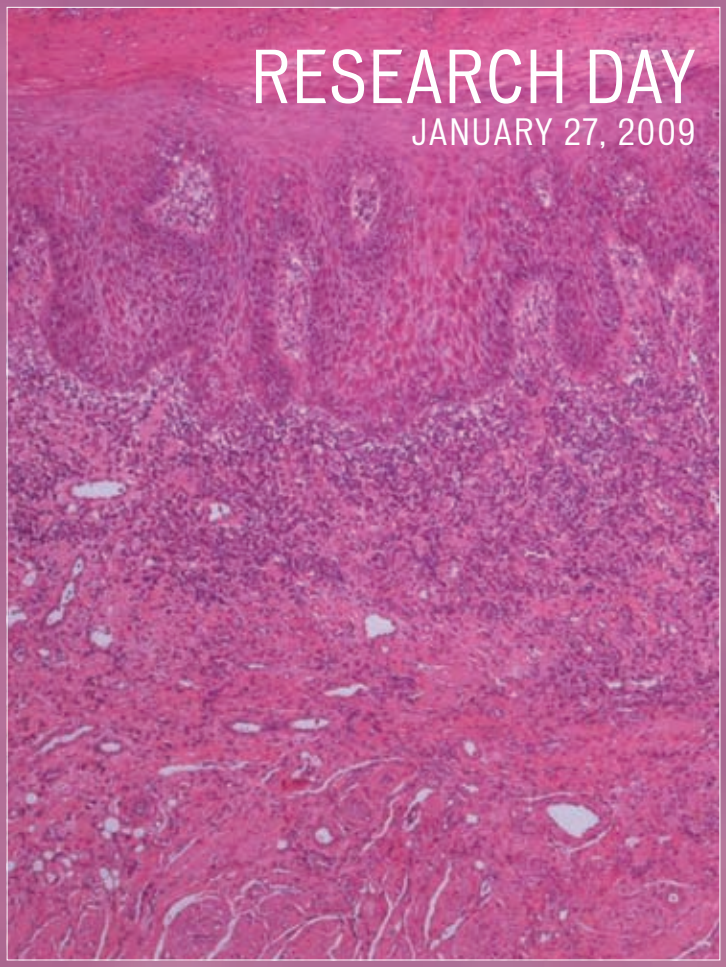
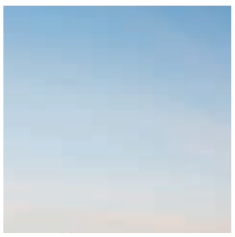
UBC DENTISTRY | THE UNIVERSITY OF BRITISH COLUMBIA

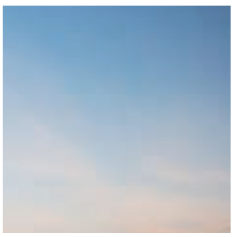
RESEARCH DAY

JANUARY 27, 2009



ORAL CANCER: EARLY DETECTION SAVES LIVES





To advance oral health through outstanding education, research, and community service.

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MESSAGE FROM THE DEAN

Welcome to the Second Annual Research Day for The University of British Columbia Faculty of Dentistry.

It should be an interesting day, featuring the research accomplishments of various research teams in the Faculty as well as a distinguished alumnus. We have once again organized this program to highlight the linkages between basic biomedical research and improvements in oral health care. The focus this year will be on the basic research of premalignant lesions and oral cancer and the progression of these findings into clinical applications that benefit our patients.

The cover of this program booklet depicts two conflicting aspects related to the clinical problem of oral cancer. The histological image is clear and precise and, as a representation of a specific biopsy sample, can be examined and diagnosed with high clarity. However, this histological clarity obscures an underlying molecular etiology for the lesion that lacks considerable focus and precision. Future advances will require similar levels of resolution for both the histology and molecular etiology. Basic research being conducted at UBC is helping to focus our understanding of these mechanisms and lead to improved approaches to patient diagnosis and management.

Oral cancer remains a troubling pathological process. While early diagnosis and treatment can prevent disastrous consequences, the fact remains that little progress has been made in the past 40 years with respect to either oral cancer incidence or therapeutic outcomes. In the program today, Drs. Lewei Zhang and Ulrich auf dem Keller will discuss recent results on fundamental processes occurring in cells as they transition from premalignant to malignant. Drs. Catherine Poh, Michele Williams and Eli Whitney will present several ways that basic research has been used to develop new approaches to evaluate the oral mucosa in patients and detect potentially dangerous changes at the earliest times. Ms. Brenda Currie will provide evidence of the links between medical and social status and the risks for oral cancer and the consequences of delay in diagnosis that can occur in these groups. It is a pleasure that a distinguished alumnus, Dr. David Wong, will present the keynote address and look at the future approaches to oral diagnosis that may allow oral lesions to be diagnosed prior to the onset of a dire prognosis. His research on the diagnostic uses of saliva is truly groundbreaking and should be an exciting conclusion to the program.

I hope you enjoy the day and recognize the contributions that the UBC Faculty of Dentistry is making to reduce the impact of oral cancer.

Charles F. Shuler, DMD, PhD
Professor and Dean, UBC Faculty of Dentistry

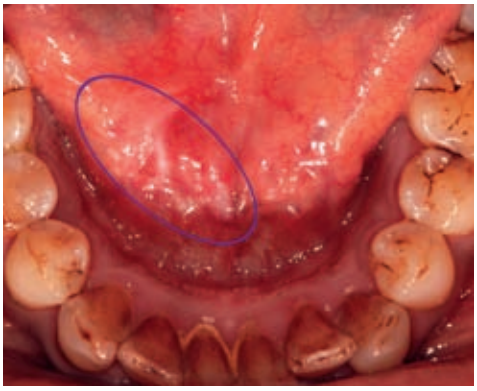
THE CASE OF MR. PETERS

Mr. Peters, a 55-year-old smoker, comes to your office for his annual check-up. The dental hygienist notices some colour changes in the anterior floor of his mouth. You see an ill-defined change that had not been noted at his last visit one year ago (Figure A). Mr. Peters denies any discomfort in the area. The same area was examined using fluorescence visualization (Figure B) and subsequently stained with vital Toluidine Blue (Figure C). When biopsied, the site with Toluidine Blue uptake was diagnosed as carcinoma *in situ*. He was subsequently referred to the Dysplasia Clinic at the BC Cancer Agency for management. [Case courtesy of Dr. Catherine Poh]

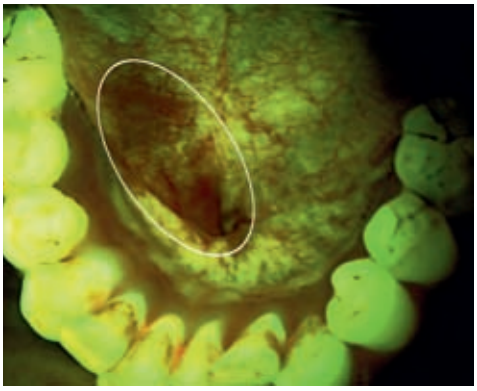
Case Learning Objectives:

At the end of the day, participants are expected to be able to:

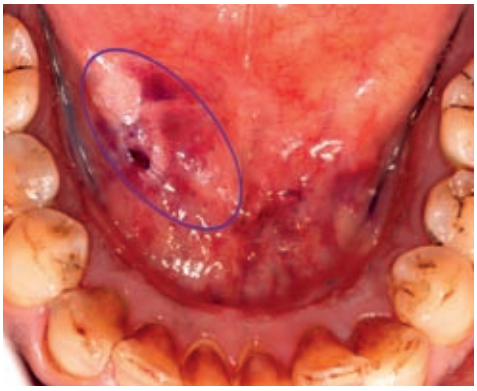
- Describe the areas of the oral cavity and which clinical presentations are most likely associated with oral premalignant or malignant changes.
- Explain the histological changes associated with progression from dysplasia to squamous cell carcinoma (SCC).
- Explain how chairside adjunctive diagnostic aids can help assess oral lesions.
- Describe the pathology of tumour invasion and metastasis.
- Describe the intracellular changes associated with tumour progression.
- Illustrate how the intracellular changes associated with tumour progression may predict oral tumour behaviour.
- Describe the histological tools that are being developed to help predict oral tumour behaviour (progression or recurrence) of oral lesions.
- Describe the role of social determinants of health as they relate to the risk of developing oral cancer.
- Discuss the components of an in-office oral cancer screening program and guidelines.
- Describe how the salivary transcriptome and proteome may be used as an oral cancer diagnostic aid.



A. An ill-defined white lesion on the right anterior floor of the mouth (oval).



B. The same lesion, viewed with a fluorescence visualization device, showing well-demarcated, dark non-fluorescent areas (oval).



C. The same lesion with vital Toluidine Blue stain applied (oval).

UBC Dentistry Research Day 2009
ORAL CANCER: EARLY DETECTION SAVES LIVES

Tuesday, January 27, 2009 · 8:00 am - 4:15 pm
UBC Student Union Building Ballroom

8:00 - 8:30	**REGISTRATION & CONTINENTAL BREAKFAST**
8:30 - 8:45	**WELCOME FROM DR. CHARLES SHULER, PROFESSOR AND DEAN**
8:45 - 9:00	**INTRODUCTION OF THE CLINICAL CASE** Dr. Edward Putnins, Professor and Associate Dean of Research & Graduate/Post-Graduate Studies Upon routine clinical exam, Dr. Riley identifies a suspicious lesion on the lateral border of the tongue that the patient was unaware of.
9:00 - 9:30	**EVIDENCE-BASED REVIEW OF BENIGN, PRE-MALIGNANT AND MALIGNANT LESIONS OF THE ORAL CAVITY** Dr. Eli Whitney, Assistant Professor and Director, Oral Medicine & Oral Pathology Residency Program "As a clinician, which areas of the mouth are associated with malignant transformation and what clinical presentation warrants follow-up?"
9:30 - 10:00	**ADVANCES IN CHAIRSIDE ASSESSMENT OF ORAL LESIONS (*E.G.,* TOLUIDINE BLUE AND FLUORESCENCE VISUALIZATION)** Dr. Catherine Poh, Assistant Professor and CHIR Clinician Scientist "What current adjunct visualization tools are available for chairside use to assess suspicious oral lesions?"
10:00 - 10:15	**COFFEE BREAK**
10:15 - 10:45	**PROTEASE ACTIVITY AT THE INVADING TUMOUR/STROMA INTERFACE** Dr. Ulrich auf dem Keller, Post-Doctoral Fellow (Overall Lab) "What biological mechanisms are activated during tumour cell invasion?"
10:45 - 11:15	**EARLY DETECTION OF ORAL CANCER: NEW TECHNOLOGIES FOR QUANTITATIVE PATHOLOGY/CYTOLOGY** Dr. Lewei Zhang, Professor and Chair, Division of Oral Medicine, Oral Diagnosis & Oral Pathology "What histological tools are being developed to help predict oral tumour behaviour (progression or recurrence)?"
11:15 - 11:45	**STRATEGIES TO REACH MEDICALLY-UNDERSERVED HIGH-RISK INDIVIDUALS** Ms. Brenda Currie, PhD Student (Poh Lab) "What social groups in our community are at high risk and what strategies can be implemented to help these patients?"
11:45 - 12:00	**RESEARCH POSTER AWARD PRESENTATION (UNDERGRADUATES, GRADUATES, POST-DOCTORAL FELLOWS)**
12:00 - 1:30	**LUNCH (BOX LUNCH PROVIDED) AND RESEARCH POSTER VIEWING** Posters by undergraduate students, graduate students, post-doctoral fellows, research associates and faculty members
1:30 - 2:15	**TRANSLATIONAL RESEARCH: THE CHALLENGE OF KNOWLEDGE TRANSFER FROM BENCH TO CHAIRSIDE** Dr. Michele Williams, Clinical Professor and Director, UBC Oral Mucosal Disease Program; Oral Medicine Leader, BC Cancer Agency "How do we transfer new knowledge about oral cancer to the dental community?"
2:15 - 2:30	**COFFEE BREAK**
2:30 - 4:00	**IDENTIFICATION OF SALIVARY DIAGNOSTIC MARKERS FOR EARLY ORAL CANCER RISK AND DETECTION (DISTINGUISHED ALUMNUS PRESENTATION)** Dr. David Wong, Professor and Associate Dean of Research, UCLA School of Dentistry "What does the future hold for early oral cancer screening and detection?"
4:00 - 4:15	**CASE WRAP-UP AND DISCUSSION**

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SUPPORTER PLANMECA OY

MESSAGE FROM THE ASSOCIATE DEAN OF RESEARCH

It is also my pleasure to extend a warm welcome to all attendees of our Second Annual UBC Dentistry Research Day.

Research Day 2009 begins with a clinical scenario that practicing dentists and dental hygienists are likely to experience at some point in their clinical practice. Personally, during routine dental visits in the first four years of my clinical practice as a general practitioner, I diagnosed two cases of cancer in the oral cavity. The lasting memory of each of these situations was that both patients were minimally aware of the presence of the cancer and neither was concerned about it. These events reinforced in me the understanding that all patients must be examined thoroughly and comprehensively during each visit. This anecdote also serves as a fitting introduction for Research Day 2009 – Oral Cancer: Early Detection Saves Lives.

We are delighted to include presentations by our graduate students, post-doctoral fellows, faculty, and alumni. Collectively, these presentations will cover all aspects of tumour diagnostics and pathobiology, as well as office and community cancer screening programs. We will end with a look to the future – the use of salivary screening for tumour detection.

