, CTGF likely plays a critical role in TGF β 1-induced myofibroblastic differentiation.

Supported by NIH/NIDCR 5RC2DE020767 (J.J.M)
Gowhar Iravani was supported by a CDM Research Assistantship

Cartilage Regeneration Without Cell Transplantation

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Introduction: Arthritis of the temporomandibular joint (TMJ) is associated with pain and dysfunction. Clinical presentation of pain and dysfunction associated with the temporomandibular joint is known as temporomandibular joint disorders. Defects causing TMJ disorders are the result of cartilage damage by arthritis, trauma, tumor, TMJ disk erosion, and improper TMJ disk alignment. Between 5 and 15 percent of people in the United States experience pain associated with TMJ disorders. Currently, there are no biological regeneration therapies for the TMJ. Research studies for cartilage regeneration primarily involve cell transplantation. However, cartilage regeneration by cell delivery has a number of drawbacks of scarce cell availability, excessive cost associated with cell manipulation, and donor-site morbidity. Cell homing is a novel concept and bypasses the need for cell transplantation. In the present study, a cytokine delivery system was developed to attract endogenous stem/progenitor cells and then differentiate them into chondrocytes. Cell types adjacent to an articular cartilage defect and of interest to this study are: bone marrow derived mesenchymal stem cells (MSCs), adipose derived stem cells (ASCs) and synovial cells.

Objective: The objective of the present study was to identify novel strategies to optimize the homing of multiple stem/progenitor cell populations in to an acellular scaffold by several clinically applicable cytokines.

Materials and methods: Stromal cell-derived factor-1 (SDF1) and transformation growth factor β 3 (TGF β 3) were encapsulated in gelatin microspheres that were fabricated using a water-in-oil emulsion technique and chemically cross-linked with glutaraldehyde. Following lyophilization, the microspheres were rehydrated in a solution containing 300 ng/mL TGF β 3, 100ng/mL SDF1 or PBS. Acellular scaffolds were fabricated with two separate but integrated layers consisting of a layer of cross-linked 4% (w/v) calcium alginate containing 30 mg (dry wt) of embedded microspheres and an underlying collagen sponge. Human bone marrow MSCs, human ASCs, and human synovial cells were isolated from adult donors and seeded in 6-well plates (100,000 cells per well). Four conditions were tested: TGF β 3 alone, SDF1 alone, SDF1+TGF β 3 and cytokine free. Each scaffold was placed in the center of the well. Scaffolds were harvested after 3 hours, 1 week, 3 weeks and 6 weeks, fixed in 10% formalin, embedded in paraffin and sectioned. DAPI staining was used to assess the number of cells per scaffold section and toluidine blue to assess chondrogenesis. ANOVA and Bonferroni tests were used for statistical analysis ($p < .05$).

Results and conclusions: Following 3 wks of cell homing, white tissue formation was visible in the collagen portion of the scaffolds. DAPI staining confirmed that MSCs, ASCs, and synovial cells were homed into the scaffold. Delivery of TGF β 3 was most effective to recruit ASCs into the scaffold upon 3 and 6 wk cell homing, generating significantly greater cell numbers than the other three conditions. SDF1+TGF β 3 homed significantly more MSCs at 3 wks than the other three conditions. At 6 wks, TGF β 3 homed the highest number of synovial cells, significantly more than the cytokine-free and SDF1 groups. Toluidine blue staining indicated cartilage positive formation in the TGF β 3 group for all three cell types and in the SDF1+TGF β 3 group for ASCs and MSCs. The cells in the remaining conditions showed positive staining.

Discussion: After 3 weeks of homing, the combination of TGF β 3+SDF1 recruited the highest number of MSCs and synovial cells into the scaffolds and induced chondrogenesis. However, at 6 weeks, TGF β 3 was the most successful in recruiting MSCs and ASCs into the scaffolds and inducing chondrogenesis. TGF β 3 was the most successful in recruiting synovial cells and inducing chondrogenesis at both 3 and 6 weeks of homing. While SDF1 showed some ability to home cells, it was inadequate on its own to differentiate the cells into chondrocytes. Current experiments are being done to further characterize the engineered tissue and to determine which concentration of cytokines is most effective at homing cells. Future studies will address *in vivo* effects of cell homing and chondrogenesis.

Brandon Knapp was supported by a College of Dental Medicine Predoctoral Summer Research Fellowship

PCR Verification of Interstrain Genetic Polymorphisms of *Porphyromonas Gingivalis*

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Introduction: *Porphyromonas gingivalis*, an oral anaerobic bacterium, has been strongly implicated as an etiologic agent of periodontal disease and recent evidence suggests its association with development of atherosclerosis. Interstrain genomic differences within the bacterial species determine varying invasion efficiencies, most importantly, invasion of non-phagocytic cells. With the use of JCVI microarrays, we identified specific open reading frames (ORFs) that are polymorphic between invasive and non-invasive *P. gingivalis* strains. We used PCR analysis to confirm the presence or absence of these ORFs in both invasive and non-invasive lab strains, along with clinical specimens obtained from healthy and diseased sites. Strain-to-strain comparisons concluded that the majority of the tested isolates contained ORFs detected in the invasive lab strains strain. These findings suggest that there might be a genetic basis for the invasive *P. gingivalis* phenotype.

Objective: In this study, we are testing the hypothesis that invasion-associated interstrain genomic polymorphisms are present in *P. gingivalis*. With the use of PCR for strain-to-strain comparison, we aim at confirming the findings of obtained microarray data and comparative genomic hybridization (CGH) in the lab strains and see if the presence of these invasion-associated ORFs is related to the health/disease sites from which the clinical strains were harvested from.

Materials and Methods: *Porphyromonas gingivalis* lab strains as well as the clinical isolates were grown anaerobically at 37°C on blood agar plates (BAP) and in Tryptic Soy Broth. Lab strains include AJW4, W83, 381, JH16-1, A7A1-28, ATCC 33277, and A7436. Clinical strains obtained from healthy sites (PD <5mm and no BOP) include 14H, 24H. Clinical strains obtained from diseased sites (PD ≥ 5mm and +BOP) include Pg1, Pg2, Pg5, Pg9, Pg18, Pg19, and Pg25. Gene specific primers used for PCR analysis include Pg0848 (Hypothetical protein), Pg1439 (Hypothetical protein), Pg1526 (Hypothetical protein), Pg1061 (Ispg6), Pg 0461 (Ispg7), Pg 0982 (TPR I), Pg 0185 (RagA), and Pg 0186 (RagB). DNA was extracted using the DNeasy Tissue Kit (Qiagen). To validate the microarray data, PCR confirmation of selected ORFs was carried out for both the invasive and non-invasive lab strains. Platinum Blue PCR Polymerase Super mix (Invitrogen) was used in a PCR protocol. The PCR mix contained 45µL of Platinum Blue, 50ng extracted of DNA, 200nM of selected primers in a total volume of 50µL. The amplification was carried out with an initial denaturation at 94°C for 2 minutes followed by 35 cycles of denaturation at 94°C for 30 seconds, annealing at 56°C for 30 seconds, and primer extension at 72°C for 30 seconds, followed by a final primer extension for 5 minutes at 72°C.

Results and Conclusions: PCR testing of the selected ORFs in both laboratory and clinical isolates, as identified by microarray analysis, was performed using gene-specific primers. *P. gingivalis* genetic polymorphisms were verified by PCR analysis, with all eight of the tested ORFs present in the invasive lab strains (W83, 381, A7A1-28, ATCC 33277, A7436) and only one tested ORF present in the less invasive lab strain JH16-1, while AJW4 has none. The majority of the tested clinical isolates, obtained from both healthy and diseased sites, contained selected ORFs that were not detected in the less invasive lab strains.

Discussion: *Porphyromonas gingivalis* genetic polymorphisms could potentially account for the different cell invasion phenotypes among different strains. In our study, significant strain-to-strain genetic differences in *P. gingivalis* genome were demonstrated between strains with different invasion phenotypes. In conclusion, although oral tissues are likely the primary sites for *P. gingivalis* colonization and infection, this bacterial species can enter the systemic circulation through various breaches in oral membranes, ultimately resulting in invasion and inflammation of the vasculature and leading to serious disease states. Therefore, identification of genes responsible for a *P. gingivalis* virulence trait, host cell invasion, can serve as targets for the development of diagnostic tools and intervention strategies in disease progression.

Darya Luchinskaya was supported by a College of Dental Medicine Predoctoral Summer Research Fellowship.

Exploring the Relationship between Integrin $\alpha\beta6$ and $\alpha\beta1$ in Oral Squamous Cell Carcinoma

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Introduction: Oral squamous cell carcinoma (OSCC) is the sixth most frequent cancer in the world with approximately 35,000 new cases diagnosed in the United States annually. The overall 5-year survival rate for OSCC remains among the lowest for major cancers and the prognosis is poor, probably due to the ability of these tumors to metastasize. In OSCC, upregulation of integrin $\alpha\beta6$ expression is recognized as a hallmark for metastases and poor prognosis. Integrins are a large family of $\alpha\beta$ heterodimeric transmembrane receptors that link the cellular cytoskeleton to the extracellular matrix (ECM). Integrin signal transduction occurs in a bidirectional manner and plays critical roles in tissue integrity and cell migration, adhesion, proliferation, differentiation and apoptosis. Integrin expression dysregulation has been implicated in tumor formation, progression and metastasis, since successful invasion requires continuous remodeling of the ECM by integrins. Previous work from our lab suggests that there might be an inverse relationship between $\alpha\beta1$ and $\alpha\beta6$ expression in epithelial tumors however the exact mechanism remains to be elucidated.

Objective: Our objective was to test the hypothesis that changes in levels of expression of integrins $\alpha\beta6$ and $\alpha\beta1$ correlated with the malignant phenotypes seen in oral squamous cell carcinoma.

Materials and methods: Three different OSCC cell lines, SCC9, SCC9 $\beta6$ and SCC9 $\beta6\beta1$, were used to study the effects of increased expression of $\alpha\beta6$ in oral cancer. SCC9 $\beta6$ cells were generated by co-culturing non-invasive SCC9 cells with AM12 retroviral producer cell lines that express full-length FLAG tagged $\beta6$. The transduced cells were selected using puromycin. The SCC9 $\beta6$ cells were then infected with $\beta1$ -myc tagged IRES-GFP lentiviruses to generate the SCC9 $\beta6\beta1$ cell line and transduction efficiency was monitored by the expression of GFP. Flow cytometry and western blot analysis were used to evaluate levels of $\beta6$. SCC9 $\beta6$ and SCC9 $\beta6\beta1$ cells were FACS sorted using a $\beta6$ antibody (6.2G2) and GFP to obtain cell populations with high $\beta6$ and high $\beta6/\beta1$ expression, respectively. The effect of differential integrin expression on growth of SCC cells was evaluated using cell proliferation assays and scratch wound assays were used to assess migration ability of mitomycin-C treated cells. Furthermore, the various cell lines were grown on coverslips coated with fibronectin (FN) for 24 hours and immunofluorescence was used to visualize phalloidin, FN, vinculin and $\beta6$ to assess the ability of these cells to organize a FN matrix *in vitro*. Proliferation assays were also utilized to evaluate whether 0.01 mM Zoledronate influenced the growth of SCC9 $\beta6$ cells. Finally, FACS analysis was used to assess surface expression of $\alpha\beta6$ in SCC9 $\beta6$ cells and SCC9 $\beta6$ cells grown in 0.01 mM Zoledronate.

Results and Conclusions: Flow cytometry and western blot analysis indicated that there was a 10-fold increase in the expression of $\beta6$ in SCC9 $\beta6$ compared to SCC9 cells. Cell proliferation assays demonstrated that SCC9 $\beta6$ cells were more proliferative than the SCC9 cells, which showed more growth than the SCC9 $\beta6\beta1$ cells. Scratch wound assays indicated that SCC9 $\beta6$ cells were the most migratory, followed by SCC9 $\beta6\beta1$ and finally by SCC9 cells. After 24 hours of growth on FN coated coverslips, the SCC9 and SCC9 $\beta6\beta1$ cells were able to organize the FN into a fibrillar pattern in association with the peripheral focal adhesions. The SCC9 $\beta6$ cells displayed numerous focal adhesions with robust $\beta6$ expression but did not organize the FN into a fibrillar pattern. Proliferation of SCC9 $\beta6$ cells in the presence of 0.01 mM Zoledronate was greatly decreased compared to SCC9 $\beta6$ cells grown in isolation. SCC9 $\beta6$ cells grown in 0.01 mM Zoledronate showed a decrease in surface expression of integrin $\alpha\beta6$ by approximately 40%.

Discussion: This data suggests that upregulation of integrin $\beta6$ increases the proliferative and migratory capacities of SCC9 cells however, the matrix organizing ability of these cells was compromised. Furthermore, increased expression of integrin $\beta1$ in SCC9 $\beta6$ cells appears to reverse these malignant phenotypes. Therefore, the tipping of the balance of these integrins, upregulation of $\alpha\beta6$ and downregulation of $\alpha\beta1$, may contribute to cell invasion and migration in OSCC. The ability of 0.01 mM Zoledronate to inhibit proliferation of SCC9 $\beta6$ cells is of great interest since OSCC cells with increased $\alpha\beta6$ expression are associated a poor prognosis and there is currently no tumor cell specific therapy for the treatment of OSCC. Downregulation of integrin $\alpha\beta6$ in SCC9 $\beta6$ cells grown in the presence of 0.01 mM Zoledronate suggests a possible mechanism by which Zoledronate inhibits cell proliferation.

Caitlin Magraw was supported by a College of Dental Medicine Predoctoral Summer Research Fellowship.

Monodisperse Gelatin Microspheres as a Platform Drug Delivery Vehicle: Release Kinetics and Effect of Crosslinking Density

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Introduction: Gelatin microspheres (GMS) are an efficient drug carrier for several administration routes including oral, nasal, gastrointestinal and rectal. Charged GMS have an ability to form a complex with an oppositely charged protein, therefore making a useful protein/peptide delivery vehicle for prolonged release. Unlike in diffusion-mediated release, proteins complexed with gelatin are released as the gelatin is degraded. Growth factors are proteins or peptides with known or exploratory roles in morphogenesis or tissue regeneration. However, due to the short half-life of growth factors, there is an acute need for a delivery method which can potentiate their therapeutic levels in vivo. However, gelatin alone dissolves too rapidly in vivo and leads to premature release of encapsulated peptide or proteins. Here, we demonstrate that GMS with different levels of cross-linking have distinctive degradation kinetics.

Objective: To investigate the effect of cross-linking on the release kinetics of GMS by varying GA concentrations.

Materials and Method: Gelatin microspheres were fabricated with negatively charged gelatin using a water-in-oil emulsion technique and washed with acetone. A negatively charged gelatin was selected for its binding to positively charged growth factors at appropriate pH levels. The GMS was then cross-linked with GA. Four different GA concentrations were tested (n=3): 0, 0.25, 0.5, and 0.75 wt.-%. The resulting GMS were then washed with a glycine solution repeatedly to remove any residual GA, followed by lyophilization. All GMS were then rehydrated with Dextran Rhodamine Green (10 kDa) fluorescent dye for 3 hrs. 10kDa Dextran was used for its comparable molecular weight to a cascade of cytokines with known potential in tissue regeneration. Subsequently, the GMS were transferred to 12 well plates and 2 mL of PBS solution was placed in each well. Samples of fluid were taken at 1-3 day intervals for 30 days and fluorescence was measured immediately after sample collection.

Results and Conclusions: After 20 days, the total release of the dye for the 0%, 0.25%, 0.5%, and 0.75% GMS samples was 84%, 79%, 76%, and 74%, respectively. All the samples exhibited similar release profiles, regardless of the GA concentrations used for crosslinking. The majority of the dye was released from all samples within the first 2 days, with the GMS releasing much less dye from days 3-20. Cross-linking with GA slowed degradation rate, accounting for modest release at each of the later time points. Total percent release from the GMS decreased with increasing cross-linking agent concentration. The 0% GMS was difficult to fabricate and maintain their shape for prolonged time. The 75% GMS were fabricated but with technical challenge due to their static attraction to pipettes and cuvettes. The 25% and 50% GMS were readily fabricated with optimal ease of fabrication, uniformity, and yield. Cross-linking the GMS induces the gelatin polymer to become more tightly networked, slowing the degradation process and thus influencing the release kinetics. These findings have broad implications in the delivery of peptides and proteins for tissue regeneration and tissue engineering therapies.

Supported by NIH/NIDCR 5RC2DE020767 (J.J.M)

Ryan Maneevese was supported by a CDM Predoctoral Summer Research Fellowship

Cytotoxic Effects of Zoledronate on Primary Human Oral Fibroblasts

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Introduction: Bisphosphonates are a class of drugs that slow the remodeling process of bone by causing osteoclasts to undergo apoptosis. Recently, bisphosphonates have been associated with the development of osteonecrosis of the jaw (ONJ), especially in patients being treated for metastatic tumors of the bone, hypercalcemia of malignancy, multiple myeloma, and Paget's disease. Most ONJ cases can also be attributed to prior dentoalveolar surgery. It has been shown that zoledronate, a nitrogen containing bisphosphonate, is toxic to oral fibroblasts at clinically relevant levels. Previous work demonstrated that oral fibroblasts were also more sensitive to bisphosphonates compared with primary osteoblast-like cells derived from the mandible. These findings support the theory that ONJ is initiated in the soft tissue and results from an inhibition of normal wound healing of the fibroblasts.

Objective: We hypothesize that the inhibition of wound healing stems from the loss of cellular focal adhesions. Furthermore, the alteration of oral soft tissue wound healing secondary to zoledronate exposure may be restored by the addition of geranylgeraniol (GGOH), a synthetic analog of geranylgeranyl pyrophosphate.

Materials & Methods: Primary human oral fibroblasts were obtained from discarded surgical tissue and exposed to zoledronate (Novartis, East Hanover, NJ) at concentrations based upon previous research using pamidronate. Cellular proliferation was measured using a MTS/PMS reagent-based kit (Promega, Madison, WI). Oral fibroblasts were treated with GGOH (Sigma-Aldrich, St. Louis, MO) and examined for wound healing capabilities using a scratch assay. To determine whether oral fibroblasts underwent apoptosis following exposure to zoledronate, TUNEL, and caspase-3 assays were performed. Immunofluorescent staining procedures using rhodamine-phalloidin and an antibody to vinculin were performed to visualize the actin cytoskeleton and focal adhesions respectively.