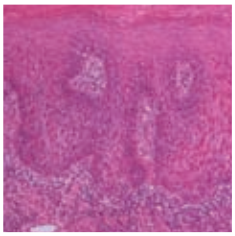
Please read through this program booklet to learn more about the presenters and the remarkable work that is being done by these clinicians and researchers. As well, lunch will be highlighted with a poster viewing session. Abstracts representing these posters have been included in this publication. This research represents a cross-section of the work being done by each of our research clusters: the Community & Educational Research Cluster, the iMatrix Research Cluster, and the Clinical Research, Technology Transfer & Dental Materials Sciences Research Cluster.

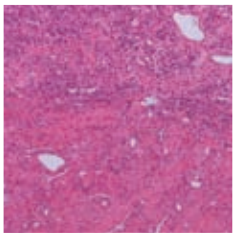
I trust that you will all leave at the end of the day with a better understanding of the diversity of research being done at the UBC Faculty of Dentistry and a focused understanding of the exciting work being accomplished by members of this Faculty and our alumni in the areas of oral cancer pathobiology, screening, chairside risk assessment and management, and what the future holds for early diagnosis of oral cancer.

In closing, I would like to express our appreciation to the outstanding speakers who have agreed to participate in Research Day 2009 and to thank the members of the Research Day Organizing Committee (Ingrid Ellis, Stephan Friedersdorf, Viki Koulouris, Alison Kovacs, Kathryn Myles, Catherine Poh, Sylvia Stephens, Andrea Wink, and Terry Wintonyk), who have contributed so much to make this event a success.

On behalf of the Research Day Organizing Committee, I hope you enjoy Research Day 2009.

Edward E. Putnins, DMD, PhD, DipPerio
Professor and Associate Dean of Research & Graduate/Post-Graduate Studies





PRESENTERS
BIOGRAPHIES AND SYNOPSES

- **ELI WHITNEY**
- **CATHERINE POH**
- **ULRICH AUF DEM KELLER**
- **LEWEI ZHANG**
- **BRENDA CURRIE**
- **MICHELE WILLIAMS**
- **DAVID T. WONG**

ELI WHITNEY, DDS, FRCD(C), CertOralMed, CertOralPath *Dr. Eli Whitney received his dental training from the University of Alberta and his specialty training at The University of British Columbia. He is an Assistant Professor and teaches undergraduate dental students and residents. Dr. Whitney is a staff dentist at Vancouver General Hospital and the Director of the Oral Medicine & Oral Pathology Residency Program at UBC. He is a Certified Specialist in Oral Medicine and Pathology and his research interest is in dental education.*

EVIDENCE-BASED REVIEW OF BENIGN, PRE-MALIGNANT AND MALIGNANT LESIONS OF THE ORAL CAVITY

In 2005, there were 432 new cases of oral cancer (buccal cavity and pharynx) diagnosed in British Columbia. The majority of these new cases were squamous cell carcinoma (SCC) and many were preceded by epithelial dysplasias. This presentation will review the literature to describe the incidence and prevalence of oral premalignant lesions and SCC worldwide and in BC. The importance of risk factors and location within the oral cavity will be emphasized. The association between the clinical presentation and the degree of dysplasia will be highlighted, along with the risk of progression from dysplasia to SCC.

CATHERINE POH, DDS, PhD, CertOralPath *Dr. Catherine Poh is an Assistant Professor at The University of British Columbia (UBC), a Canadian Institutes of Health Research Clinician Scientist and the Outreach Leader of the BC Oral Cancer Prevention Program. She is a dentist with specialty training in Oral Pathology and a doctoral degree in the area of molecular analysis of oral cancer. Dr. Poh is also an active staff member of the Oral Oncology Division at the BC Cancer Agency and the Oral Mucosal Disease Program, a joint venture between Vancouver Hospital and the UBC Faculty of Dentistry Specialty Clinic.*

ADVANCES IN CHAIRSIDE ASSESSMENT OF ORAL LESIONS (*E.G.*, TOLUIDINE BLUE AND FLUORESCENCE VISUALIZATION)

Oral premalignant lesions (OPLs) represent an extremely heterogeneous group of lesions which varies widely in its potential for malignant transformation, since only a fraction of these lesions will eventually progress into cancer. Histology, the current assessment for the presence and degree of dysplasia, remains the gold standard in risk assessment. Clinically, OPLs present mainly as white or red patches. It can be challenging for the clinician to differentiate abnormalities requiring biopsy from reactive lesions associated with other causes such as infection and inflammation. Thus, there is an urgent need to develop a new approach to enhance lesion visualization in order to facilitate decision-making for clinicians on when and where to do biopsies for risk assessment. Chairside application of Toluidine Blue staining and fluorescence visualization will be discussed.

ULRICH AUF DEM KELLER, PhD

Dr. Ulrich auf dem Keller received his Diploma in Biochemistry in 2000 from the University of Tubingen, Germany and his PhD in 2005 from the Swiss Federal Institute of Technology, Zurich, Switzerland. In 2006, he joined Dr. Christopher Overall's laboratory at The University of British Columbia as a Post-Doctoral Research Fellow and he is currently working on how proteases contribute to the development and metastasis of breast carcinogenesis. Dr. auf dem Keller is the recipient of a Research Fellowship from the German Research Foundation.

PROTEASE ACTIVITY AT THE INVADING TUMOUR/ STROMA INTERFACE

Proteases modulate angiogenesis, growth, invasion, metastasis, and phenotypic evolution of cancer cells by the irreversible processing of bioactive proteins and signalling molecules. To better understand the mechanisms of protease activity in cancer development and metastasis, we generated primary breast tumours in a syngeneic xenograft model in mice. Using the CLIP-CHIP™, a dedicated protease microarray, we identified matrix metalloproteinases (MMPs) to be highly expressed in primary tumours. We exploited this high and specific expression by a combination of nanomolar small organic molecule MMP inhibitors and novel, rapid radiotracer chemistry to generate high-resolution microPET images of breast carcinogenesis in live animals. Finally, we used Terminal Amine Isotope Labelling of Substrates (TAILS), a newly-established quantitative proteomic technique, to identify novel substrates of the identified MMPs.

LEWEI ZHANG, BDS, PhD, DipOralPath, FRCD(C) *Dr. Lewei Zhang obtained her dental degree from Sichuan Medical School, China, and her Diploma in Oral Pathology and PhD from the University of Toronto. Her research interest is on early diagnosis and prevention of high-risk oral lesions. Dr. Zhang's research collaboration with Dr. Miriam Rosin (BCCA, SFU) led to the formation of the BC Oral Cancer Prevention Program, the leading research team on the study of oral premalignant lesions (OPLs), with the largest longitudinal study on OPLs internationally.*

EARLY DETECTION OF ORAL CANCER: NEW TECHNOLOGIES FOR QUANTITATIVE PATHOLOGY/CYTOLOGY

Histopathology assessment of dysplasia is the current gold standard for cancer risk assessment. However, this standard is far from accurate because of a number of issues, including its subjectivity, the lack of knowledge of the weight of each or combination of the dysplasia criterion and the resemblance to reactive changes. Although molecular technologies have been found to help identify high-risk OPLs, they are currently expensive and time-consuming. Development of histological tools that help to triage lesions for molecular assessment should improve our ability in the cancer risk assessment of OPLs. In this presentation, the value of the nuclear phenotypic score (NPS) as measured by a computer-driven microscope imaging system developed by our research team to assess the cancer risk of OPLs will be discussed.

BRENDA CURRIE, DipDH, BDSc (DH), MSc, RDH *Ms. Brenda Currie is a PhD student at The University of British Columbia and the BC Cancer Agency and an online instructor in the UBC Dental Hygiene Degree Completion Program. She has a Master of Dental Science degree and 30 years of experience as a clinical and community dental hygienist. Ms. Currie is interested in developing novel approaches for oral cancer prevention, harm reduction and screening that will improve oral health and enable equitable access to care in high-risk and vulnerable populations.*

STRATEGIES TO REACH MEDICALLY-UNDERSERVED HIGH-RISK INDIVIDUALS

Oral cancer is a deadly disease. There has been little improvement in the five-year survival rate over the past several decades as a result of late-stage diagnosis (stage III or IV). Smoking is the most important risk factor, responsible for 75% of all oral cancers. The risk for oral cancer is further enhanced by the social, cultural, environmental, and economic disparities in high-risk communities. Oral cancer occurs in an accessible site with identifiable clinical manifestations and is easily detected upon oral examination. However, inequity in access to oral cancer screening is a major reason for the late diagnosis of oral cancer, especially in high-risk communities. There is an urgent need to develop effective and appropriate screening strategies to control this deadly disease.

MICHELE WILLIAMS, BSN, DMD, FCDS(BC), FRCD(C) *Dr. Michele Williams is a Clinical Professor and Certified Specialist in Oral Medicine. She is the Oral Medicine Leader of the BC Oral Cancer Prevention Program and the BC Cancer Agency Division of Oral Oncology. Dr. Williams is also the Director of the Oral Mucosal Disease Program at Vancouver Hospital. Her interests are in education, research and care related to oral mucosal disease, with a special focus on oral premalignant disease, oral cancer and oral manifestations of cancer therapies.*

TRANSLATIONAL RESEARCH: THE CHALLENGE OF KNOWLEDGE TRANSFER FROM BENCH TO CHAIRSIDE

When researchers generate new knowledge, successful information transfer into the community is critical. With this in mind, a team of scientists and clinicians recently partnered with organized dentistry to develop and distribute the first *Clinical Practice Guidelines for the Early Detection of Oral Cancer in British Columbia*. The guiding principles used in the development of this practical and clinically-relevant document, the approach to information transfer and the strategy for keeping it current will be discussed in this presentation.

DISTINGUISHED ALUMNUS PRESENTATION

DAVID T. WONG, DMD, DMSc

Dr. David Wong is a Professor and the Associate Dean of Research at the University of California, Los Angeles (UCLA) School of Dentistry. He is also the Director of the UCLA Dental Research Institute (DRI). Dr. Wong is an active and leading scientist in oral cancer and saliva diagnostics research. He has authored over 160 peer-reviewed scientific publications. His research has been funded by the National Institutes of Health (NIH) since 1986. Dr. Wong directs the UCLA Collaborative Oral Fluid Diagnostic Research Center and the UCLA comprehensive T32 Clinical Research Training Program, as well as the Laboratory of Head and Neck Oncology Research. He chaired the National Institute of Dental and Craniofacial Research (NIDCR) Special Grant Review Study Section from 2002-2005. Currently, he is a member of the NIH CSR Cancer Genetics Study Section and a fellow of the American Association for the Advancement of Sciences.

For the past five years, Dr. Wong's research has focused on defining the diagnostic coordinates of saliva (proteomics and genomics) as well as developing nanotechnology-based point-of-care technology for salivary diagnostics. Significant progress has been made based on these emerging technologies as well as the translational applications for human disease detection. Dr. Wong is the recipient of the 2007 Salivary Researcher Award.

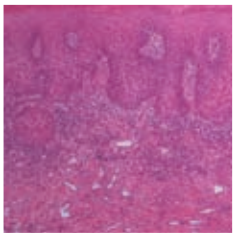
IDENTIFICATION OF SALIVARY DIAGNOSTIC MARKERS FOR EARLY ORAL CANCER RISK AND DETECTION

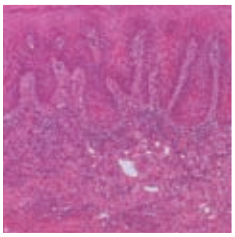
The use of saliva for clinical detection of major human diseases is only a few years away. Intense research is ongoing to discover diagnostic saliva biomarkers. A necessary prerequisite is to know, in a comprehensive manner, the informative biomarkers in saliva: the diagnostic alphabets. Like languages, which are synthesized from a foundation of alphabets, there are multiple diagnostic languages and thus diagnostic alphabets in saliva. The salivary proteome and the salivary transcriptome are two diagnostic alphabets that have matured and have been prepared for translational and clinical applications.

The human salivary proteome is a consortium effort by three NIDCR-supported research groups (Scripps/Rochester, UCSF and UCLA) which has led to the identification of over 1,100 proteins in saliva. The salivary transcriptome revealed ~3,000 mRNA species in saliva, of which 185 are common amongst all healthy subjects examined.

Using the salivary proteome and transcriptome as diagnostic alphabets to search for diagnostic signatures, we have found five salivary proteins and four salivary RNAs to be highly discriminatory for oral cancer (>90% clinical accuracy). We have also examined the saliva from patients with the autoimmune disease Sjögren's syndrome and have found a small subset of the salivary proteome and transcriptome to be highly discriminatory for this disease.

With the availability of the human salivary proteome (www.hspp.ucla.edu), the salivary transcriptome and the demonstrated value of saliva for oral cancer and Sjögren's syndrome detection, we can now fully extend the effort to translate the clinical utilities of saliva. The potential is enormous.





POSTER ABSTRACTS

Poster Competition Judges

- **DR. DIETER BRÖMME**
- **DR. MARIO BRONDANI**
- **DR. JEFFREY COIL**
- **DR. LARI HÄKKINEN**
- **DR. ALAN LOWE**
- **DR. MICHAEL MACENTEE**
- **DR. N. DORIN RUSE**
- **DR. RAVINDRA SHAH (CHAIR)**
- **DR. DAVID SWEET O.C.**
- **DR. J. DOUGLAS WATERFIELD**
- **DR. SUSAN WILSON**
- **DR. CHRISTOPHER WYATT**
- **DR. LEWEI ZHANG**

1 Ethnic Disparities in Oral and Oropharyngeal Cancer

Auluck A[1]*, Poh C[1], Zhang L[1], Hislop G[2], Rosin M[2], Bajdik C[2], Christina M[3]

[1] Department of Oral Biological & Medical Sciences, Faculty of Dentistry, The University of British Columbia, Vancouver, Canada; [2] Cancer Control Research, BC Cancer Agency, Vancouver, Canada; [3] Cancer Rehabilitation Network, BC Cancer Agency, Vancouver, Canada

OBJECTIVES: Habits and behaviours of different populations differ; therefore, the cancer incidence may also vary in different populations. The objectives of this study were to calculate and compare the following for South Asian (SA) and the general population: (1) age-adjusted incidence rate (AAIR) for oral and oropharyngeal squamous cell carcinomas (SCC); (2) AAIR of oral SCC in different oral sites; (3) differences in age and age-specific incidence rate; (4) gender predilection; and (5) stage at diagnosis.