Results & Conclusions: Cellular proliferation of oral fibroblasts was shown to be significantly reduced by zoledronate at a concentration of 0.008mM after 72 hours of exposure. Marked detachment from the plate was observed at the same concentration and time point. TUNEL and caspase-3 assays showed that apoptosis was not induced until 144 hours at the 0.03mM concentration of zoledronate exposure. Slide staining procedures indicated a lack of focal adhesions of oral fibroblasts at 96 hours treated with 0.03mM of zoledronate. GGOH treated oral fibroblasts (50µM) demonstrated full rescue and closure of scratch wounds at concentrations as high as 0.1mM of zoledronate after 72 hours.

Discussion: Our results show that proliferation and wound healing ability of primary oral fibroblasts are significantly reduced by zoledronate at clinically relevant levels. It is interesting to note that detachment of oral fibroblasts from the plate occurred much earlier (72 hrs.) and at a lower concentration of zoledronate (0.008mM) than when apoptosis was observed (144 hrs., 0.03mM) possibly indicating a loss of focal adhesions prior to cell death. Perhaps, the most startling finding involved the rescue of oral fibroblasts with GGOH. Cell proliferation was severely diminished and cell detachment from culture plates was evident after only 24 hours of treatment with 0.1mM of zoledronate. The addition of 50µM of GGOH fully rescued this cytotoxic effect, implicating a promising application for this analog of an intermediate in the mevalonate pathway. At the present time, the pharmacological and toxicological properties of GGOH have not been fully investigated, and it is not approved for use in humans.

The research was supported NIH Grant NIH R21-DE017164 (Landesberg). Bradley M. Pinker was supported by a College of Dental Medicine Predoctoral Summer Research Fellowship.

Homing of stem cells by competitive actions of multiple cytokines

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Introduction: A lot of the tissue regeneration methods this far have relied on cell delivery, but there are drawbacks to this approach. These downfalls include donor site trauma, possible immune reactions, and long term storage difficulties. The idea of tissue regeneration by cell homing is a relatively new idea that possesses the advantages of a lower cost and accelerated clinical translation. One of the upcoming ideas utilizes an acellular biomaterial scaffold containing chemoattractants that actively recruits endogenous cells and modulates their behavior to promote tissue regeneration. In order to successfully develop tissue regeneration strategies by cell homing, the process of cell migration must be studied and characterized.

Objective: The objective of the current study was to understand the process of chemokine mediated stem cell migration by 1) Designing and fabricating a microfluidic device to study the attraction of stem cells towards a cytokine 2) Characterizing the diffusion profile of cytokines through the device and 3) Identifying locomotion patterns and migratory distances of individual cell populations over a specified time period.

Materials and methods: Microfluidic devices to study cell migration were fabricated using standard photolithography and soft-lithography techniques. These devices emulate an under-agarose assay in a microfluidic environment. To visualize the cytokine diffusion a fluorescent dextran with a molecular weight similar to comparable cytokines was utilized. The channels of the microfluidic device were filled with 1% agarose, dextran was added to one side of the channel and time-lapse images were taken over a twelve hour time period. In a separate experiment to study the effect of SDF1 on stem cell migration, human adipose derived stem cells (ASCs) were exposed to SDF1 for more than twelve hours, while monitored using time lapse imaging. Individual cell locomotion patterns and distances were determined.

Results and conclusions: We were successfully able to develop microfluidic devices that allow the visualization and characterization of cell migration. Images of the fluorescent dextran diffusion through the agarose demonstrated a gradient of cytokines can be formed in the device over time. Cell migration experiments using these devices showed that SDF1 promoted the migration of ASCs within four hours of cytokine exposure. Individual cell locomotion patterns and migratory distances were determined.

Discussion: These novel microfluidic devices offer a rare opportunity for high-throughput screening of cell homing efficacy, potentially applicable to any stem cell population including iPS, skeletal, muscular, and embryonic. Using this device one can address a number of biological questions regarding the migration of cells, including: transendothelial cell migration, cell motility, and migratory distances. Current experiments are aimed to cross-test the homing ability of multiple cytokines against a given stem cell population and to investigate how a given cytokine may differently affect the homing of multiple stem cell populations. Furthermore, various other cytokines that are not typically considered cell homing cues are being tested including: TGF β 3, TGF β 1, VEGF-A, TNF- α , and IGF1. Figuring out which combinations of cytokines are the most effective at maximizing cell homing may offer novel approaches for tissue regeneration without a need for cell delivery. In addition to studying cell migration, this device also has the potential to be used to identify ways to prevent cancer cell aggregation and spread.

Brian Sybo was supported by a College of Dental Medicine Predoctoral Research Fellowship.

Secreted Factors of Osteogenic Differentiation from Stem Cells Regenerate Bone *in vivo*

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Introduction and Objectives: Although stem cells have tremendous potential in the healing of tissue and organ defects, delivery of stem cells as a therapeutic tool is limited by complex and costly procedures. Thus far, few stem cell therapies are in clinical use, at least partially due to scientific, regulatory and commercialization difficulties including cell yield, pathogen transmission, immunorejection, packaging, shipping and handling. We hypothesize that secreted factors in the differentiation of stem cells towards each mature lineage are capable of regenerating tissues. The objectives of the present study are to 1) derive soluble factors that are capable of driving stem cell differentiation into osteogenic cells, 2) concentrate soluble factors into a cocktail and determine whether this secreted factor extracts (SFE) is capable of differentiating stem cells into osteoblasts, 3) apply SFE towards *in vivo* bone regeneration and 4) analyzing critical components of the SFE towards further therapeutic extracts. We report below that the derived SFE indeed promoted osteogenesis *in vitro* and *in vivo*, and therefore proposing a new stem cell therapeutic that may serve as an alternative to current stem cell delivery for tissue regeneration.

Materials and Methods: Primary osteoblasts were isolated from neonatal mouse calvaria and cultured with serum-free DMEM medium. The cultured media were collected at days 1, 4 and 9 and concentrated by de-salting and freeze-drying to yield secreted factor extracts (SFE). Human bone marrow mesenchymal stem cells (MSCs) from multiple adult donors were treated with SFE. The SFE with the most robust osteogenic activity was encapsulated in PLGA microspheres and delivered to microporous beta tricalcium phosphate (β -TCP) scaffolds (dia: 1 cm³). Then, SFE-loaded β -TCP scaffolds were implanted in surgically created subcutaneous pockets in SCID mice for *in vivo* bone regeneration. SFE-free PLGA microspheres encapsulating PBS were loaded into β -TCP scaffolds and implanted in additional SCID mice as controls. All scaffolds were harvested 4 wks after *in vivo* implantation.

Results and Conclusion: One of the 3 concentrated SFEs showed the most robust *in vitro* osteogenic potential based on ALP activity and Von Kossa assay. Upon *in vivo* implantation of SFE-delivered β -TCP scaffolds, we found substantial cell ingrowth, positive expression of osteopontin and osteocalcin, along with von Kossa staining. In comparison, osteogenesis in SFE-free β -TCP scaffolds was minimal. Mass spectrometry was then performed to identify the molecular make-up of SFE. A total of 84 proteins secreted by osteoblasts were identified, among which 22 are soluble matrix proteins and growth factors. Some of these proteins and peptides have been reported to promote osteoblasts differentiation. Furthermore, myriads of proteins and peptides identified by mass spec are those that have not been previously associated with osteogenic differentiation or osteogenesis, and therefore may be potential targets for the identification of novel factors that may play important roles in bone regeneration.

Discussion: This study represents a novel approach to identify secreted factors that can potentially be delivered as drugs for tissue regeneration. These secreted factors may serve as stem cell replacements for tissue regeneration. Our follow-up studies attempt to screen novel molecular cues that are potent for bone regeneration for patients with orofacial and skeletal defects.

Supported by NIH/NIDCR 5RC2DE020767 to J.J.M

Catherine Woo was supported by a CDM Predoctoral Summer Research Fellowship

Changes in Daily Living Brought About by Dental Symptoms among Central Harlem Adults

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Introduction: Although oral health status in U.S. has improved over the years, the burden of oral disease is still disproportionately endured by people of color and the socio-economically disadvantaged. These disparities have been attributed to, among others things, limited access to dental services, fear of intervention, and a deep-rooted belief regarding the inevitability of dental problems. The range of possible changes and/or disruptions to daily routine that minority populations experience, when faced with oral problems, is thus of central concern. To explore in-depth the impact of oral health symptoms held by urban African Americans drawn from a community that had previously cited oral health as its most prevalent health care need, a study was conducted to investigate the types of changes in daily living that oral symptoms brought about among adult residents of Central Harlem.

Objective: 1) To systematize and understand the types of impacts that oral symptoms have on daily living, 2) to identify principal activities that are most often changed by oral symptoms, 3) to document the frequency, overall, with which changes in routine daily activities are mentioned as a consequence of oral symptoms experienced, 4) to identify, according to symptom, the activities most frequently mentioned as changing, 5) to contrast the changes in daily behaviours for those experiencing 2 or < versus 3 or > oral symptoms, and 6) to contrast the changes in daily behaviours for the three most prevalent symptoms, toothache, sensitivity to cold, and difficulty to biting and/or chewing.

Materials and Methods: Study participants were recruited in locations throughout Central Harlem, using a street intercept approach to screen for eligibility. Individuals who met the study's eligibility criteria were invited to participate in an in-depth interview about oral symptoms they had experienced in the past 6 months for two or more days duration, including a segment on their impact on daily physical activities, oral hygiene routines, speaking, eating, and oral habits. A sample of N=118 African American men and women agreed to participate in in-depth interviews with a trained interviewer, lasting from 90 to 120 minutes, conducted from September 2004 to June 2005. The interviews were tape recorded and transcribed. Interview transcripts were then analyzed using the qualitative software, Atlas.ti, followed by more detailed thematic coding/analysis by members of the study team.