MATERIALS AND METHODS: All head and neck SCC were retrieved from the BC Cancer Registry database from 1980-2006. Ethnicity was determined using surname lists and ICDO-3 codes were used for comparisons.

RESULTS: When different ethnic groups were compared, the SA population had a higher AAIR for oral SCC (males 5.74, females 4.41) than that of the general population (males 4.32, females 2.73), whereas the general population had a higher AAIR for oropharyngeal SCC (males 2.94, females -1.18) than that of the SA population (males 0.94, females 0.73). When the AAIR of oral subsites was compared, the SA population showed a higher AAIR for gum and cheek cancer (males 2.51, females 1.34) than the general population (males 0.92, females 0.74), whereas the general population showed a higher AAIR (males 1.15, females 0.56) for floor-of-mouth cancer than the SA population (males 0.12, females 0.29). The age-specific incidence rate of oropharyngeal cancer is lower than that of oral cancer in both ethnic groups. In both ethnic groups, oral cancer was diagnosed at an earlier stage and the oropharyngeal cancers were diagnosed at a later stage.

CONCLUSIONS: Trends of oral and oropharyngeal cancer are different in the South Asian and the general population because of differences in their habits and behaviours. The South Asian population of BC is at higher risk for developing oral cancer.

ACKNOWLEDGEMENTS: The authors would like to thank the British Columbia Oral Cancer Prevention Program team members for their support and help in this study.

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2 Experimental Periodontitis in Diabetic β6 Integrin Deficient Mice

Aurora S*, Häkkinen L, Larjava H

Department of Oral Biological & Medical Sciences, Faculty of Dentistry, The University of British Columbia, Vancouver, Canada

OBJECTIVES: Periodontal disease involves transformation of the junctional epithelium (JE) to pocket epithelium (PE). Integrin αvβ6 is constitutively expressed in healthy JE but not in PE, and mice deficient of this integrin (β6-/- mice) exhibit increased periodontal bone loss and PE migration. Thus, αvβ6 integrin may have a protective role in JE. As diabetes aggravates periodontal disease, we hypothesized that diabetic β6-/- mice would develop a faster progression of periodontal disease compared to mice expressing this integrin.

METHODS: Wild-type (WT), β6-/-, β6 integrin overexpressing (K14-β6; β6 integrin expression is driven by K14 promoter), and β6 integrin rescue (β6-rescue; cross-breed of β6-/- and K14-β6 mice) mice were induced to develop diabetes by injections of streptozotocin. Control animals were exposed to the citrate vehicle only. Tail blood samples were used to confirm the diabetic state (glycosylated hemoglobin levels >324 mg/dl). After four months in the diabetic state, mice were sacrificed, mandibles were defleshed and standardized images were obtained for quantitation of periodontal bone loss by image analysis.

RESULTS: During the four-month diabetic state, β6-/- (71%) and β6-rescue (67%) mice showed significantly higher death rates compared to WT and K14-β6 groups. Periodontal bone loss was most advanced in the β6-rescue mice, regardless of whether they were diabetic or not. Although bone loss in β6-/- mice did not differ from WT mice in the non-diabetic group, there was significantly more bone loss in the diabetic β6-/- mice compared to the diabetic WT mice ($p<0.05$).

CONCLUSIONS: Integrin αvβ6 protects diabetic animals from death and periodontal bone loss. Expression of β6 integrin driven by the K14 promoter did not rescue the β6-/- mice from death, suggesting that the protective role of β6 integrin in diabetes may be linked to kidney function, as kidney epithelium is naturally deficient of K14 expression.

ACKNOWLEDGEMENTS: This study was supported by a grant from the Canadian Institutes of Health Research.

3 Does Screening Reduce Time Delay to Diagnosis of High-Risk Oral Lesions?

Biggar H[1]*, Hislop TG[2], Bottorff J[3], Rosin MP[4], Poh CF[1]

[1] Faculty of Dentistry, The University of British Columbia, Vancouver, Canada; [2] BC Cancer Control Research, BC Cancer Agency, Vancouver, Canada; [3] The University of British Columbia Okanagan, Kelowna, Canada; [4] Simon Fraser University, Burnaby, Canada

OBJECTIVES: Oral cancer has a poor prognosis (50%-60% five-year survival rate) and is often diagnosed at a late stage, significantly impacting survival and quality of life. The objectives of this study were to: (1) collect information from patients with high-risk oral lesions (HRLs: dysplasia/carcinoma *in situ*/squamous cell carcinoma) regarding their experiences from first lesion identification to diagnostic workup; and (2) determine if screening reduces diagnostic delay as compared to self-detection.

METHODS: An interview-style questionnaire has been developed to collect both qualitative and quantitative data on patients' experiences. Forty patients with HRLs diagnosed within 12 months were interviewed.

RESULTS: Among 40 patients interviewed, 21 (53%) self-identified their lesions initially (SIG) and 19 (47%) were identified by health professional screening (PSG; 84% by dental professionals). SIG showed higher rates of T1-T2 compared to PSG (76% *vs*. 32%, P=0.01). SIG took twice as long to have the initial biopsy performed than PSG (23±52 vs. 11±28 months). Among those with a time lag of more than 12 months from initial lesion identification to the diagnosis of HRLs (N=11), 4 were PSG. The main reason for this delay was due to choosing to "wait and see" rather than have an immediate baseline biopsy performed by health professionals (HPs). Notably, the main symptom of patients in SIG was pain or presence of non-healing ulcers (18/21; 86%). However, two-thirds of patients had no related concerns and the majority (79%) were not aware of oral cancer. This further delayed their action to seek help from HPs. In contrast, all lesions in PSG were asymptomatic.

CONCLUSIONS: These results suggest that HPs, especially dental professionals, can play a critical role in the early identification of HRLs at an asymptomatic, pre-invasive stage through screening. This data indicates the importance of increasing oral cancer awareness in both patients and health professionals.

ACKNOWLEDGEMENTS: This study was supported by research grants from the Michael Smith Foundation for Health Research (MSFHR) and the Canadian Institutes of Health Research, and a MSFHR award to CFP.

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4 Oral Health Education in a Long-Term Care Facility

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BACKGROUND: The oral health care of residents in long-term care (LTC) facilities has historically been inadequate. Due to current demographic trends, this problem is becoming ever more evident.

OBJECTIVES: To educate and increase the knowledge about oral health care of the care aides and registered nurses in an LTC facility. We assumed that as a result of increasing the knowledge caregivers have, an increase in the oral health care of the residents would ensue.

METHODS: Pre-tests of caregivers' oral health knowledge were conducted before the intervention. The intervention consisted of a PowerPoint guided lecture with other visual aids and demonstrations. Post-test scores were compared to pre-test scores to assess changes in knowledge.

RESULTS: Both tests had a maximum score of 16. The mean pre-test score was 10.5±2.7 and the mean post-test score was 12.4±3.6, a statistically significant increase in test results post-intervention ($p<0.001$). Mean differences of individual scores of registered nurses compared to care aides were not significantly different.

CONCLUSIONS: A statistically significant increase in oral health knowledge of participants was observed. Further studies aimed at following the oral health care of LTC residents to document the actual effects that can be attributed to increased knowledge of health care providers would be beneficial.

5 Oral Sex and Oral Cancer: Does Pleasure Need Caution in HPV Infection?

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OBJECTIVES: The objectives of this study were to appraise the health beliefs and behaviours of men and women about the potential links between oral sex, human papillomavirus (HPV) infection and oral cancer development.

METHODS: One hundred and ten men and women in Vancouver, Canada anonymously answered a brief questionnaire. Questions included frequency of oral sex practices; number of oral sexual partners; perceived risks for HPV infection, other sexually-transmitted infections, and oral cancer in the context of oral sex; and whether or not respondents were asked about oral sex practices by physicians and dentists.

RESULTS: Most participants considered oral sex to be a moderate- to high-risk activity for sexually-transmitted infections such as chlamydia. For the transmission of HPV, 60% of the participants believed that oral sex is an activity of no or low risk, whereas 74% felt oral sex posed no risk in the development of oral cancer. Ninety participants (82%) were never asked about oral sex practices by a physician whereas the vast majority (94%) were never asked by a dentist.

CONCLUSIONS: The potential association between oral sex practices and HPV infection remains almost unknown to participants. There is a need to fully understand the reasons behind such beliefs and to increase rapport between physicians and dentists and their patients. Further studies should target a larger sample of the population and design effective awareness campaigns.

ACKNOWLEDGEMENTS: The author is grateful to all participants who anonymously filled out the questionnaires. Support for this research was provided by the Faculty of Dentistry at The University of British Columbia through the 2007-2008 Pilot Project Research Award Competition.

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6 The Perspective of the Filipino Immigrant Community on Childrearing and Dental Health

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BACKGROUND: Anecdotally, dental providers have reported increased caries experience among Filipino-Canadian children. In response, we conducted a community-based survey using both quantitative (phase 1) and qualitative (phase 2) methods to determine the need for, and content of, an oral health promotion program for the Filipino immigrant community. This report presents findings from the qualitative study.

OBJECTIVES: To explore the relationship between culture, childrearing practices and caries risk in the Filipino immigrant community.

METHODS: Qualitative research using iterative textual analysis of transcripts from audiotaped focus group discussions and interviews of mothers, fathers, grandparents, and nannies.

RESULTS: Analysis revealed a range of beliefs and practices pertaining to childrearing and children's dental health. Variation in participants' perspectives was based on Philippine town (rural/urban) of origin and years in Canada. Common themes which emerged: (1) teeth were strongly linked to concepts of beauty and cleanliness; (2) lack of knowledge and skill in dental care were barriers to good dental health; (3) dental caries was only recognized at an advanced stage (*e.g.,* "black stains," "holes"); (4) excessive sweet consumption and inadequate oral hygiene were primary causes of dental caries; (5) low awareness of bacterial transmission between caregiver and child; and (6) families rapidly but selectively adopted Canadian childrearing practices. Participants emphasized: (1) the need for culturally-appropriate dental health education materials (multimedia, bilingual, ethnic-specific images); and (2) participation of the community, through existing family and social networks and events, in designing oral healthy promotion activities.

CONCLUSIONS: Although Filipinos valued teeth in relation to aesthetics and grooming, dental health was sub-optimum because of lack of knowledge and skills in dental care. Some specific areas of misinformation contributing to caries susceptibility of Filipino-Canadian children were revealed. The Filipino immigrant community was eager to participate in the development of culturally-appropriate dental health education materials and activities.

ACKNOWLEDGEMENTS: This study was supported by The University of British Columbia Faculty of Dentistry S. Wah Leung Endowment Fund and the Canadian Institutes of Health Research Randomized Controlled Trials grant #FRN 67817.

7 Morphological Comparison of Midfacial Epithelial Development in Kyoto and Carnegie Human Embryos

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OBJECTIVES: Isolated cleft lip is one of the most common human craniofacial congenital malformations. Cleft lip results from failure of the medial nasal prominences to unite with the lateral nasal and maxillary prominences between stages 16 and 18. It is known that oralfacial clefts occur much more frequently in Asian newborns compared to Caucasian newborns. This study examined the histological and morphological differences between Caucasian and Asian embryos in the developing human face epithelium between stages 16 and 18, when the upper lip and nose form.

METHODS: Photographs of slides of serially-sectioned Japanese and Caucasian embryos were obtained from the Kyoto and Carnegie collections, respectively. Using the 3D reconstruction program *WinSURF*, developed by Lozanoff *et al*., serially-sectioned stage 17 Japanese and Caucasian embryos were reconstructed to show the 3D morphology of the midfacial region.

RESULTS: During lip formation, medial nasal, lateral nasal and maxillary prominences fuse. During this fusion, a midline epithelial seam transiently forms at the contacts of the prominences. Three-dimensional reconstruction of the serially-sectioned embryos showed the medial nasal prominence coming into contact with the lateral nasal prominence and the maxillary prominence. The Carnegie embryos showed very little epithelial seam and a very prominent mesenchymal bridge at stage 17. At stage 17, the Kyoto embryos had very thick epithelium at the contact of the facial prominences forming the epithelial seam.

CONCLUSIONS: At stage 17, most Carnegie embryos have a mesenchymal bridge whereas most Kyoto embryos have an epithelial seam. In Kyoto embryos, the epithelial seam is thick and multilayered at stage 17. Kyoto embryos have smaller and more retruded medial nasal prominences, which alter the sites of epithelial contact with the lateral nasal and maxillary prominences. This difference appears to lead to delayed fusion, mesenchymal bridge formation through the seam, and merging between the facial prominences.

ACKNOWLEDGEMENTS: This study was supported by a Health Professional Student Research Award from the Canadian Institutes of Health Research and an Undergraduate Summer Research Student Award provided by The University of British Columbia Faculty of Dentistry.

8 Altered EGFR Signalling Pathway in Oral Dysplasias – A Tissue Microarray Study

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OBJECTIVES: To examine the expression of epidermal growth factor receptor (EGFR) and associated downstream molecules in oral dysplasias and to provide biological insights into the role of these molecules in oral carcinogenesis.

METHODS: This study involved a unique tissue array comprised of 70 1.0-mm tissue cores of oral dysplasias. As a control, a separate array was used containing 20 tissue cores, each of normal mucosa and squamous cell carcinoma (SCC). Immunohistochemical staining of EGFR, phosphorylated EGFR (pEGFR) and 11 downstream proteins were examined on serially-cut sections.

RESULTS: There was no difference in demographics among normal, dysplasia and cancer groups. All dysplasias showed cytoplasmic membrane staining of EGFR with it extending to over half of the epithelial thickness in 28 (40%) of dysplasias. This upregulation was associated with increased degrees of dysplasia (P=0.007). Phosphorylated EGFR expression occurred in membrane, cytoplasm and/or in nucleus, and the latter 2 patterns are associated with degrees of dysplasia (P=0.003 and 0.0001). All dysplasias showed similar expression patterns of mTOR and its downstream target pS6 in either a perinuclear or diffuse cytoplasmic pattern. The latter pattern of mTOR (commonly seen in SCC) was correlated with the upregulated nuclear pattern of pEGFR, supporting a possible role for nuclear localized pEGFR as a transcriptional factor. Of interest, pAkt was downregulated with degree of dysplasia (P=0.011), whereas pERK1/2 nuclear staining was present in all dysplasias (staining was absent in all normal samples). Cyclin D1 was present with nuclear staining in all of the dysplasias and 38% (26 cases) showed additional cytoplasmic staining, a condition that was common among SCC.

CONCLUSIONS: Unique tissue microarrays provide an effective approach to examine multiple molecules in different signalling pathways in relation to the histology. An altered EGFR signalling pathway may play a role in the phenotypic progression during oral carcinogenesis.

ACKNOWLEDGEMENTS: This study was supported by National Institute of Dental and Craniofacial Research grant #R01DE13124, the Canadian Institutes of Health Research, and the Michael Smith Foundation for Health Research.

9 Three-Dimensional Tongue Complex Modelling from Magnetic Resonance Imaging Data

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OBJECTIVES: This study was designed to create a computational three-dimensional (3D) tongue complex model from a magnetic resonance imaging (MRI) dataset.

METHODS: Multiple MRI slices of the head and neck region of a young non-overweight Caucasian male volunteer were taken in the supine position with a passive oral appliance (OA) in place. The DICOM MRI slices were transcoded into Analyze 7.5 format for use with the registration and segmentation software tools. Data from each of the 3D views were registered and merged to reconstruct a high-resolution volumetric dataset. The merged dataset was input into the 3D Livewire application developed in MATLAB which performs computer-assisted tracing of the tongue contour based on anatomical structure and tissue contrast of the images with an interval of 2-4 slices. The contour traced on each slice of 1 direction was projected on the other 2 directions, allowing for modifications to be made if contours did not agree with each other.

RESULTS: We reported 3D tongue extractions resulting from 11, 35, and 29 planar contours from sagittal, coronal, and axial directions, respectively. The extracted tongue complex consists of intrinsic and extrinsic muscles (posterior part of styloglossus and palatoglossus excluded), geniohyoid muscle, as well as submucosal glands. The resulting model is compatible with other software providing tools to verify its integrity and error estimation before being meshed or smoothened. To estimate model error, we selected 380 landmarks from the tongue boundary (tongue apex, bottom, lateral borders, ventral, dorsum) to compare them with the extracted tongue contour.

CONCLUSIONS: The confirmed tongue model can be imported into an existing 3D biomechanical model of the jaw to simulate the mechanisms and treatment protocols of medical disorders such as obstructive sleep apnea (OSA). This tongue modelling procedure may be customized for OSA patients who utilize an oral appliance for their therapy.

ACKNOWLEDGEMENTS: This research was supported by a UBC Faculty of Dentistry Undergraduate Summer Research Student Award.

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10 Role of p38 MAPK Signalling During Murine Palatal Fusion

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PURPOSE: The TGF-β/Smad signalling pathway is critical in regulating medial edge epithelium (MEE) disappearance during palatal fusion. The role of Smad-independent TGF-β signalling, such as MAPK signalling, has not been determined. We have identified p38 MAPK in MEE. Characterization of p38 MAPK activation and regulation by TGF-β3 is required to understand the role of this pathway in the disappearance of MEE.

OBJECTIVES: To examine the temporal expression levels and role of p38 MAPK and phosphorylated p38 MAPK (pp38 MAPK) in MEE during murine palatal fusion.

METHODS: *In vivo* – wild-type (WT) and TGF-$\beta3^{-/-}$ embryonic heads at specific stages of fetal development were fixed in 4% paraformaldehyde-PBS and embedded in paraffin. Immunohistochemistry was performed with antibodies against p38 MAPK, pp38 MAPK, cytokeratin 14, and E-cadherin. *In vitro* – palatal shelves were dissected at embryonic day 13 (E13) and cultured with a p38 MAPK inhibitor for 72 hours, then fixed and embedded as above. Both *in vivo* and *in vitro* sections were stained, and then MEE remaining in the midline seams was identified and measured.

RESULTS: *In vivo* – during critical stages of palatogenesis associated with palatal shelf adherence and midline seam breakdown, p38 and pp38 MAPK were expressed at high levels in WT samples, specifically in the MEE. However, pp38 MAPK expression within MEE was reduced in TGF-$\beta3^{-/-}$ samples. *In vitro* – with 10 μM inhibitor, more MEE remained in the midline epithelial seams than in untreated cultures at E13+72 hours ($P<0.01$).

CONCLUSIONS: The p38 MAPK pathway is activated in MEE during palatal fusion in WT animals but not in TGF-β3 null mice. Inhibition of the p38 MAPK pathway in WT palatal shelves led to survival of MEE and failure of fusion. These results indicate that TGF-β3/p38 MAPK signalling plays an important role in regulation of MEE disappearance during murine palatal fusion.

ACKNOWLEDGEMENTS: This project was supported by National Institute of Dental and Craniofacial Research grant #R01 DE16296.

11 Preliminary Data on DHDP Degree Completion Students and Graduates

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OBJECTIVES: Two degree completion options (Category 1 and Category 2) in the UBC Dental Hygiene Degree Program (DHDP) enable diploma dental hygiene graduates to earn a BDSc (DH) degree by building onto diploma-level education. This study investigated academic records of Category 1 and 2 students to determine if the number of years of practice upon application, diploma GPA, or the diploma-awarding institution were determinants of academic success. We also investigated these factors in relation to the likelihood of a DHDP graduate applying to graduate programs.

METHODS: Admissions and academic progress data (1992-2008) from the Faculty of Dentistry's Student Services files were analyzed. Academic records were reviewed, including GPAs of graduates and current students' course grades and GPAs.

RESULTS: Preliminary results indicate that students admitted to fourth year (Category 1) are no more likely to be successful than students admitted to third year (Category 2). Where students obtained their dental hygiene diploma, years of practice experience, or diploma GPA do not appear to determine the success rate. Data revealed that students are distributed across Canada, concentrated in BC and Ontario. The lack of difference in GPAs between Category 1 and 2 students upon graduation suggests that the third year of the DHDP adequately compensates for any differences in dental hygiene background. Category 1 students are more likely than Category 2 students to pursue graduate studies. This may be a reflection of the smaller number of Category 2 students completing the DHDP prior to the availability of all courses being offered online in 2006.

CONCLUSIONS: Ongoing research is necessary to determine if there are any measurable differences between students who received their dental hygiene diploma in different geographic locations and their success in the DHDP. To date, 23 of the 93 DHDP graduates have completed or are in a graduate program.

ACKNOWLEDGEMENTS: This study was supported by a UBC Faculty of Dentistry Undergraduate Summer Research Student Award.

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12 Factors Influencing Dentists' Decisions to Treat Patients Residing in Long-Term Care

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OBJECTIVES: The purpose of this study was to determine if dentists in Metro Vancouver and dentists practising elsewhere in BC had different opinions on treating patients in long-term care (LTC) based on personal, professional, or economic factors.

METHODS: The British Columbia Dental Association (BCDA) provided a random list of dentists from both rural and urban areas of the province. A package containing 3 forms for dentists who currently treat, have never treated, and stopped treating patients in LTC were mailed out to 800 dentists (400 in rural and 400 in urban areas). Dentists filled out one of the surveys and faxed it back to the BCDA. A reminder to fill out the survey was sent by fax and e-mail 2.5 weeks after the mail-out.

RESULTS: The 251 respondents (46 females, 197 males and 8 unspecified) consisted of 37 dentists who currently treat, 166 dentists who have never treated, and 49 dentists who stopped treating patients in LTC. A response rate of 31.4% was achieved. As indicated by Pearson's chi-square test, 75% of the responding dentists who currently treat patients in LTC reside outside of Metro Vancouver, 78% of dentists who stopped treating patients in LTC reside outside of Metro Vancouver, and 58.2% of dentists who have never treated patients in LTC reside outside of Metro Vancouver. Dentists who currently treat patients had a more positive attitude towards the elderly. For dentists from all 3 groups, professional and personal factors were the main determinants of providing treatment to patients in LTC facilities.

CONCLUSIONS: Professional and personal factors played an important role in deciding whether or not to treat LTC patients. The main factors that determined whether dentists decided to treat patients in LTC were years of practice, education and training in geriatric dentistry, and attitudes towards the elderly.

ACKNOWLEDGEMENTS: This study was supported financially by the British Columbia Dental Association.

13 Evaluating Antibacterial Medicaments in an *In Vitro* Oral Plaque Biofilm Model

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OBJECTIVES: To develop a dental biofilm model suitable for evaluating the antibacterial efficacy of various antibacterial medicaments and apply 2.0% chlorhexidine to this model to ascertain its functionality.

METHODS: Mixed supragingival and subgingival plaque was sampled from patients at periodontal pockets ≥5 mm and dispersed in blood heart infusion culture medium. Dense ceramic hydroxyapatite discs (0.25″ diameter) were immersed in this medium in a 24-well cell culture plate, and a biofilm was allowed to form over the discs for 2 weeks under anaerobic conditions, with the growth medium refreshed at 1 week. The discs were then immersed in sterile tap water for 3 (Group A) or 15 minutes (Group C), or 2.0% chlorhexidine for 3 (Group B) or 15 minutes (Group D). The biofilm/disc samples were stained with LIVE/DEAD® BacLight™ Bacterial Viability Kit, which distinguished cells with intact membranes (green fluorescence) from ones with damaged membranes (red fluorescence) when scanned under the confocal laser scanning microscopy in 3 dimensions. In each sample, 3-5 fields were randomly selected to be recorded. The raw data were quantified by dichotomized (red/green) volumetric analysis with Imaris 5.0 software (Bitplane Scientific Solutions). The volume ratio of red fluorescence to green fluorescence was translated into the "kill ratio" of the medicament. ANOVA was used to determine the statistical significance between groups.

RESULTS: The mean "kill ratio" of Group B was significantly higher than Group A ($p<0.05$). The mean "kill ratio" of Group D was significantly higher than Groups A ($p<0.05$) and C ($p<0.05$). There appeared to be a difference or gradient in the "kill ratio" at various depths of the biofilm.

CONCLUSIONS: The 2.0% chlorhexidine solution demonstrated significant antibacterial efficacy compared to control in an *in vitro* anaerobic biofilm model. In addition, the ability of the model to quantify antibacterial efficacy of medicaments has been confirmed.

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14 A Retrospective Study of Defects in NiTi Instruments in an Undergraduate Clinic

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OBJECTIVES: There have been many reports of the benefits of nickel–titanium (NiTi) rotary instruments, but studies related to the use of these systems in dental schools are few. The purpose of this study was to analyze the incidence and mode of ProFile instrument separation during a predefined protocol in clinical use by the undergraduate students in a dental school over a 4 year time period.

METHODS: A total of 3,706 ProFile instruments discarded from the same undergraduate student program between 2003 and 2007 were collected. Each set of ProFile instruments was limited to use on 3 clinical cases. All discarded instruments were ultrasonically cleaned, autoclaved, and then examined under a stereomicroscope at 10X magnification. Any defect was noted and classified into one of the following categories: (a) intact but with unwinding defects; or (b) fractured. The lateral and fracture surfaces of 12 separated instruments were examined by scanning electron microscopy (SEM) and the location and type of the fracture was recorded.

RESULTS: The overall frequency of instrument defects was 1.3%; deformation without fracture occurred in 1% and separation in 0.3%. The majority of instrument defects occurred in size 20 (34/48). Often, each defective instrument showed more than one type of defect. The ProFile instruments (10/12) failed mostly because of shear stress, while only 2 failed due to fatigue fracture. The broken fragments resulting from shear failure were shorter than those from fatigue failure.

CONCLUSIONS: Teaching and implementation of a NiTi rotary system to the undergraduate dental students at UBC can be regarded as successful since its introduction. This positive outcome of introducing rotary instruments to the undergraduate student program at UBC could help motivate more dental schools to consider such a change. Small-size files should be considered as single-use, disposable instruments because of the higher possibility of torsional deformation.

ACKNOWLEDGEMENTS: The authors thank Mr. Andre Wong for technical assistance with the SEM.

15 Strategies for Early Detection of Oral Cancer in High-Risk Populations

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BACKGROUND: Oral cancer is a deadly disease combining both high mortality and morbidity. Prevention and early identification of this disease in high-risk communities, such as the Vancouver Downtown Eastside (DTES), is a cost-effective approach to improving outcomes. It is critical that all individuals, especially those identified at risk for oral cancer, have access to information about oral cancer and to screening programs that will provide them with the opportunity for early detection of this disease.