Results and Conclusions: Across all symptoms, study data indicate that chewing and eating habits, rather than physical activities are most often affected. Specifically, 48% of subjects reported changes in the types of foods consumed, which includes avoidance of sweet, cold, and harder food types and 54% respondents reported changes in chewing habits, citing changing the dominant chewing side. Sensitivity to cold (23%), toothache (23%), and difficulty biting/chewing (12%) were the dental symptoms most often experienced within the past 6 months with duration of two or more days. For sensitivity to cold, most frequently noted changes in daily activities were chewing on one side/opposite side and stopping eating certain types of foods followed by taking longer to finish meals. For toothache, the same two activities were noted, followed by brushing more often. Changes in daily living did not differ between participants with fewer (two or less) symptoms and those with more (three or more) symptoms. Participants experiencing difficulty biting and/or chewing expressed more problems with speaking than did those experiencing sensitivity to cold ($p < .01$) or toothache ($p < .10$).

Discussion: Findings provided evidence that the African American adults of Central Harlem reported a range of diverse impacts in daily living brought about by the oral symptoms that they experienced within the past six months of at least two days duration. Generally (not specific to a single oral symptom), changes typically lay with activities such as eating and chewing habits. If considered with a larger sample, study findings suggest the occurrence of significant differences in changes in daily activities according to oral symptom among the sampled group. These findings call for more public health education focused on the importance of preventive dental care and the importance of seeking professional dental care. In addition, they indicate that oral symptoms can affect daily activities regardless of types or quantity of symptoms. With these results, it is clear that educational and other oral health intervention efforts in the Harlem community can usefully be targeted toward the African American community residing in Central Harlem.

This research was supported in part by NIH/NIDCR grant DE015115 (Siegel)

Do Medicaid payment rates correlate with program performance?

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Introduction: States are required to provide dental care to Medicaid-enrolled beneficiaries under age 21 years by the Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) benefit. Payments for dental services vary across states but are less than what dentists typically charge. Despite high levels of decay in low-socioeconomic status (SES) children and strong demand for care, dental service use by these children is far less than by privately insured children. The Government Accountability Office attributes this low utilization primarily to the paucity of participating dentists. The most commonly cited reason that dentists do not participate in Medicaid is low reimbursement.

Objectives: (1) To determine the state-specific levels of Medicaid payments relative to commercial rates. (2) To test the claim that Medicaid payment levels correlate with EPSDT dental utilization.

Materials and Methods: Medicaid payment schedules for 13 of the most common pediatric dental procedures were obtained from states. Ingenix, a health information company, used their proprietary commercial dental claims database to calculate a weighted index, based on procedure frequency, of Medicaid payment rate as a percentage of 50th percentile of commercial insurance billings by state and year from 1999 to 2006. EPSDT dental utilization rates were calculated by state and year from data available on the federal Centers for Medicaid and Medicare Services website.

Results and Conclusions: The national dental utilization rate of EPSDT-enrolled children increased by an average of 1.1% per year, from 25.2% in 1999 to 32.6% in 2006. Dental Medicaid payment rates, as a percentage of the 50th percentile of commercial rates, decreased by 0.9% per year, from 66.6% in 1999 to 60.1% in 2006. Among states that raised fees during this period, fee increases were associated with higher average utilization rate increases for one year following the rate hike (1.7% vs. 1.1%) but this change was not maintained after one year. The relationship direction between Medicaid payment rates and Medicaid program performance as measured by EPSDT dental utilization was inverse, but no correlation was found ($R^2=.04$).

Discussion: Findings support the conclusion that increasing Medicaid payments alone may not be sufficient to increase utilization. Study limitations that may partially or fully explain the lack of correlation between payment rates and utilization include incomplete and/or inaccurate data reported by states. During the study period, between 4 and 9 states failed to provide both utilization and fee data in a year, and the quality of state dental utilization reporting has been challenged by federal authorities.

Expectations and Perceptions of an EoHR system in an Academic Institution

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Introduction: Electronic health records have become a necessity for progress in the health care industry. However, there are many misconceptions about how electronic oral health records (EoHRs) will affect clinical management from the point of view of the students and faculty members. These misconceptions often create a barrier to proper implementation of the EoHR system, decrease efficiency and increase costs. We posit that if students' and faculty's expectations and perceptions are understood before implementation, the transition to EoHRs will occur with fewer setbacks. This allows for the system implementers to focus on the most pressing issues, creating a better overall product. It is important to reduce these misconceptions at the inception of the implementation process and to keep all members involved positively focused to enable the implementation process to run more smoothly.

Objective: To evaluate the current expectations, perceptions and misperceptions of Columbia's College of Dental Medicine (CDM) students and faculty members from an EoHR system. This will allow for a more efficient implementation of the Axium EoHR system that CDM has chosen.

Materials and Methods: This cross-sectional survey was administered via surveymonkey.com. The survey contained 22 statements were given, and responders were able to pick one of five options from strongly disagree and strongly agree. At the end of the survey, the responders had the option to leave a comment. Inclusion criteria included participants that will be using the EoHR system. The sample size was 66 and included 40 students and 26 faculty members.

Results and Conclusions: The data was analyzed between student class (2010 or 2011), part-time or full time faculty as well as faculty with EoHR experience or without. When comparing the expectations from the system of the students and the faculty members it is evident that the students expect more and are more optimistic about the transition and implementation process. The percentage of responders that believe that electronic health records will improve health care quality is comparable and even higher to other studies in similar environments.

A common and important barrier to implementation is the belief that learning to use the system will be tough and frustrating. This is somewhat true at our institution as well, though students believe this less than do faculty members. The diverse answers and mixed responses shown throughout many questions of the survey represent the variety of effects that EHRs can have on efficiency. It has been shown that at times using EHR systems can lead to increased documentation time, but at other times can improve effectiveness and allow for faster results as compared to paper charts. The ranges of efficiency of EHRs were due to the type of system used as well the specific items being documented.

Perhaps the most important finding was the realization of the importance to correct faculty's misperceptions long before those of the students. Many students look up to the faculty members and often take what they say for fact rather than opinion. Therefore if faculty members have false perceptions or even negative outlooks, it will greatly modify attitudes of the students. A negative attitude has the power to greatly hinder the implementation process.

Robert Geiman was supported by the New York Academy of Dentistry Predoctoral Research Fellowship

Ethiopia: A Report on Dentistry in a Resource-Limited Setting

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Introduction: Dentistry is relatively new as a professional service in Ethiopia. As Ethiopian society grows, awareness of oral health and the demand for dental services is also increasing. There are several private dental clinics that offer the full scope of dental services. However, almost all of these facilities are located in the capital city of Addis Ababa and almost 90% of the population of Ethiopia resides in a rural setting. Even if geographical accessibility was not a problem, the cost of private dental care is financially inaccessible for most Ethiopians. Certain government-funded hospitals offer emergency dental care locally at a relatively low cost. These dental care facilities are partially funded by the International Center for AIDS Care (ICAP) and Treatment Programs. The quality of dental equipment and dental care at these facilities has yet to be evaluated.

Objective: To use observation and informal interviews to find out how well the government hospital dental clinics are serving the clients. The long-term objective was to identify areas of weakness so that measures could be taken towards improvement.

Materials and Methods: My 6-weeks in Ethiopia were spent traveling with the ICAP team to dental clinics in ICAP-supported government hospitals. I was based in Addis Adaba, but the cities I saw were Adama, Bishoftu, Fiche and Ambo. I spent at least two days at each site, observing and assisting the dental health professionals in their daily activities. I evaluated each clinic based on five standards including: the level of training of the dental professional, the availability and use of personal protective materials and instruments, the condition of the dental equipment and the infection control practices. Each clinic was ranked according to these categories as either very poor, poor, adequate, good or excellent.

Results and Conclusions: The general picture in the dental clinics is one of neglect, extreme neglect in some cases. The level of dental training and degree of infection control were rated as either good or excellent at all sites. Scores of very poor and poor were common in categories that required government support, such as the availability of dental instruments, dental equipment and personal protective equipment. It was rare to find a dental clinic with a functional dental chair. During my stay in Ethiopia electricity was being rationed, meaning that every other day there was no power. This made sterilization and lighting a critical problem. Adama fared the worst overall with a critical shortage of gloves and disposable masks. Fiche scored the highest.

Discussion: The dental providers at each site were extraordinary clinicians, but their ability to serve patients was hindered by a critical lack of staff, instruments and equipment. Conversations with the dental clinicians, hospital administrators and my in-country mentor led to one conclusion: shortages in the dental clinic are not due to a general lack of funds, but due to a problem with fund allocation. Dentistry is rarely a question of life and death, so when hospital directors must make those hard decisions on where to allocate scarce resources the dental clinic is often forgotten. The long-term solution is to educate people about the benefits of good oral health. It is important to show that a small investment in dental staff, reliable instruments and equipment will lead to big returns in improved patient health.

June Harewood's externship was jointly supported by the International Center for AIDS Prevention and Treatment Programs at the Mailman School of Public Health and by the College of Dental Medicine.

The Association between Community Water Fluoridation and Adult Tooth Loss

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Introduction: Community water fluoridation (CWF) is one of the most commonly provided local public goods in the United States. While studies have demonstrated a clear inverse relationship between dental caries and contemporaneous exposure to CWF, particularly in children, little is known about the long term impact of CWF exposure on adult oral health.

Objective: This study focuses on estimating the association between CWF exposure at various stages of life and adult tooth loss.

Methods: This study estimates the association between CWF and tooth loss by relating community-level measures of CWF at various time intervals, computed from data collected by the Centers for Disease Control and Prevention (CDC), to data on the oral health status of individuals who live in these communities, obtained from the Behavioral Risk Factor Surveillance Survey (BRFSS), controlling for other characteristics of these communities.

This study uses data from the 1995-1999 Behavioral Risk Factor Surveillance Survey, merged with data from the 1992 Water Fluoridation Census, to estimate interval regression models that relate CWF exposure with tooth loss.

Results: The results indicate that CWF levels in the county of residence at the time of the respondent's birth are significantly related to tooth loss but current CWF levels are not. The results imply that for every four individuals currently living in a county that fluoridated water at their time of birth, one individual has one more tooth than had they not lived in a county that fluoridated. In addition, the impact of CWF exposure is larger for individuals of lower socio-economic status.

Conclusions: This study suggests the benefits of CWF may be larger than previously believed and that CWF has a lasting improvement in racial and economic disparities in oral health.

Karin Herzog was supported by a College of Dental Medicine Predoctoral Summer Research Fellowship

Analysis of Dental Care Utilization Rates in Children Enrolled in Medicaid by State

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Introduction: Tooth decay is the most common chronic childhood illness and is concentrated among low-income children, yet many low-income children do not receive needed dental preventative and treatment services. Medicaid's Early and Periodic, Screening, Diagnostic and Treatment benefit (EPSDT) requires that states provide beneficiaries under age 21 with comprehensive dental care at levels commensurate with their higher income peers in the same geographic area. This requirement is infrequently met according to state reports to the federal Centers for Medicare and Medicaid Services (CMS) which detail use of dental services by age and type of service. Although Congressional investigations have raised some concerns about the accuracy of some state's filings, these "Medicaid 416 Reports" are the best available information on Medicaid beneficiaries' use of any dental services as well as preventive and therapeutic services. State policy and programmatic reforms in some states have demonstrated improvements in utilization. Such interventions can further improve utilization in other states once poorly performing states are identified.

Objective: To quantify disparities in EPSDT Medicaid dental utilization across the 50 states.

Materials and Methods: Using the 2008 Medicaid 416 Forms submitted by states for FY2008, data were collected for the total number of EPSDT-enrolled children nationally and by state and the proportion of these children who received "any dental visit," a "preventative dental service," and a "dental treatment service." States were ranked on these three parameters and their performances compared to the national average.

Results and Conclusions: 48 of the 50 states submitted Medicaid 416 forms for 2008. National averages for percentage of enrolled children receiving any dental visit, a preventative dental service and a dental treatment service were 37.8%, 33.5% and 19.2%, respectively. Florida was the state with the lowest reported utilization rates (20.9%, 13.8% and 7.8%) and Idaho the highest reported utilization rates (56.1%, 49.9% and 42.1%). 26 states of the 48 reporting were found to be above the national average. This indicates that states below the average deviated more significantly from the mean than above average states. The mid-western states with their lower populations generally reported higher utilization rates than states with very large urban areas.

Discussion: Disparities exist across the United States in dental utilization by Medicaid-enrolled children. These disparities appear to be related to state demographics but may also be related to policies and program design differences. Future work in this project will include exploring the relationship between historical utilization in relationship to Medicaid dental expenditures and overall US dental spending.

Aimee Leibowitz was supported by a College of Dental Medicine Research Assistantship

Dental Services at Harlem United: The Influence of Clients' Dental Beliefs on Dental Fear

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Introduction: Harlem United Community AIDS Center (HU) is a federally qualified health center (FQHC) in New York City that provides comprehensive dental, medical and supportive health care to over 3,500 clients annually. Virtually all HU clients are HIV-infected or at high-risk for HIV-infection; some have a history of substance abuse, homelessness and mental illness; most have a history of limited or no access to quality health care. In an earlier survey, reported at Birnberg 2008, new patients at the HU dental clinic identified "fear of the dentist and/or pain" as the most prevalent reason for not going to the dentist regularly.

Objectives: The goals of the study were to 1) identify the types of dental fear and beliefs about dentists experienced by HU patients, 2) identify which beliefs about dentists most influence fear of dental work, 3) determine the extent to which these beliefs, along with other variables, predict fear of dental work, and 4) use the results of this study, as warranted, to target the delivery of dental care to HU dental patients.

Material and Method: Of 160 candidate dental patients, 156 English-speaking patients (response rate = 98%) were recruited and participated in the study during July-August of 2008 and 2009. (Nine patients preferred to speak in Spanish and were not eligible to participate in this phase of the study). During the two summers, three student research assistants interviewed the patients in the clinic's waiting room and/or chairside, using a pre-coded questionnaire asking about the nature of their dental beliefs and dental fears, their perceived oral health status, the reason(s) for their dental visit, their oral hygiene habits, and their past oral health utilization practices. Responses were entered into a computer-based data set and analyzed using SPSS. 17.0.

Results: Seventy-six percent of participants reported they had seen a dentist in the past 6 months; while nearly 40% reported going to the dentist more than 2 times per year. Approximately 60% of participants had come to the clinic for routine or follow-up care. 63% self-identified as African American, while 29% identified as Hispanic. Using factor analysis on 15 items measuring dental beliefs about dentists, three factors were identified: 1) concern that the dentist is not trustworthy, 2) concern that the dentist is indifferent; and 3) concern that the dentist will not stop if the patient wishes him/her to do so. Similarly, using factor analysis on 20 items assessing dental fears, three factors were identified: 1) fear of having dental work done with sharp instruments, 2) anticipatory fear of the dental visit, and 3) presence of physiological signs of fear. Reported mean levels of fear, signs of fear, and negative beliefs about the dentist were low to modest. Bivariate correlations between types of beliefs about the dentist and types of fear indicated belief that the dentist is untrustworthy was not correlated with any of the types or presence of signs of fear. However, belief that the dentist was indifferent was significantly correlated with the two types of dental fear. Concern that the dentist would not stop, even if the patient requested, was significantly correlated with both types of fear ($r = .28$ and $.30$, respectively, $p < .001$) and with signs of fear ($r = .34$, $p \leq .001$). Using multivariate regression analysis a predictive model of fear of dental work/procedures was developed ($R^2 = .315$, $p \leq .001$). The three most influential predictors of increased fear of dental work were belief that the dentist will not stop if the patient requests (standardized beta (B) = .422, $p \leq .001$); perceiving one's teeth as poor (B = .276, $p \leq .01$); and being non-Hispanic (B = -.236, $p \leq .05$).

Discussion: This study indicates a high rate of dental service utilization within a sample largely composed of established HU patients. The likelihood of these clients having received dental care within the past six months was high. It seems clients are supported in this effort by the holistic approach employed by HU in delivering comprehensive health care. The high percentage of HU clients who visit the dental clinic without pain, and the frequency with which they visit the clinic, further supports this claim. For these clients, the belief that "the dentist will not stop" during dental procedures, is the most influential predictor of fear of dental procedures. It appears that the experience of fearing having dental work done is strongly related to patients' feelings of control or loss of control during dental treatment. In addition their sense of the condition of their teeth is also strongly predictive of level of fear of dental procedures. Apparently the experience of having "poor teeth" fosters more fear of having dental work done.

Conclusion: This study provides more understanding about the dental beliefs of dental patients at HU, and how these beliefs shape their dental fears. It focuses attention on the importance of the dentist-patient relationship in addressing dental fear. Based on study results, it can be helpful in understanding dental fear to consider the relationship between patient and dentist, where both participants are considered important. Understanding dental fear in relation to the role of the dentist can help frame future efforts to prevent and to treat dental fear among HU dental patients.

This research was supported in part by HRSA grant H65HA00014 (BE), and by a College of Dental Medicine Research Assistantship (USM).

Tracking trends in dental students' attitudes towards providing care to underserved populations

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Introduction: According to the landmark U.S. surgeon general's report in 2000, oral health care disparities stem from the poor access to dental care by historically disadvantaged and underserved populations. More than 31 million Americans now have no dentist in their immediate area. Dental care is out of reach for so many Americans, yet there are too few practicing dentists committed to improving this public health concern. Approximately 4,700 students graduate from dental school each year in the U.S., the majority of whom go on to practice in upper middle-class suburban neighborhoods. The foundations of a student's understanding of dentistry and their place in the field are laid during predoctoral training. While dental institutions are successful in preparing students to perform clinical procedures competently, dental schools do not adequately encourage students to explore public health dentistry as a career path. This is demonstrated by the lack of graduating dental student interest in pursuing the certified dental public health specialty or incorporating public health dentistry into practice plans.

Objective: To determine trends in dental students' attitudes towards providing care to underserved populations.

Materials and Methods: An 11-item questionnaire was distributed to students in all four years of study at the College of Dental Medicine. Responses were obtained from 75 1st year, 50 2nd year, 50 3rd year, and 51 4th year students. The questionnaire contained 3 open-ended questions and 7 questions using a five-point Likert scale. For qualitative questions, open-ended responses were combined across the four years and categorized. Participants were asked to reflect on their interest, possible barriers, and self-perceived prepared for providing care to the underserved.