OBJECTIVES: To (1) pilot a health promotion program; (2) increase access; (3) raise awareness about oral cancer; and (4) enhance prevention and early detection of oral cancer in a disadvantaged, hard-to-reach community.

METHODS: An education and screening program was established through a partnership with a drop-in community centre (LC) in the DTES. Participants were identified and invited by LC staff to attend an education session for oral cancer awareness. Participants were given a demographic and knowledge survey followed by a PowerPoint presentation. An oral cancer screening program was held 1 week later.

RESULTS: Two sets of combined sessions were held at the LC. A total of 53 (60% male) participants attended the education sessions: 47 (89%) had smoked, 29 (55%) had heard of oral cancer, 29 (55%) said they would attend a free oral cancer screening, and 16 (23%) indicated an interest in a tobacco cessation program. Among these, 24.5% attended the screening session the following week. In total, 71 participants were screened over two 3-hour sessions. Two suspicious lesions and 1 infection were identified as requiring follow-up.

CONCLUSIONS: This combined education and screening activity is an example of a novel strategy through community partnership and outreach in a hard-to-reach, high-risk community. There is an urgent need to expand this initiative to create a more comprehensive strategy for oral cancer prevention outreach in this community.

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16 Mid-Main Community Outreach

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OBJECTIVES: A situational analysis of the Mid-Main Community Health Centre (CHC) showed that a large proportion of their patients belong to a minority population. Through research, we concluded that these populations tend to have poor oral health. Two projects (A and B) were implemented to help the Mid-Main CHC reach out to the community as well as to help those individuals we identified as our target population.

METHODS: Project A – A booth was set up at a local information fair to evaluate knowledge and demographics of the fair attendees while promoting the Mid-Main CHC and educating attendees about oral health. Project B – Interactive presentations were given to educate children about oral nutrition and tooth brushing techniques as well as to assess their knowledge of oral health.

RESULTS: Project A – Demographically, we confirmed that there is a minority population in the community. Based on the survey given out, we found that although most people brush and visit the dentist, there were gaps in oral health knowledge. Project B – Students have a greater knowledge of oral health than expected. Children's brushing techniques were successful, but limited by their psychomotor skills.

CONCLUSIONS: Through research, collaboration with the Mid-Main CHC, and implementation of our projects, we have gathered data and built the framework for future sustainable projects within the Mid-Main community.

ACKNOWLEDGEMENTS: Mid-Main Community Health Centre, Dr. Sandy Ko, Irene Clarence, Julie Crawford, Mihaela Albu, General Wolfe Elementary School, David Livingstone Elementary School, Canadian Dental Association, Health Canada, Parents-as-Teachers Fair organizers, and Bell Canada.

17 A Gingival Inflammation Index for Elderly Long-Term Care Residents

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OBJECTIVES: Gingivitis is often diagnosed by the presence of gingival bleeding and/or other signs of inflammation such as changes in tissue colour, contour, and consistency. While many indices have been developed to aid examiners in the identification and quantification of gingivitis, a review of the literature has failed to identify a gingivitis index that is suitable for use with elderly long-term care (LTC) residents. Gingival assessments for this population are often done in institutions with compromised operator positioning and poor lighting. The residents have varying dentitions, are medically compromised, may require antibiotic prophylaxis for probing, and have a limited tolerance for lengthy exams. This study tested the utility, accuracy, and appropriateness of a new gingival inflammation index that does not elicit bleeding but is a dichotomous visual assessment.

METHODS: Fifteen elderly residents of LTC facilities were examined using both the gingival bleeding index (GBI) and the new gingival inflammation index (GII) by 1 calibrated examiner who routinely provides oral assessments to residents of LTC facilities. A mean score for each index was computed and a Pearson correlation test conducted. The examiner also provided an in-depth interview to discuss the benefits and limitations of the 2 indices.

RESULTS: The GII and the GBI were found to be comparable. The operator found the GII an easier assessment to perform and believed that it was more tolerable for the residents. This GII was also suggested as an appropriate index for nursing staff to use in the assessment of gingival inflammation among residents of LTC facilities.

CONCLUSIONS: These preliminary results suggest that the GII is comparable to the GBI in the detection of gingivitis, with the benefits of being much less invasive and easier to perform. A study with a larger sample size is needed to confirm the accuracy and utility of this index.

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18 Mechanism of Collagen Degradation by Cathepsin K

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OBJECTIVES: The unique triple-helical collagen degrading activity of cathepsin K depends on the formation of high molecular weight complexes with bone and cartilage resident glycosaminoglycans (GAGs) such as chondroitin 4-sulphate (C4-S). However, the mechanism of collagen degradation by cathepsin K is not yet understood. Crystallographic analysis of these complexes revealed the interaction sites between cathepsin K and chondroitin sulphate molecules. Using this structure, we deduced an oligomeric model consisting of cathepsin K and chondroitin sulphate molecules in a ratio of 2:1.

METHODS: Based on this model, the cathepsin K/chondroitin sulphate complex forms a ring-like structure with a central pore. Interestingly, this pore is narrowed by 4 glutamine residues which dissect the pore into 3 subchambers. Site-directed mutagenesis was used to characterize the role of the glutamine residues in collagen degradation. Furthermore, the denaturation of collagen was determined by circular dichroism, and structural information about the complexes was obtained by atomic force microscopy.

RESULTS: Our studies revealed the importance of these glutamine residues for the unique triple-helical collagenase activity of cathepsin K. The replacement of the bulky glutamine residues by small alanine residues dramatically reduced the collagenase activity but left the gelatinase and peptidolytic activity of the protease unchanged. Circular dichroism studies revealed that these glutamine residues are necessary for the local denaturation of triple-helical type I collagen by cathepsin K. Finally, atomic force microscopy supported the existence of the hypothesized ring-like structure of cathepsin K/chondroitin sulphate complexes at molar concentration ratios which favour the collagenase activity of cathepsin K.

CONCLUSIONS: Cathepsin K molecules form a ring-like complex with chondroitin sulphate. Cathepsin K-specific glutamine residues are required for the partial unfolding of triple-helical collagen prior to the hydrolysis of the substrate.

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19 Challenges in Dental Implant Self-Care Experienced by Older Adults

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OBJECTIVES: The provision of dental implants for older adults is increasing, and we know that dental implant prostheses involve substantial maintenance. This study aimed to explore challenges or problems that aging older adults perceive in the self-care of their dental implants.

METHODS: Semi-structured interviews were conducted with 4 elderly adults, each with an oral prosthesis supported by a minimum of 5 dental implants placed more than 5 years ago. Their dental history documentation was reviewed, as were the findings of professional oral examinations. Emerging themes were identified in verbatim transcripts of the audiotaped interviews.

RESULTS: Preliminary findings indicated that it was initially very challenging for participants to learn how to care for their dental implant prostheses, that specialized dental implant self-care products were difficult to find in retail stores, and that it was difficult and upsetting to access professional care to manage urgent problems with dental implant prostheses while travelling abroad. A major concern expressed by some participants and their spouses was regarding who would assist in maintaining the dental implants should they be unable to due to a loss of independence. Furthermore, various management and coping strategies utilized by the participants were identified. Through this initial analysis, it was determined that further research was warranted to identify patient perceptions of the challenges posed by the care of oral implants, and how they cope or manage with such challenges. Therefore, re-interviews were conducted with 3 of the original participants and 2 new participants, utilizing a revised interview guide addressing management and coping strategies.

CONCLUSIONS: This investigation suggests that data on patient perceptions can reveal important insights into the challenges and management strategies that dental implant patients can anticipate.

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20 Early Childhood Caries in Filipino-Canadian Children

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BACKGROUND: Annual screenings have shown that dental caries in kindergarten children in BC is increasing. The ever-growing new immigrant population in BC may be partially contributing to this increase. Filipino families comprise the third largest group of recent immigrants.

OBJECTIVES: (1) To report prevalence of early childhood caries (ECC) in a sample of Filipino-Canadian children; (2) to explore associations between ECC and family demographics; and (3) to assess children's access to dental care.

METHODS: A cross-sectional survey was undertaken using a sample of 130 children, ages 11 to 71 months. Questionnaires recorded family demographics. Caries was diagnosed using the International Caries Detection and Assessment System (ICDAS). Univariate, bivariate, and multivariate analyses were performed using SPSS.

RESULTS: Sixty-five percent of the participants had ECC (mean dmft 4.7±5.3), with increasing prevalence in older children (94% at age 60-71 months). The earliest onset occurred at 14 months of age. Bivariate and multivariate analyses revealed significantly higher ECC in Philippine-born children (dmft 7.2) compared to Canadian-born children (dmft 4.2). A significant association ($p=0.013$) was found between ECC and mother's age at pregnancy: dmft 6.0 for children with mothers ≤20 years old compared to dmft 0.3-0.7 for children with mothers 36-45 years old. A significant correlation ($p=0.039$) was also noted between ECC and more recent immigration (*i.e.*, fewer years in Canada). No significant associations were observed between ECC and other family demographics (parents' education, father's age, immigration status). Additionally, 57% of children had not yet experienced their first dental visit.

CONCLUSIONS: There is an increased prevalence and early onset of ECC in Filipino-Canadian children. Data supported associations between the severity of ECC and the child's birthplace, mother's age, and amount of time spent in Canada.

ACKNOWLEDGEMENTS: This research was supported by The University of British Columbia Faculty of Dentistry S. Wah Leung Endowment Fund and Canadian Institutes of Health Research Randomized Controlled Trials grant #FRNH 67817. The work of the many student volunteers is gratefully acknowledged.

21 PI15 (Sugarcrisp) Expression During Avian Craniofacial Development

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OBJECTIVES: The secreted protein Sugarcrisp (*aka* PI15, CRISP-8) belongs to the family of cysteine-rich secretory proteins characterized by 16 conserved cysteine residues. In all animal models where *PI15* has been characterized, including the chick, mouse, chimpanzee, and human, it functions as a peptidase inhibitor. Embryonic expression of the RNA has briefly been described in one organism, the chicken. Our lab has recently described that, in the craniofacial region, mRNA coding for Sugarcrisp is present in the paraxial mesoderm and frontonasal mass (unpublished data). Since post-translational modification of protein may result in different expression than the RNA, the aim of this study is to characterize the expression of PI15 with immunocytochemistry and Western blotting.

METHODS: Immunofluorescence on serial sections of wax-embedded chicken embryos was performed using the Mouse Monoclonal anti-PI15 antibody (Novus Biologicals) detected with anti-mouse Alexa 488. Embryonic tissues were dissected from stage 28 embryos and protein used for Western blots. We compared expression of the RNA and protein in the frontonasal mass, maxillary, and mandibular facial prominences.

RESULTS: PI15 RNA was expressed in the mesoderm that forms the cranial base at stage 15. At stage 24 there was slight expression of RNA in the globular processes of the frontonasal mass and anterior edge of the maxillary prominence. These are the regions that fuse to make the lip. At stage 28, there was strong upregulation of PI15 in the center of the frontonasal mass and no expression elsewhere in the face.

CONCLUSIONS: We will present antibody staining at comparable stages.

ACKNOWLEDGEMENTS: This work was funded by Canadian Institutes of Health Research grants to JMR. SN is a Michael Smith Foundation for Health Research Post-Doctoral Fellow.

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22 Mechanical Wounding-Induced Epithelial Chymase is Associated with Cell Migration

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OBJECTIVES: Chymase is a serine protease predominantly produced by mast cells and associated with various aspects of wound healing. We sought to determine if chymase was expressed by epithelial cells in a wound healing model.

METHODS: Human cutaneous and gingival keratinocytes, ovary surface epithelia, and a porcine epithelial cell line were assayed by homology-based cloning and the amplified DNA fragments identified as a chymase. *In vitro*, chymase could not be induced by serum or cytokine treatment alone but was activated 3X within 60 minutes in basal media by scratch wounding, and further potentiated over 10X at 18 hours by additional serum and cytokine treatment.

RESULTS: Chymase activity was cell-associated and found to peak within 24 hours of wounding, then steadily decreased, reaching baseline levels before confluence was re-established. Affinity column purified enzyme was found to effectively degrade fibronectin. Immunostaining revealed chymase activation at the wound edge co-localizing with reactive oxygen species generation. Chymase activation was attenuated by inhibition of nitric oxide, superoxide, and peroxynitrite. Exogenous peroxynitrite, but not hydrogen peroxide, resulted in chymase activation in unwounded monolayers. Disruption of cytoskeletal stress fibers by cytochalasin D attenuated both wound-activated chymase and reactive oxygen species generation. Chymase inhibitor chymostatin reduced the loss of cell-cell contacts and the onset of porcine and human skin epithelial cell migration at the wound edge.

CONCLUSIONS: This study shows that an epithelial chymase is rapidly activated by a ligand-independent mechanism following mechanical stress via cytoskeletal and reactive oxygen species signalling. This is associated with the onset of epithelial cell migration.

ACKNOWLEDGEMENTS: Supported by a Canadian Institutes of Health Research grant to EEP.

23 Role of WNT11 During Avian Facial Morphogenesis

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OBJECTIVES: Perturbations in the normal process of face development cause cleft lip with or without cleft palate to develop, a condition that affects 1:800 babies each year. The causes of non-syndromic clefting are unknown but recently WNT proteins have been implicated. Wnts are secreted glycoproteins and little is known about their function in facial morphogenesis. We recently found that WNT11 is expressed close to the lip fusing regions. Here, we investigated the hypothesis that *WNT11* regulates the process of lip fusion.

METHODS: The mechanism for the clefts was determined by examining the effects on target genes in viral (WNT11 RCAS) injected chicken embryos. The position of the virus infection was determined by using an *in situ* probe to the viral envelope. Impact on other signalling pathways was determined by *in situ* hybridization of virus-injected embryos. We also examined the effects of other growth factors on *WNT11* expression.