Results and Conclusions: For all four years, the mean value for students' interest in providing care to the underserved increased by an average of 0.25 as a current dental student compared to their interest before entering dental school. While the mean interest expressed by 4th year students (4.07) is comparable to that of 1st (4.16) and 2nd year students (4.14), interest expressed by current 3rd year students (3.68) is the lowest. For all years, the average frequency with which students plan on providing care to the underserved is a monthly basis. Students further along in dental school reported feeling more knowledgeable on ways to provide care to the underserved and more aware of opportunities for pursuing public health dentistry. For qualitative questions asking students to indicate barriers that may deter interest or ability to provide care to underserved populations, 25% of respondents expressed financial concerns, 24% stated loans specifically, 16% stated location, and 10% stated lack of time. In response to an open-ended question asking students to identify factors most influential in affecting interest in providing care to the underserved, 24% of respondents indicated exposure to the community and patients, 20% identified personal values, 16% indicated awareness of need, and 30% indicated various volunteer experiences such as global and community outreach events.

Discussion: In comparing responses to questions on interests, barriers, and preparedness in regards to providing care to underserved populations, certain trends and patterns were identified. While students' sense of preparedness increased over the four years, their interest level did not show much change. Furthermore, common barriers towards caring for the underserved and factors that influence students' interest levels were identified. The results of this study will help dental school faculty understand the current student perspective, a first step in determining how to encourage more students to provide care to the underserved and close the access to care gap.

Enrolling as a Dental Medicaid Provider: A 50 State Comparison

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Introduction: As a consequence of the recession and demographic trends, enrollment in Medicaid increased by 5.4% in fiscal year (FY) 2009 and is projected to increase by 6.6% in FY 2010. Lack of dentists' participation in Medicaid has been cited by federal authorities as the primary reason for lack of access to dental care in Medicaid as 23% of dentists provide 80% of services. The American Dental Association's 2008 Medicaid Provider Symposium challenges to providing care to Medicaid recipients. Participants identified inefficient administration of state Medicaid dental programs, including the administrative burden of enrolling as a provider, as one of the primary challenges faced.

Objective: The purpose of this study is to determine the ease or difficulty with which dentists can become Medicaid providers in each state. The objectives are to determine whether provider enrollment is objectively a barrier in some states and to identify best practices for provider enrollment that simplify and streamline the process.

Materials and Methods: Ten students from the Columbia University College of Dental Medicine served as proxies for dentists wishing to enroll as Medicaid providers. Each attempt to enroll in five states. Students kept journals on their efforts and met as a group to discuss their experiences. A standard data collection form was developed from students' initial attempts to enroll. Students documented their enrollment efforts according to the parameters outlined on the form. Descriptive statistical analysis was performed on the results.

Results and Conclusions: The Medicaid dentist enrollment process in most states appears to be facile and does not appear to constitute a barrier to dentists' engagement in Medicaid for those who wish to enroll as providers. All states had enrollment information available online and 20 states allowed direct online enrollment. Most frequently, online form completion required 10 minutes and paper 30 minutes (Paper: min 8 minutes, max 180 minutes, mean 42.4 minutes; online: min 5 minutes, max 90 minutes, mean 23.8 minutes). Most students rated ease of accessing enrollment information as relatively easy, ranking the accessibility an average of 2 on the 5 point scale (min 1, max 5, mean 2.5). Completing the application and the overall experience of enrollment was listed as a 3 on a 5 point scale, indicating little strong feeling towards the process (Ease of completion: min 1, max 4, mean 3.4; overall experience: min 1, max 5, mean 3.7). For 80% of states, based on the application process alone, students indicated willingness to enroll as a Medicaid provider.

Discussion: Removing real or perceived barriers to the Medicaid dentist enrollment process may encourage greater provider participation and potentially greater care. The data on providers' perceived ease of the Medicaid enrollment process can be analyzed against state provider data to examine the validity of the claim that administrative barriers discourage participation in Medicaid. A subset of states can still streamline their Medicaid enrollment process further to encourage provider participation.

A Study Using Anterior Root Canal Treated Teeth, Restored With A Minimally Invasive Porcelain Veneer and A Modified Porcelain Post

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Introduction: The use of metal posts, prefabricated or cast type, in endodontically treated anterior teeth can result in micro-fractures. These can result in the future loss of the tooth. An alternative approach is to restore the endodontically treated anterior tooth with a conservative veneer preparation supported lingually by an inlay and modified post preparation. These preparations can utilize the strength of a Zirconia type porcelain and prevent coronal and root fractures. Zirconia exhibits a physical property called transformation toughening (strengthening). Cercon Zirconia has a distinctive combination of excellent physical, mechanical, and chemical properties that make it an ideal biomaterial.

Objective: The purpose of this study was to construct a restorative model for an endodontically treated anterior tooth with a post space barrier. A minimal, facial veneer preparation of 0.5 mm or less, with a slight lingual wrap was prepared on all teeth. Support was enhanced by the porcelain inlay and modified post on the lingual surface. All restorations were fabricated using the Cerec 3D Software, which is Windows-based and three-dimensional. Unlike other restorative methods, it provides maximum control and vision, allowing views of the preparation from all angles.

Materials and Methods: --10--operators used 20 clear plastic incisors, and 10 extracted human maxillary incisors. Each operator prepared 3 conservative facial veneer preparations, and an access inlay and modified post on the lingual. Three teeth were restored with Cerec porcelain facial veneers and access inlays with modified posts. These served as representative models for all teeth prepared in the study. Twenty teeth were prepared with Duralay, as pattern guides for the inlay access and modified post preparation. All teeth were instrumented and filled with gutta percha. A modified post space preparation of 3 mm was made on all teeth. An additional 2mm of gutta percha was removed to accommodate the post barrier. Portland Cement an equivalent to MTA Cement was injected into the root canals for 2mm as a barrier material.-Three Veneers and Three modified posts were fabricated using the Cerec 3 D Software. The veneers and posts were cemented using Ivoclar, Variolink cement.

Results: Cerec lab cameras reproduced esthetic facial veneers. inlay access and .modified porcelain posts directly from the tooth We can assume that these preparations, made of strong porcelain material, will reduce the fracture incidence which is so often encountered with metal posts.

Conclusion: The prognosis of an endodontically treated tooth is largely dependent on the placement of a permanent coronal restoration. The literature states that none of the post systems tested were capable of consistently achieving a fluid-tight seal. It has been demonstrated from previous studies that the placement of a post barrier, such as MTA into the root canal, will inhibit the ingress of oral microorganisms if the coronal restoration is compromised. The gutta percha directly below the post is not capable of preventing the microleakage from reaching the apex.

An Alternative Approach To Treating Anterior Root Canal Teeth Using A Porcelain Veneer and Access Inlay With A Modified Post

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Introduction: Intact endodontically treated anterior teeth do not need complete crown coverage unless they are weakened by large and/or multiple coronal restorations. Using a Zirconia like porcelain veneer restoration with a minimally invasive preparation, followed with an access inlay and modified post, is another alternative to the natural tooth with a composite access seal, or a metallic post core and crown. It has been stated that the Zirconia like porcelain veneer will support the clinical crown of an anterior endodontically treated tooth from fracturing.. Further support from the lingual surface, using the same material would give additional backing to the clinical crown.

Objective: The purpose of this study was to construct an alternative model restoration for an anterior endodontically treated tooth. By constructing a minimal veneer preparation of 0.5 mm or less, with a slight lingual wrap, we would reduce the amount of tooth structure and restore it with a strong porcelain veneer. It would be buttressed by a lingual inlay/modified post restoration to prevent the shearing of the clinical crown at the cervical. A 2mm post barrier of Super EBA was to be placed into the root canal space proximal to the terminus of the modified porcelain post to prevent the egress of microleakage into the root canal

Materials and Method A total of twenty four (24) root canal treated anterior teeth were instrumented, filled with gutta percha and sealer, and prepared minimally for veneers. Sixteen (16) teeth were plastic typodont and eight (8) extracted human anterior teeth, Brassier depth cut burs were used to remain in enamel and reduce only enough tooth structure so that approximately 0.3-0.5 mm of labial enamel and 0.5-mm of incisal enamel was removed. Twenty four (24) teeth were prepared for an inlay access with a modified post preparation of approximately 3mm. A Duralay pattern was constructed of the inlay and modified post. Three (3) Zirconia like restorations were fabricated from the tooth directly, using a CEREC 3D Software which is Windows[®]-based and three-dimensional. Unlike other restorative methods, it provides maximum control and vision, allowing views of the preparation from all angles Six- porcelain veneer crowns were constructed from the Cerec 3D Software. The porcelain veneer crowns were cemented using Ivoclar, Variolink cement. Three millimeters of gutta percha were removed for the post space preparation and an additional 2mm for the Super EBA post barrier material.

Results and Conclusions: Although stress tests were not conducted in this study, a review of the literature would support the use of Zirconia like porcelain veneers to be a useful alternative in restoring endodontically treated teeth. Zirconia's superior strength as a restorative material lends itself to be used without removing excess tooth structure. The replacement of cast and prefabricated metal posts which lead to micro fractures and failures with Zirconia -like porcelain is a plausible alternative.

Post-Doctoral Student Abstracts

Radiographic Periodontal Status and Chronic Kidney Disease

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Introduction and Aims: Chronic kidney disease, a pathological condition characterized by progressive loss of kidney function, is a worldwide public health problem. Earlier studies have suggested an association between periodontal disease and renal insufficiency. In this study we assessed the prevalence, extent and severity of periodontal bone loss among a sample of patients with stage 3, 4 or 5 chronic kidney disease, as well as in patients on dialysis, to explore a dose-response relationship between severity markers of both diseases.

Materials and Methods: All patients attending the Columbia University Dialysis Center and the Chronic Kidney Disease Clinic were invited to participate and a total of 129 patients, 62 from the Dialysis Center and 67 from the Chronic Kidney Disease Clinic were enrolled (mean age 63.5 years; SD=13.7). Sixty percent of the enrollees were male and 73% were Hispanic. Panoramic radiographs were obtained, the severity of bone loss was measured at the mesial and distal surfaces of each tooth, and a ratio of supporting bone/root length of 0.7 was used as a threshold to differentiate between intact and affected sites. Bone loss affecting > 30% of the tooth sites signified generalized periodontitis. Demographic variables, body mass index, glomerular filtration rate, smoking status and diabetic status were recorded for all subjects, as well as type and duration of dialysis when applicable. Blood samples were used to determine a total of 18 variables (hemoglobin, calcium, phosphorus, parathormone, albumin, triglycerides, cholesterol, high density lipoprotein, low density lipoprotein, very low density lipoprotein, blood urea nitrogen, glycosylated hemoglobin A1c, glucose, white blood cell count, platelet count, vitamin D, C-reactive protein and erythrocyte sedimentation rate) were analyzed for all patients, and three additional parameters (dialyzer urea clearance x time/volume, normalized protein catabolic rate and urea reduction ratio) were assessed in patients on dialysis.

Results: Twenty nine patients (22.5%) were edentulous. In dentate patients with generalized bone loss (N=38), parathormone was significantly elevated (p=0.02), while cholesterol (p=0.04), VLDL (p=0.04) and CHOL/HDL (p=0.02) were significantly lower when compared to patients with localized bone loss (N=52). When severity of bone loss was used as a continuous independent variable, parathormone (p=0.05) and glucose levels (p=0.05) were significantly higher, and cholesterol (p=0.009) and LDL significantly lower (p=0.03) with increasing bone loss severity. In non-dialysis patients, (N=66), no significant differences were found when the extent of bone loss was used as the independent variable, but calcium was significantly lower (p=0.01), and WBC (p=0.03) was significantly higher with increasing severity of bone loss. Extent and severity were not significantly associated with glomerular filtration rate (p=0.30 and p=0.32, respectively). In dialysis patients (N=63), extent of bone loss was significantly associated with lower BUN (p=0.02), triglycerides (p=0.01), cholesterol (p=0.02), VLDL (p=0.01), CHOL/HDL (p=0.04) and higher glucose levels (p=0.01). Phosphorus (p=0.04), triglycerides (p=0.02), cholesterol (p=0.003) and VLDL (p=0.02) were significantly lower, and glucose (p=0.002) was significantly elevated with increasing severity of bone loss.

Conclusions and Discussion: The findings indicate a complex association between periodontitis and chronic kidney disease. The seemingly counterintuitive finding of an inverse association between lipid levels and bone loss is in accordance with earlier "reverse epidemiology" observations in dialysis patients, and may suggest that periodontitis correlates positively with markers that signify increased morbidity and/or mortality in patients with renal insufficiency.

Supported by a grant from Johnson & Johnson, USA (PNP).

Cone-Beam Computer Tomography and Dental Implants: Is what you see, what you get? An ex-vivo study on the ability to assess the integrity of the buccal cortical plate around dental implants.

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Introduction: Cone-Beam Computed Tomography (CBCT) has become an important diagnostic and treatment planning tool in implant dentistry. However, the presence of metallic structures such as dental implants can distort the radiographic image and lead to misinterpretations of the radiographs. The ability to detect a buccal cortical plate after implant placement is important in evaluating the prognosis of implant success and the need for additional procedures.

Objectives: The aim of this study is to determine the ability of practitioners to detect the presence of a buccal plate around a dental implant using a CBCT (i-CAT® Classic, Imaging Sciences international).

Materials and Methods: Four mandibles from human cadavers were used in this *ex vivo* study. Twenty four titanium bone level dental implants were placed following the manufacturer's surgical protocol. A synthetic material was placed after implant placement over the jaws to simulate the soft tissue. The implants were randomly assigned to a position and a jaw. They were placed as follows: 1) Eight implants with at least 1 mm width of buccal plate (Thick Bone), 2) Eight implants with no buccal bone (No Bone), 3) Eight implants with less than 1 mm in thickness buccal plate or partially present buccal plate (Thin Bone).

The mandibles were scanned with the HR (0.2 mm voxel size) protocol of the i-CAT acquisition software. The reconstructed images included consecutive cuts 0.2 mm in thickness, perpendicular to the buccal aspect of the mandibular bone.

Ten post-doctoral graduate students in the periodontics post-graduate program reviewed the CBCT images under standardized viewing conditions and assessed the existence of a buccal/labial cortical plate around the dental implants with a "Yes" or "No" answer. The examiners viewed the images interactively.

The analysis included the ability of the students to detect the presence of buccal plate correctly in three aspects of the implant (coronal third, middle third, and apical third).

Results: The students were able to correctly determine the absence or presence of buccal bone in the area of the implant 75.5% of the time. The ability to detect the presence or absence of bone varied by the portion of the implant being examined. The examiners correctly determined the presence /absence of bone $85.0 \pm 2.6\%$ (mean \pm standard error) of the time in the apical aspect, $75.4 \pm 1.2\%$ of the time in the middle aspect, and $69.2 \pm 3.4\%$ of the time in the coronal aspect. This data suggests that the ability to detect the presence of buccal bone on Cone beam scans is variable and is inaccurate in the coronal third of the implant with greater than 30% of the observations being incorrect.

Conclusion: Despite the advent of newer technologies to detect the presence of buccal bone in the area of implant placement, the ability to detect bone is dependent on the practitioners with correct assessment of the presence of buccal bone occurring approximately three-quarters of the time. The ability to detect the buccal cortical plate on the coronal aspect of the implant is considered low.

Effectiveness of an Interactive Oral Health Promotion Video in a Pediatric Dental Clinic Waiting Room

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Background: The patient waiting room can be an effective venue for health promotion. However, little research has been done showing the effectiveness of audiovisual materials in communicating pediatric oral health. We hypothesize that a video designed specifically for this research project focusing on pediatric oral home care and preparing for the first dental visit which is both interactive, age appropriate, bilingual, and appealing to watch, will engage and communicate to parents more effectively.

Objective: To determine the effectiveness of a bilingual interactive oral health promotion video (IOHPV) in increasing pediatric oral health knowledge and attitudes in a parents of a child population who present at the Columbia University Medical Center Pediatric Dental Residency Clinic for comprehensive dental care.

Materials/Methods: A control (Disney video) was shown in the waiting room for the initial 2 months of the study. The IOHPV was then shown for the following 2 months. During this 4 month period, all parents of children seeing a single pediatric dental resident were invited to complete a questionnaire which included demographic information and questions on parental knowledge and attitudes regarding oral health. Independent t-tests were then performed using a statistical software package (SPSS).

Results: Ninety-eight controls and 98 test subjects participated in the study (N=196). Control group scored an average of 60.1% in knowledge questions. The IOHPV group scored an average of 69% in knowledge questions. Interactive OHPV parents scored significant higher ($P<.05$) in knowledge questions overall. Both control and IOHPV groups scored high on attitude questions. No significant difference was found between IOHPV and control in their attitudes regarding pediatric oral health.

Conclusions/Discussion: In a convenient sample of parents attending a pediatric dental residency clinic, use of an interactive OHPV, a sequence of short bilingual instructive and interactive segments, was effective in increasing dental knowledge. Use of an interactive OHPV in a non-dental setting may be effective in improving parental dental knowledge and attitudes.

A Survey of New York Pediatric Dentists Regarding Child Abuse and Neglect

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Background: Previous studies have indicated that dentists generally do not report instances of child abuse and neglect as frequently as other professionals. Several different reasons for a lack of action among professionals, in general, have been suggested, including lack of knowledge in identifying such cases, uncertainty in reporting, and fear of the repercussions that can accompany taking such actions. To date there is little information about those social behavioral factors that potentially prevent dentists from reporting instances of child abuse and neglect. A study that explores these social behavioral factors will hopefully lead to ways to increase the reporting by dentists, and ultimately reduce the number of injuries, even death, experienced by children due to abuse and neglect.

Objective: The purpose of this study is to identify and describe social-behavioral factors that may influence pediatric dentists in New York State regarding their decisions to report child abuse/neglect.

Materials/Method: A cross-sectional online survey (using Survey Monkey) was conducted in which 273 pediatric dentists were asked to complete a closed ended structured questionnaire. This was sent to pediatric dentists via email addresses provided by the American Academy of Pediatric Dentistry (AAPD). The survey consisted of 31 questions that included items about their training in child abuse and neglect, past encounters with child abuse and neglect in the office, the nature of their practices, as well as the influence of other significant people in their lives in regard to their decision making processes. It was sent out three times at two-week intervals to prospective respondents.