RESULTS: In the present study, we found that misexpression of *WNT11* in the maxillary prominence/frontonasal mass using an avian retrovirus led to large gaps in the soft tissues and skeleton. These effects are equivalent to cleft lip in humans. We also found that WNT11 overexpression downregulated the expression of *MSX1* whereas *DKK1* (canonical Wnt antagonist) was upregulated. Thus the cleft phenotype may be due to blocking the activity of canonical WNT signalling. Furthermore, we also found that SHH, BMP4, and FGF8 negatively regulate *WNT11* expression whereas retinoic acid induces *WNT11*. These results are the first to show the context-dependent regulation of *WNT11* and its interaction with the other known signalling pathways involved in normal facial development.

CONCLUSIONS: In this study we identified WNT11 as a new gene involved in facial clefting. Detailed investigations on this will reveal new aspects of facial development which could be used to treat craniofacial defects.

ACKNOWLEDGEMENTS: This study was funded by a Canadian Institutes of Health Research grant to JMR. PG-L and SN were supported by Post-Doctoral Fellowship awards from the Michael Smith Foundation for Health Research.

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24 Guiding Reflection in a Community Service Learning Dental Curriculum

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OBJECTIVES: To draft a guide for reflections within the community service learning (CSL) component of the Professionalism and Community Service (PACS) module in the UBC Faculty of Dentistry undergraduate dental curriculum.

METHODS: Individual interviews and small focus group discussions were held with first- and second-year Doctor of Dental Medicine (DMD) students and site coordinators during the summer of 2008. Participants were asked about the pros and cons of reflecting, and for ideas on probing questions to optimize CSL reflections. Interviews and discussions were conducted by the second author and were tape-recorded for verbatim transcription. The first author (under mentorship) conducted a review of the relevant literature and did thematic analysis of the transcripts.

RESULTS: Interviews and focus groups ranged from 25-80 minutes, and 11 students and 6 site coordinators participated in total. Participants did not highlight any significant cons since they favoured reflections as one way to enhance learning and self-awareness. Students highlighted the need for structure and focus of reflections in order to mirror the PACS's objectives accordingly, and to perform such activities in class whenever possible. Site coordinators favoured reflective questions to elicit ideas around the effects of "encouraging" and "discouraging" CSL experiences upon students' professional behaviour. A draft guide emerged based on the feedback of students and site coordinators.

CONCLUSIONS: This summer project afforded a DMD student the opportunity to become involved in research—from literature review to data analysis and reporting. The guide for reflecting has been implemented in PACS 410 (DMD 2012) and PACS 420 (DMD 2011), and has also been incorporated into the draft syllabus for PACS 430 and 440.

ACKNOWLEDGEMENTS: The authors are grateful to all the students and site coordinators who donated their time and effort for this study. Support was provided by a Canadian Institutes of Health Research Health Professional Student Research Award and by the S. Wah Leung Endowment Fund of the UBC Faculty of Dentistry.

25 Implant Surface Roughness Modulates Macrophage Morphology, Src-FAK, and ERK1/2-MAPK Signalling

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INTRODUCTION: Implant surface topographies are known to alter cell morphology and subsequent cellular behaviour *in vitro* and *in vivo*. Upon implantation, macrophages are among the first cell types to attach to the surface, releasing cytokines essential for wound healing. Previous studies have shown that rough surface topographies such as sand-blasted, large-grit and acid-etched (SLA) increase secretion of the proinflammatory cytokines IL-1, IL-6, and TNF-α by murine macrophages in the presence of suboptimal concentrations of LPS. The control of cytokine secretion involves several signalling pathways. For example, ERK1/2 activation in macrophages increases the proinflammatory cytokine TNF-α production and $Src^{-/-}$ macrophages exhibit less secretion of proinflammatory cytokines IL-1 and TNF-α.

OBJECTIVES: To study the effects of implant surface topography on macrophage morphology and Src and ERK1/2 signalling cascades.

METHODS: Murine macrophages (RAW 264.7) were seeded on Ti-coated epoxy replicas of polished, blasted, etched, and SLA surfaces, with PP1 used to inhibit Src activation. SEM, immunocytochemistry, and Western blotting techniques were used to analyze the effects of topography and Src inhibition on macrophage behaviour.

RESULTS: Macrophage spreading on polished surfaces increased with time but on rough surfaces decreased after 1 day. Src activation correlated with increasing surface roughness. SLA increased macrophage ERK1/2 phosphorylation two-fold compared to polished surfaces at day 1, while at day 3 ERK1/2 phosphorylation was decreased two-fold. The inhibition of Src activation using PP1 caused a downregulation of ERK1/2 phosphorylation on all surfaces (ANOVA with Bonferroni, $p<0.05$). FAK activation was also decreased on etched and SLA surfaces compared to macrophages cultured on polished and blasted surfaces at 3 days (ANOVA with Bonferroni, $p<0.05$).

CONCLUSIONS: Our results indicate that implant surface topography affects signalling pathways known to control cytokine release in macrophages. Substratum topography may therefore represent a means to control inflammation and thus wound healing around implants.

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26 Effect of Saliva Substitutes on Human Enamel Measured by QLF

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INTRODUCTION: Biotene® and MouthKote® are amongst the most readily available xerostomia remedies in Canada and were reported to be effective in alleviating dry mouth symptoms. Significant *in vitro* enamel demineralization, validated histologically, caused by xerostomia remedies has been reported previously. Titratable acidity, the presence of inorganic ions within the salivary substitute, and frequent or prolonged utilization were suggested to be the main factors influencing mineral dissolution in dentate xerostomic individuals. Quantitative light-induced fluorescence (QLF) is a new method for detecting changes in the mineral composition of enamel subjected to xerostomia remedies.

OBJECTIVES: To establish the effect of the xerostomia remedies Biotene® (Laclede International) and MouthKote® (Parnell Pharmaceuticals) on human enamel using QLF technology.

DESIGN AND METHODS: A randomized, experimental, partially-blinded, controlled *in vitro* study. Seventy-eight caries-free, permanent molars and premolars (previously extracted for orthodontic purposes) were randomly divided into 3 groups. The teeth were prepared by gentle polishing with a rubber cup and coating in an acid-resistant nail varnish, leaving a window on the buccal surface. QLF baseline images were taken and the teeth were then exposed to distilled water (control) or a demineralizing solution (experimental groups). After 48 hours, the teeth were air-dried and QLF images were taken. The images were analyzed by a single, blinded examiner. Mineral loss (measured by mean percent fluorescence loss), maximum fluorescence loss in the lesion (%), and the extent of the area lesion (%) were recorded.

RESULTS: Significant demineralization was noted in all experimental teeth ($P<0.05$) immersed either in Biotene® or MouthKote®. The amount of demineralization was less in the Biotene® group. No demineralization was detected by QLF in the control group.

CONCLUSIONS: Biotene® and MouthKote® caused significant demineralization in extracted teeth, although the amount was less in the Biotene® group. All findings of this study should be validated in a clinical setting.

ACKNOWLEDGEMENTS: This study was partly funded by the British Columbia Dental Hygienists Association (grant # 2007-17 BCDHA). Many thanks to Dr. Ailenbaum, Dr. Braverman, Dr. David, Dr. Marks, and Dr. Seth for providing extracted teeth and to Dr. Ian Pretty (University of Manchester, UK) for his valuable advice.

27 Sonic Hedgehog Signalling in Amniote Tooth Morphogenesis and Evolution

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OBJECTIVES: Our objective was to define the role of Sonic hedgehog (Shh) signalling in the development and evolution of teeth in reptiles and mammals (Amniota). It is already known that Shh is essential for dental epithelial initiation and growth in amniotes. Gene-targeting experiments in mice suggest an additional role for Shh in mammalian tooth morphogenesis; *Shh*-mutant teeth are misshapen, lack enamel, and fail to separate from the oral epithelium. This phenotype evokes the vestigial, first-generation teeth that occur naturally in many reptiles and mammals, suggesting a Shh-mediated evolutionary origin for these teeth.

METHODS: To explore the role of Shh signalling in squamate tooth morphogenesis, we (1) compared gene expression of the Shh pathway genes *Patched1* and *Gli2* in the embryonic teeth of the mouse, the gecko *Eublepharis macularius*, the bearded dragon *Pogona vitticeps*, and the snake *Python regius*; and (2) performed Shh loss-of-function experiments on developing squamate teeth by applying pathway antagonist cyclopamine to explanted gecko dental tissues maintained in organ culture.

RESULTS: Shh receptor *Patched1* and transcription factor *Gli2* were expressed throughout the dental epithelium and mesenchyme of all squamates studied. Within the epithelium, transcripts for both genes were particularly high in the dental stalk and enamel organ. In contrast, expression was relatively lower (*Patched1*) or completely absent (*Gli2*) in the epithelial component of vestigial teeth. Experimental reduction of Shh signalling in gecko teeth produced a phenotype that closely resembles that of *Shh*-mutant mouse teeth as well as squamate vestigial teeth: flattened shape, disorganized ameloblast layer, and close apposition to the oral epithelium.

CONCLUSIONS: Our gene expression and organ culture data corroborate a role for Shh signalling in the morphogenesis and deep-budding of teeth in squamates. Furthermore, they suggest that the evolutionary vestigialization of first-generation teeth in amniotes occurred with a decrease in epithelial Shh pathway activity.

ACKNOWLEDGEMENTS: Funding provided by the National Sciences and Engineering Research Council (GRH, KJL, JMR) and the Michael Smith Foundation for Health Research (GRH, JMR).

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28 Gene Expression in the Naturally-Cleft Secondary Palate of Avian Embryos

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OBJECTIVES: Abnormal development during the palatal fusion process causes cleft palate, one of the most common birth defects in humans. However, avians naturally have a secondary palate, which may suggest that avian gene expression profiles are different from those of mammals. In this study of avian embryos, we examined gene expression patterns of genes known to have a crucial role during palatal development.

METHODS: Chicken embryos were collected during the time when palatine shelves are growing toward each other, between E7.5 and E10.5. Whole-mount *in situ* hybridization was then performed.

RESULTS: We tested 18 genes, including FGFs, BMPs, WNTs, and transcription factors—all of the genes known to be related to palatal development. We found *TBX2, TBX22, BARX1, PAX3, OSR2, PITX2*, and *SHH* were expressed; however, the patterns of expression for several genes were different from those found in the mouse. *Pax3* expression is downregulated in the mature palatal shelves of mice, but in chicken embryos the expression remained at high levels even after the palatal shelves had stopped growing. In other cases, genes expressed in the palates of mice, such as *Msx1*, were completely absent in the chickens. Interestingly, no expression of growth factors from the FGF, BMP, or WNT families was seen in the palatal shelves.

CONCLUSIONS: Our data showed different expression patterns in the secondary palates of chickens compared to mice. These differences may be related to the ability of palate shelves to fuse.

ACKNOWLEDGEMENTS: This work was funded by Canadian Institutes of Health Research grants and an Alpha Omega Foundation award to JMR. NH is funded by a Department of Trade and Industry Canada Post-Doctoral Fellowship Award.

29 Challenges and Strategies in Recruitment of Filipino Immigrants for Community-Based Research

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INTRODUCTION: Difficulty in subject recruitment from marginalized ethnic groups, such as immigrants, is the most common cause of delay and failure in community-based research. This report documents challenges and strategies in recruitment of Filipino immigrants for 2 consecutive and complementary quantitative/qualitative needs-assessment surveys.

OBJECTIVES: The objective of this study was to determine strategies to successfully engage Filipino immigrants in community-based health research projects.

METHODS: Qualitative analysis of researchers' field notes and focus group discussion/interview transcripts was performed.

RESULTS: Challenges in recruitment were identified at 3 levels: community, individual, and researcher. Initial attempts to partner with community organizations failed primarily because we could not offer financial incentives for their collaboration. Apathy, time constraints, and lack of familiarity with researchers' identities were the main barriers for prospective individual participants. Process evaluation resulted in the following strategies that worked: (1) identifying programs and collaborating with community workers involved in early childhood development; (2) obtaining endorsement from organization and church leaders; (3) providing modest financial incentives to facilitate partnership with a community organization; (4) developing a network of contacts and maintaining researcher visibility in the community; (5) targeting churches and malls as recruitment venues; (6) inviting past study participants through mail and follow-up telephone calls; (7) using incentives (*e.g.,* dental gift packs, raffle, $25 cash); and (8) decreasing barriers (*e.g.,* providing childcare).

CONCLUSIONS: Recruitment of Filipino immigrants is facilitated through collaboration with community-based organizations. Prospective participants' lack of familiarity with research processes, methods, and identities of researchers hamper recruitment. Researchers could establish credibility by increasing their visibility among Filipino immigrants through participation in community and organizational events.

ACKNOWLEDGEMENTS: UBC Faculty of Dentistry S. Wah Leung Endowment Fund, Canadian Institutes of Health Research (CIHR) Randomized Controlled Trials grant #FRNH 67817, CIHR Health Professional Student Research Award, and UBC Faculty of Dentistry Undergraduate Summer Research Student Award.

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30 Role of WNT Signalling in Intramembranous Bone Induction

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OBJECTIVES: Epithelial-mesenchymal interactions are required to form the craniofacial skeleton. One of the epithelial signals to participate in intramembranous osteogenesis is Wnt signalling. Ectopic expression of canonical Wnt signalling has been shown to enhance ossification in mouse embryos. In the present study, we investigated the role of canonical Wnt signalling in the initiation of maxillary and mandibular intramembranous bones of the chicken face in organ culture experiments.