Results: A net response rate of 34% (N=91) was obtained. Eighty six percent (of 78 responses) agreed strongly that they are willing to report an incident. When given a scenario, 84% (of 73 responses) would report the suspected abuse; and 43% (of 73 responses) would consider this an easy decision to make. Sixty three percent (of 72 responses) have suspected child abuse/neglect and 51% (of 72 responses) have made reports. Decision to report was positively associated with not viewing false incident reporting as a barrier ($r=.26$, $P<.05$). The latter was positively associated with confidence in ability to identify signs/symptoms of child abuse ($r=.30$, $P<.001$). Although 94% (of 72 responses) received training in child abuse/neglect, only 44% (of 80 responses) felt they had good knowledge of the signs/symptoms, while 41% (of 80 responses) felt somewhat confident that they could identify the signs/symptoms.

Conclusions/Discussion: Those who responded were largely positive in regards to reporting suspected child abuse/neglect and can be viewed as potential role models for colleagues finding it more difficult to do so. However, despite their positive attitude, even this group demonstrated that there are factors that hinder them from reporting. The most commonly mentioned barriers to reporting child abuse/neglect were the fear of giving a false report, fear of legal entanglements and the potential for negative reactions from parents. In addition, only 14% felt very confident in their ability to identify the signs and symptoms of abuse, with 21% reporting their knowledge as "excellent". This information can be of particular value, since it is expressed by a group seemingly predisposed to report instances of child abuse and neglect, yet indicating those areas where they have the most reservations. It can help identify the content areas where there is a particular need to make improvement, so that these lessons can be applied not only to this sub-group, but to all pediatric dentists.

Effectiveness of an Oral Health Program with Head Start and Early Head Start Children in Washington Heights, New York

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Background: The Columbia Head Start Oral Health Program (C-HSOHP) has partnered with Early Head Start/Head Start (EHS/HS) grantees in the Washington Heights neighborhood of New York City and provides a tailored oral health program which includes on-site dental screenings, staff training, parental educational sessions, and assisted referral to the local pediatric dental homes to address the major oral health crisis affecting infants, children, expectant women, and the families of this largely based Latino community.

Objective: The purpose of this retrospective chart review was to describe and compare the oral health status EHS/HS patients who engaged in the C-HSOHP with a similar pediatric population who attended the Columbia University Medical Center Pediatric Dental Residency Clinic (CU-Ped) from 2007-2009.

Materials/Methods: Demographic data of enrollees from a single EHS/HS grantee who participated in C-HSOHP was cross-referenced with 2007-09 clinical chart data. (N=91). Out of 261 EHS/HS enrollees, 91 were patients of record at CU-Ped. EHS/HS data included: date of birth, date of referral, age at time of referral, gender, ethnicity, program type, and number of siblings. A random selection of non-C-HSOHP clinical charts with similar demographics were also reviewed (N=101). Information from clinical charts included: Clinical findings on initial examination including need for pulpal therapy, restoration, extraction, or emergency treatment, time required to complete initial treatment plan, number of broken appointments, behavior score at initial examination (Frankl), and need for adjunctive therapies such as oral sedation, immobilization via papoose, nitrous oxide/oxygen (N₂O/O₂), or general anesthesia. T-test and Chi-square were performed using a statistical software package (SPSS).

Results: A total of 192 pediatric dental charts were reviewed. Of those, 91 (47%) participated in C-HSOHP. Mean initial examination age for C-HSOHP subjects was 1.3 years (SE=0.82) compared to 1.8 years (SE=0.16) for non-C-HSOHP subjects ($P<.05$). In terms of dental need, 10% of C-HSOHP subjects presented with decay on initial examination compared with 34% of non-C-HSOHP subjects ($P<.5$). Of these, 9.9% of C-HSOHP subjects required a dental restoration on initial examination compared to 28.7% of non-C-HSOHP subjects ($P<.01$). One percent of C-HSOHP subjects required an extraction compared to 14% of non-C-HSOHP subjects ($P=.01$). Mean behavior score on initial examination of C-HSOHP subjects was 1.28 compared to 1.77 of non-C-HSOHP subjects ($P<.01$). N₂O/O₂ was treatment planned for 4.4% of C-HSOHP subjects compared to 12.9% of non-C-HSOHP subjects ($P<.03$) and immobilization via papoose was treatment planned for 7.7% compared to 17.8%. ($P<.03$) Mean number of days to complete treatment plan was 15.3 days (SE=13.1) for C-HSOHP subjects and 88.7 days (SE=43.8) for non-C-HSOHP. Eighteen percent of C-HSOHP subjects returned within six months for a routine dental recall exam compared to 5% of non-C-HSOHP subjects ($P<.05$).

Conclusions/Discussion: Our study suggests that EHS/HS children who participate in C-HSOHP are more likely to establish a dental home at an earlier age, have higher behavior scores and have less decay. The C-HSOHP participants completed treatment plans quicker and were more likely to return for routine recall examinations. Engaging the EHS/HS community through oral health programs such as C-HSOHP may be helpful in ensuring earlier establishment of a dental home and lowering rates of dental caries in high risk underserved populations.

Assessment of Infant Oral Health Education on Resident Physician Knowledge

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Background: Dental caries remains the most common chronic disease of childhood. Primary care physicians see a large percentage of children during their infant and toddler years and can play a key role in prevention and control of severe early childhood caries because of their access to this population. Both American Academy of Pediatrics (AAP) and American Academy of Pediatric Dentistry (AAPD) recommend the first dental visit by age one. Nonetheless, data suggests that few children have received this preventive care as 50% of the primary care physicians report having no previous dental health education in medical school or residency. Our hypothesis is if an early childhood oral health education seminar is provided to resident physicians it would improve their oral health knowledge and promote early detection of dental problems such as severe early childhood caries and assist in reducing disease burden.

Objective: The aim of this study was to implement and evaluate the effect of an early childhood oral health education seminar given to pediatric medicine residents at the Columbia University Medical Center.

Materials/Methods: A sample size of 92 physician residents who presented for their block rotations participated in this study. A one hour seminar describing common dental findings including poor oral hygiene and severe early childhood caries was presented and identical 14 question pre and post tests were completed. The pre and post-test was administered to, and results analyzed for all participants. Statistical differences between pre and post-tests were calculated using a paired T-test ($P < .05$) and a statistical software package (SPSS).

Results: Average of 77% correct responses on pre test and 90% correct responses following instruction (N=92, $P < .05$). Mean improvement in score of two questions on post-test. There was a significant improvement in the knowledge base of physician residents on topics related to severe early childhood caries and its prevention and anticipatory guidance.

Conclusions/Discussion: Oral health knowledge of physician resident is particularly limited. This study demonstrated that an educational intervention can improve oral health knowledge of physician residents, specifically relating to severe early childhood caries, fluoride and oral hygiene practices. While improvements were evident with the limited education provided, it is apparent that supplementary training is essential to enhance physician oral health counseling. A better-quality analysis would have been to re-test at a later date to evaluate knowledge retention.

Influence of a Master's Degree in Public Health in Pediatric Dentists

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Background: Despite the many achievements of dental public health professionals in the prevention of oral diseases, epidemiologic studies demonstrate that a considerable amount of oral disease continues to affect Americans. While there is a critical need for oral health leadership roles to address the prevalence of oral diseases in the nation's most vulnerable population, the number of dental public health professionals has decreased dramatically. The rationale for this study is that U.S. trained pediatric dentists who have completed a graduate degree in public health, such as Master of Public Health (MPH), may be more likely to have or have had a position in academe, research, or dental public health. The significance is its potential to address the current need of pediatric dentists in public health and to eventually achieve the optimal level of oral health for the population as a whole.

Objective: This investigation explores the utility of MPH in U.S. trained pediatric dentists' pursuit of alternative careers in academe, research, or dental public health.

Materials/Methods: The primary data collection approach for this study was via a survey instrument to be distributed electronically to 3717 pediatric dentists who were registered members of the American Academy of Pediatric Dentistry (AAPD). Data pertaining to demographics, current/past involvement in alternative careers, and experience with MPH was recorded. The obtained data from the survey was de-identified and analyzed using a statistical software package (SPSS). In addition, in-depth structured telephone interviews on a convenience sample of pediatric dentists who have successfully completed their MPH (N=10) were set up to guide in parallel with the electronic questionnaire as a mechanism to augment questions that could not or could only partially be addressed in the questionnaire. The telephone interviews were transcribed and themes were identified from among responses.

Results: Of 3717 surveys, 1667 (45%) were returned. Seventy-five (5%) claimed to have a MPH and of that 29 (39%) received prior to residency, 28 (37%) concurrently, and 18 (24%) after residency. Within the group with MPH, there was no significant difference ($P>.05$) in their satisfaction with the utility and integration of MPH with their career. When comparing pediatric dentists with MPH to those without the degree, a significant difference was found in their involvement in paid/volunteer positions of research and oral health policy and paid positions of teaching. There was no significant difference in paid/volunteer positions providing service for low income/poor and special needs populations and volunteer positions of teaching. Themes from structured telephone interviews revealed that those with MPH had pre-existing interests in public health and were satisfied with the utility of the degree.

Conclusions/Discussion: This investigation demonstrated that pediatric dentists with MPH are more likely to be involved in research, oral health policy, and paid positions of teaching. No significant difference was found between the completion of MPH in relation to their pediatric dental residency and its influence or satisfaction with the utility and its integration with their careers. While pediatric dentists with MPH were satisfied with the utility of the degree, a primary motivation for pursuing the degree appears to be their pre-existing interests in public health.

The Students and Faculty

of the

College of Dental Medicine

at Columbia University

wish to acknowledge the generous support

of our student research programs by

New York Academy of Dentistry

We also wish to acknowledge the support of the

Student Clinician Award Program by:

Dentsply International