METHODS: Maxillary and mandibular processes were dissected from stage 22 chicken embryos and either cultured intact or separated into their epithelial and mesenchymal components using 2% trypsin. These tissues were cultured on nucleopore membranes in organ culture media containing mineralization reagents. Isolated mesenchyme was treated with Wnt agonists (LiCl and BIO) whereas intact facial prominences were treated with Wnt antagonists (CGP049090). Control samples were cultured in DMSO. Some of the cultures were grown for 8 days *in vitro* while the others were first cultured for 1 day *in vitro* and then grafted to the chorio-allantoic membranes of stage 30 host chicken embryos for 8 days. Both organ cultures and grafted tissues were then fixed, embedded in wax, serially sectioned, and stained with Alcian Blue and Picrosirius Red to detect cartilage and bone formation, respectively.

RESULTS: In the present study, we observed substantial formation of cartilage in all of the untreated mandibular cultures with or without epithelium. In these control cultures, maxillary mesenchyme also formed cartilage and bone was observed in intact organ cultures as predicted. In chorio-allantoic membrane grafts, growth was much better and large Meckel's cartilages were formed in mandibular cultures. The histological appearance of WNT agonist/antagonist treated cultures has yet to be analyzed; however, opaque areas consistent with the presence of mineralized tissues were observed.

CONCLUSIONS: Interfering with WNT signalling affects skeletal tissue formation in facial mesenchyme.

ACKNOWLEDGEMENTS: This study was supported by a research grant from the Canadian Institutes of Health Research.

31 Prevalence of Human Papillomavirus-6/11 in Oral Squamous Papillomas

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OBJECTIVES: Low-risk human papillomavirus (HPV) types 6 and 11 are known to cause benign warts or squamous papillomas, including in the head and neck regions. Specific expression patterns of p16 have been used as a surrogate marker for HPV infection in cervical cancer or pre-cancer. However, little is known about HPV-6/11 in oral tissue. The objectives of this study were: (1) to examine the presence of HPV-6/11 genome and p16 expression in oral squamous papillomas; and (2) to determine the relationship between HPV-6/11 and the expression of p16.

METHODS: This study involved a tissue microarray containing 73 0.6-mm tissue cores of oral squamous papillomas, diagnosed and retrieved from the BC Oral Biopsy Service. DNA probes for HPV-6/11 (DAKO) were used for chromogenic *in situ* hybridization (CISH) analysis, and anti-p16INK4A (E6H4, MTM Laboratories) was used for immunohistochemistry analysis.

RESULTS: A diffuse "episomal" nuclear HPV-6/11 staining pattern was observed in 6 (8%) of the 73 cases. Cytoplasmic p16 expression was shown in 16 (22%) of the 73 cases: 14 with a patchy (1- to 10-cell clusters) staining pattern, which is different from the diffuse pattern reported in those with high-risk HPV infection, and 2 with a diffuse staining pattern. Three (50%) of the HPV-6/11 positive cases also expressed a p16INK4A patch staining pattern. However, 2 cases with a diffuse cytoplasmic p16INK4A staining pattern were HPV-6/11 negative.

CONCLUSIONS: Only a small proportion of oral squamous papilloma is caused by HPV-6/11. Low-risk HPV infection showed a different p16 expression pattern than high-risk HPV infection. We are currently testing the high-risk HPV DNA probe using CISH for oral dysplasias and squamous cell carcinoma. CISH can potentially provide an easy method of screening for the presence of HPV infection in archival tissue.

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32 The Significance of Oral Health in the Lives of Elderly Chinese Immigrants

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OBJECTIVES: A recent study by Lai *et al.* (2003) concludes that Chinese elders in Canada are less healthy than elderly Caucasians. The purpose of this study was to seek information about the perceptions of oral health and related health care among Chinese elders in Vancouver, and to begin the process of identifying the role of Chinese culture and health-related beliefs in the lives of elderly Chinese immigrants in Canada.

METHODS: We conducted 8 open-ended interviews with a purposeful selection of elders who attended a community centre in East Vancouver. Each interview was audiotaped in Cantonese, translated into English, and then transcribed. The transcription was checked for accuracy against the original tape-recording by another Cantonese speaker. The transcription was analyzed systematically for specific themes based initially on the conceptual framework of the International Classification of Functioning, Disability, and Health (WHO, 2001) and current theoretical models of oral health.

RESULTS: Our results indicated that Chinese immigrant elders were influenced by a mixture of Chinese and Western health-related beliefs and behaviours. They were aware that their current oral health was influenced strongly by the care they received as children or adults before they immigrated to Canada. They all felt that oral health had an important influence on general health. However, some still return to China or their countries of origin in Southeast Asia for ongoing dental treatment because they cannot afford to get dental treatment in Canada. Other than that, their beliefs and behaviours on the significance of oral health in old age correspond closely to the views of Caucasian elders in Vancouver.

CONCLUSIONS: This study may pave the way for further studies about oral health beliefs, behaviours, and acculturation of visible minority seniors in Canada.

33 Culture of Progenitor Cells from Adult Mouse Submandibular Salivary Gland

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OBJECTIVES: Two major causes for loss of salivary gland function leading to xerostomia are the autoimmune disease Sjögren's syndrome and radiation therapy for head and neck cancer. Patients suffering from xerostomia experience considerable morbidity, including dry mouth, dysphagia, dental caries, and oropharyngeal infections. Currently, no proven therapy exists to treat patients with lost salivary gland function. Restoration of lost organ function using isolated stem or progenitor cells has recently attracted significant interest. To achieve this goal, identification and isolation of the stem or progenitor cells and establishment of optimized cell culture conditions for maintenance and amplification of these cells are crucial. We hypothesized that the mouse submandibular gland contains progenitor cells that can be isolated, maintained, and propagated in culture while maintaining their differentiation potential for salivary gland epithelial cells.

METHODS: Cells were isolated from adult mouse submandibular salivary glands. Optimized culture conditions to select, maintain, and amplify the progenitor cell subpopulations were developed. Cell phenotype and ability for differentiation was analyzed using monolayer and three-dimensional (3D) culture systems, phase-contrast and electron microscopy, immunostaining, and real-time quantitative reverse-transcription PCR.

RESULTS: We isolated and propagated subpopulations of salivary gland cells that could be maintained in culture for more than 20 passages. When placed in a 3D culture system, the cells differentiated to recapitulate the features of salivary gland epithelium *in vivo*, including the formation of acini-like spheroids with a hollow lumen and apicobasal polarization of the cells and production of the salivary gland signature protein, amylase.

CONCLUSIONS: The mouse submandibular salivary gland contains progenitor cells that can be isolated, propagated, and induced to differentiate to form salivary gland acini-like structures *in vitro*. The developed method and cell lines may be valuable tools for studying salivary gland morphogenesis and can be used for tissue engineering aimed at regenerating salivary gland function.

ACKNOWLEDGEMENTS: Supported by the UBC Faculty of Dentistry.

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34 Community Service Learning: Oral Health Promotion by Undergraduate Dental Students

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OBJECTIVES: (1) To briefly describe the Community Service Learning (CSL) component of the Professionalism and Community Services (PACS) module; and (2) to exemplify a CSL project carried out by a group of first-year dental students.

METHODS: A class project was conducted as per the regular requirements for the PACS module. The project followed a methodology including situational analysis, plan and implementation, evaluation, and sustainability.

RESULTS: CSL through the PACS module was designed to expose students to a variety of experiences, including assessing community needs, developing, applying, and evaluating an educational health promotion activity, and demonstrating a systematic approach to ethical reasoning and critical thinking.

CONCLUSIONS: PACS offered an experiential educational pedagogy and encouraged students to develop comprehensive knowledge and awareness of the needs and dynamics of a long-term care facility as a community site. The students' CSL project was done collaboratively with the site and focused on health promotion activities for care aides and staff, and was an enjoyable experience for the students and the community site. We would like to engage other schools in discussing community-based dental education in their dental curricula.

ACKNOWLEDGEMENTS: The authors are grateful to all the participants and the Director of Care at the long-term care facility, who donated their time to engage and contribute to this CSL initiative. Support for this study was provided by the S. Wah Leung Endowment Fund of the UBC Faculty of Dentistry.

35 Surface Topography Affects Bone Marrow Mesenchymal Stem Cell and Osteoblast Growth

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OBJECTIVES: Bone marrow mesenchymal stem cells (BM-MSCs) can differentiate into a variety of cells including osteoblasts, adipocytes, fibroblasts, and cartilage cells. It is known that the surface topography affects cell growth. The present study investigated the effect of gap-cornered boxes on BM-MSCs and osteoblast growth.

METHODS: BM-MSCs and osteoblasts were used in this study. Those cells were seeded on 6 designated surfaces (45W58P≡box width of 45 μm, pitch [*i.e.,* pattern repeat] of 58 μm, 40W53P, 25W38, 20W33P, 5W18P, 2W15P) and smooth surfaces. Cells cultured on those surfaces were observed for up to 24 hours by scanning electron microscope (SEM) and cell numbers on field days 1-7 by cell proliferation were counted. Cells were stained with DAPI and imaged using fluorescence microscopy. Cell area and morphology were measured on SEM image by ImageJ. Total RNA was extracted from cultured cells (RNeasy® Mini QIAGEN®). Expression of proliferating cell nuclear antigen (PCNA) in BM-MSCs and osteoblasts were measured by real-time PCR using SYBR Green.

RESULTS: The growth rates of BM-MSCs and osteoblasts on 45W58P and on smooth surfaces were significantly higher than the other surfaces at 5-7 days. Cell spreading (area) of BM-MSCs and osteoblasts on 25W38 and 2W15P was significantly less than on control smooth surfaces at 24 hours. The cell spreading area of BM-MSCs was significantly less than that of osteoblasts on 45W58P and smooth surfaces at 24 hours. The expression levels of PCNA on 25W38 and 2W15P tended to be lower than that found on control smooth surfaces for both BM-MSCs and osteoblasts.

CONCLUSIONS: The growth rates of BM-MSCs and osteoblasts differed significantly amongst the surfaces. Surface topography also appeared to affect PCNA level in the cells. These results indicated that surface topography affects cell growth and cell spreading of BM-MSCs and osteoblasts.

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36 Can Fluorescence Visualization Improve Surgical Management of High-Risk Oral Lesions?

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BACKGROUND: Recurrence following excision of high-grade dysplasia, carcinoma *in situ*, or squamous cell carcinoma (high-risk lesions, HRLs) implies that the presence of subclinical changes at the margins were not apparent at surgery, resulting in incomplete excision. Fluorescence visualization (FV) has shown its value in identifying high-risk oral lesions which are not apparent clinically.

OBJECTIVES: The objective of this study was to assess the efficacy of FV-guided surgery in reducing the recurrence of lesions.

METHODS: During 2004-2008, 163 patients with HRLs were treated with surgical excision and had a follow-up period of at least 6 months. Among these patients, 87 had the surgery done under FV guidance (FV group) while the other 76 were treated with the conventional surgery procedure (control group). Recurrence was defined as the presence of a clinical lesion at follow-up or those with biopsy-proven HRLs. The time to recurrence curve was estimated by the Kaplan-Meier method and the relative risks were determined using Cox regression analysis.

RESULTS: There was no significant difference between the FV and control groups in age, gender, smoking habit, lesion anatomical site, or the degree of diagnosis. There were fewer cases presenting with a clinical lesion or histological HRLs at the last follow-up in the FV group than in the control group (7% *vs.* 55%; 2% *vs*. 41%, $P<0.0001$). When the recurrence was defined only as the presence of HRLs, the FV surgery group had a longer mean time for recurrence (44.5±1.0 months) than the control group (30.4±1.6 months, $P<0.0001$). The FV control group had a 6X higher risk of clinical lesions or HRLs and a 13X higher risk of only HRLs than those in the FV surgery group.

CONCLUSIONS: The use of fluorescence visualization in the operating room can improve outcomes.

ACKNOWLEDGEMENTS: Supported by Canadian Institutes of Health Research (CIHR), National Institute for Dental and Craniofacial Research/National Institutes for Health, and Michael Smith Foundation for Health Research grants, a CIHR Health Professional Student Research Award, and a UBC Faculty of Dentistry Undergraduate Summer Research Student Award.

37 Comparative Investigation of Tooth Attachment in Reptiles

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OBJECTIVES: Many reptiles have conical teeth that lack roots and attach directly to bone. In contrast, mammalian teeth attach to bone via a periodontal ligament. Our goal was to examine gene expression during the tooth attachment stage in two species of lizards, *Eublepharis macularius* (leopard gecko) and *Pogona vitticeps* (bearded dragon), in order to find genes that are differentially expressed in mammals and lizards and, in turn, may relate to the different attachment types. We focused on the Sonic hedgehog (Shh) and bone morphogenetic protein (BMP) gene pathways, both of which are required for mammalian root development.

EXPERIMENTAL METHODS: Hedgehog and BMP genes were cloned by degenerate real-time PCR from *E. macularius* and *P. vitticeps* cDNA. These clones served as templates for the synthesis of ^{35}S-labelled antisense RNA probes that were used in *in situ* hybridization to detect gene expression in paraffin-sectioned dental tissues of lizard embryos and hatchlings.

RESULTS: Initial work revealed that the extending cervical loop of lizard teeth is characterized by high levels of cell proliferation and expression of the Hedgehog pathway receptor *Patched1*. These data suggest that Shh protein produced by the inner enamel epithelium is actively inducing cervical loop cells to proliferate and extend towards the tooth-bearing bone.

CONCLUSIONS: The Shh signalling pathway appears to play a conserved role in tooth root development in lizards and mammals. However, further scrutiny of gene expression in lizard tooth roots may reveal differences that underlie variation in tooth attachment types among amniotes and, specifically, lead to the fusion of tooth to bone in lizards. Our reptile studies may shed light on the etiology of human dental ankylosis, a pathological fusion of cementum or dentin to alveolar bone that impairs tooth eruption and the shedding of deciduous teeth.

ACKNOWLEDGEMENTS: This project was funded by a National Science and Engineering Research Council (NSERC) grant to JMR. GH is funded by NSERC and a Michael Smith Foundation for Health Research Post-Doctoral Fellowship Award.

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38 Identification of Exosites Required for the Elastase Activity of Cathepsin V

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OBJECTIVES: Human cathepsins V and L are closely related cysteine proteases which share an amino acid sequence identity of 80%. Although their subsite specificities towards peptide substrates are very similar, their activities towards the extracellular matrix protein, elastin, are dramatically different. Whereas cathepsin L exhibits only a weak elastase activity, cathepsin V is the most potent elastase among mammalian proteases. Given that the catalytic sites of both cathepsins are highly similar, we hypothesized the presence of a specific elastin-binding exosite in cathepsin V.

METHODS: To test this hypothesis, several chimera mutants containing the N-terminal part of cathepsin L and variable C-terminal parts of cathepsin V were constructed. The mutant proteins were expressed in yeast, purified, and their elastolytic activities were determined using fluorescence-labelled insoluble elastin. The cleavage specificity was addressed by HPLC analysis.

RESULTS: The enzymatic characterization of these mutants revealed that a peptide sequence region between amino residues 53 and 117 is critical for the potent elastase activity of cathepsin V. To further narrow the responsible sequence for the exosite, we constructed additional mutants. Mutant analysis resulted in the identification of a small sequence of 7 amino acid residues which contributes about 60% of the elastase activity of cathepsin V. Moreover, the mutant analysis delineated the presence of a second exosite which accounts for about 40% of the elastase activity. Additional mutant proteins were prepared and the size of the second exosite was determined.

CONCLUSIONS: The identification of 2 exosites in cathepsins, each remote from the catalytic sites, is novel and corroborates the importance of the overall structure of proteases with respect to their substrate specificity towards biologically-relevant substrates. This information might be used for the design of novel exosite-directed inhibitors of cathepsin V.

ACKNOWLEDGEMENTS: This study was supported by a research grant from the Canadian Institutes of Health Research.

39 Keratocystic Odontogenic Tumour

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OBJECTIVES: In 2005, the WHO reclassified the keratocystic odontogenic tumour (KCOT), formerly the parakeratinizing variant of the odontogenic keratocyst, as an odontogenic neoplasm. The purposes of this systematic review (SR) were to characterize this lesion's clinical and radiological features, and to determine any significant differences in them among 4 global groups. These groups broadly represent the basic ethnic division of humanity.

METHODS: The world literature was systematically searched. The primary source was MEDLINE, supported by LILACS research, reference harvesting, and hand searching. The literature was passed through a sequence of selection criteria. Each SR-included report was assigned to one of 4 global groups.

RESULTS: Forty-two reports were included and 71 were excluded. There were no differences between them as far as global group, language of publication, or source of the report were concerned. All 4 global groups were represented by at least 1 SR-included report. There was no significant difference between the global groups regarding syndromic or non-syndromic cases. The KCOT first presented most frequently in the third decade of life and it predominately affected males. There was no difference with respect to gender between the global groups. Predilection for either mandible (most frequently) or maxilla, first presenting finding (swelling, pain, numbness, discharge of pus, or discovery incidental to examination for a separate complaint) varied significantly between the global groups. The differences between the East Asian and Western global groups were significant for the 6 radiological features compared. The East Asian lesions were more likely to be multilocular, better defined, and corticated. They displayed buccolingual expansion and root resorption more frequently, but were less associated with unerupted teeth.

CONCLUSIONS: KCOTs display significant differences in their presentations between global groups. This urges caution when applying the results from one community to another.

ACKNOWLEDGEMENTS: The author is grateful to H. Lin, Asian Studies, The University of British Columbia, for her assistance with some of the Chinese-language literature.

40 Critical Role for αvβ6 Integrin in Enamel Biomineralization

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OBJECTIVES: Tooth enamel has the highest degree of biomineralization of all the hard tissues of the body. During the secretory stage, epithelium-derived ameloblasts deposit an extracellular matrix that undergoes enzymatic modification resulting in almost total degradation during the mineralization stage of enamel formation. The ameloblast plasma membrane has direct contact with the matrix and its mineralizing crystallites. The receptors of ameloblasts that mediate ameloblast-matrix adhesion and organization are not well characterized. Integrins mediate cell-matrix adhesion and signalling in most cell types. We hypothesized that epithelia-restricted αvβ6 integrin plays a role in the organization of ameloblast matrix and subsequent biomineralization of enamel.

METHODS: Sections of 12-day-old wild-type mouse mandibles were used to investigate the expression of αvβ6 integrin in ameloblasts of the developing incisors using immunofluorescence and *in situ* hybridization techniques. Tooth histology from wild-type and β6 integrin-deficient mice was analyzed by light and transmission electron microscopy. Tooth surface characteristics and mineralization were further assessed by scanning electron microscopy and micro-computed tomography. Attrition of the molars was also quantitated.

RESULTS: In the wild-type mice, ameloblasts expressed β6 integrin mRNA and protein. Teeth in the β6-/- mice developed and erupted normally. Interestingly, maxillary incisors of these mice lacked yellow pigment and mandibular incisors appeared chalky and rounded although the thickness of the enamel appeared to be relatively normal. Molars in the β6-/- mice showed progressive and severe attrition, reduced enamel mineralization, and the enamel surface appeared rough. At the histological level, an excessive amount of non-mineralized enamel extracellular matrix was observed between the ameloblasts and the forming enamel, and also between cells in the ameloblast layer itself.

CONCLUSIONS: Integrin αvβ6 is expressed by ameloblasts and it plays a crucial role in enamel matrix deposition and subsequent enamel biomineralization.

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41 PI15 (Sugarcrisp) Modulates Patterning of the Avian Face

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OBJECTIVES: Our lab has shown that applying Noggin (a BMP antagonist) and retinoic acid (RA, a vitamin A derivative) to the early avian embryo causes a homeotic transformation in the face, essentially causing a duplication of the upper beak. A microarray experiment profiling gene expression in RA/Noggin-treated mesenchyme identified *PI15* (peptidase inhibitor 15/Sugarcrisp) as one of the most highly induced genes. In this study, we investigated whether PI15 mediates the beak duplication phenotype.

METHODS: Human *PI15* was cloned into the avian-specific RCAS retrovirus. Affigel blue beads were soaked in Noggin protein (0.64 mg/ml or 0.1 mg/ml) and AG1X2 beads were soaked in retinoic acid. Beads were implanted or virus-injected into the maxillary region of the stage 15 chicken embryo. Embryos were fixed at short intervals for gene expression or after 12 days of incubation for skull analysis.

RESULTS: RA beads induced *PI15* to a greater extent than Noggin, suggesting that PI15 mediates the effects of RA. We also found that BMP4 and SHH induce expression whereas FGF8 downregulates *PI15*. Target genes downregulated by the PI15 virus included *DLX5, MSX1*, and *MSX2*. PI15 ectopic expression inhibited the formation of maxillary bones and induced clefts. To see whether *PI15* can replace RA and synergize with Noggin to induce maxillary transformation, *PI15* was injected and simultaneously a bead soaked in a solution of 0.1 mg/ml Noggin was implanted. This soaking concentration is too low to induce pattern changes. This treatment induced a full set of duplicated elements showing that *PI15* can replace RA.

CONCLUSIONS: The focus of this study identified a new gene that mediates the effect of the RA signalling pathway in controlling jaw identity in the face. Since PI15 is a trypsin inhibitor, it is possible that it may act during normal development to modify the activity of other morphogens.

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42 Oral Squamous Cell Carcinoma and Risk Habits in Oncology Patients in Vietnam

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INTRODUCTION: In South-Central Asia, 80% of head and neck cancers are found in the oral cavity and oropharynx. The reported etiological agents and risk factors for oral cancer include tobacco use, frequent alcohol consumption, the use of areca nut, compromised immune system, past history of cancer, dietary habits, and infection with certain types of human papilloma viruses. In Vietnam, oral cancer is often not detected until people experience circumstances debilitating to normal oral function.

OBJECTIVES: The aims of this study were to explore the patterns of oral squamous cell carcinoma (OSCC), trends in prevalence of cultural risk habits in southern Vietnamese patients, and the structure of oral health care in Vietnam.

METHODS: A retrospective clinical study was performed from July 1, 2005 to April 1, 2006 at Benh Vien Buou, Ho Chi Minh City Oncology Hospital in Vietnam. Of the 161 cases, 147 subjects were diagnosed with OSCC including 100 male and 47 female adults ages 24-85. Data was collected by a structured interview and clinical examination.

RESULTS: Over 40% of the women with OSCC reported chewing betel quid and the most prevalent risk habit in males was smoking (91%). Daily alcohol use was reported by 79.0% of males and 2.1% of females. Two-thirds of the OSCC cases were diagnosed at the second or third stages of cancer. The more advanced stages of cancer were observed in males. The prevalence of tobacco and alcohol use in males with OSCC was higher in the present study than in previous studies.

CONCLUSIONS: A high prevalence of risk habits in both genders was reported in OSCC Vietnamese patients. A trend of increased tobacco and alcohol use was observed in male OSCC patients. A lower prevalence of later staging was observed in the present study than in earlier studies.

43 Quantitative Analysis of the Effects of Irrigation Sequences on Dentin Erosion

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OBJECTIVES: Sodium hypochlorite (NaOCl) and ethylenediaminetetraacetic acid (EDTA) are the most commonly used endodontic irrigants. However, there is no consensus in the literature about the ideal irrigation sequence, volume, or time of application. The purpose of the present study was to examine the effect on root canal wall dentin of different irrigation protocols, and to compare the level of erosion caused by different irrigation sequences.

METHODS: Standard size dentin blocks were cut from the middle part of the roots of extracted teeth which had a single root. After 1 minute of hand instrumentation to create a smear layer, each block was split in half and randomly divided into 5 experimental groups. Each group was subjected to 17% EDTA and 5.25% NaOCl, varying the time of irrigation and the order of the irrigants. The blocks were then dried and prepared for scanning electron microscopy. Randomized digital images of the root canal dentin surface at a magnification of 2,000X were taken, and the area of tubule openings was measured by a semi-automatic method using image analysis software. Data was analyzed using Student's t-test.

RESULTS: Erosion of peritubular and intertubular dentin was detected when 17% EDTA was used as an initial rinse (even for 0.5 minutes), followed by 5.25% NaOCl. The area of dentin tubule opening increased markedly when compared with the irrigation sequence of NaOCl-EDTA ($P<0.05$). An initial rinse with EDTA for 5 minutes, followed by a final rinse with NaOCl, regardless of the duration of the NaOCl rinse (1 minute *vs.* 5 minutes), resulted in an over 100% increase in the area of dentin tubule openings ($P<0.01$).

CONCLUSIONS: When 5.25% NaOCl is used as a final irrigation after 17% EDTA, it causes marked erosion of root canal wall dentin.

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44 Economic Evaluations in Dentistry: A Systematic Review of "Systematic Reviews"

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BACKGROUND: The demand for economic evaluation studies in health care generally is growing with the likelihood that evidence from the studies plays a key role in policy developments, provincially and nationally, in Canada and abroad. We present here the results of one study performed in our Dental Economic Evaluation Research (DEER) project, which is systematically reviewing the scope and content of dental economic evaluation studies that have been published over the last decade.

OBJECTIVES: To determine literature reporting "review," "systematic review", and "meta-analysis" studies in economic evaluation and dentistry, and to identify information gaps.

METHODS: A systematic search of literature published between 1997 and 2007 was conducted using 15 electronic databases. Two independent reviewers selected the relevant literature. Studies were summarized descriptively in terms of language, design, topics, and information gaps.

RESULTS: From 2,714 published references, we found 176 pertinent to the reviews in dentistry, general health, or economics, and 38 of them were reviews, systematic reviews, or meta-analyses in dental economics. Topics of over half (53%) of the 38 reviews were focused on prevention, 21% on treatment, 5% on diagnosis, and 21% on issues such as service delivery. There are large information gaps in all topic areas, but particularly relating to the economics of caries, periodontal disease, and oral cancer.

CONCLUSIONS: Over half of the dental economic reviews in dentistry focus on preventive interventions, and there is a serious scarcity of useful economic evidence in other aspects of dentistry.

45 Defects in NiTi Instruments After Clinical Use: An Electropolished Instrument

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OBJECTIVES: Fatigue is of concern because it may lead to nickel–titanium (NiTi) instrument separation during clinical use. Electropolishing has been suggested to improve the ultimate strength of NiTi material and, consequently, resistance to fracture by fatigue of a rotary instrument. This study examined the type and location of defects observed in one brand of electropolished NiTi instrument after routine clinical use.

METHODS: A total of 414 RaCe instruments with structural deformations, discarded from 1 endodontic clinic over a period of 24 months, were analyzed. The lateral and fracture surfaces of those separated instruments were examined by scanning electron microscopy (SEM) for the type of fracture (shear or fatigue), and the location of the fracture was recorded. The distance from the tip of the instrument to the coronal end of the distorted area was measured on the deformed instruments. Data was analyzed using chi-square, Fisher's exact or Student's t-test, as appropriate.

RESULTS: Of all the defective instruments, 388 had an area of structural change and 26 were fractured. The distance from the tip of the instrument to the end of the deformed area was significantly longer in 0.02 taper instruments than in other tapers ($P<0.01$), whereas in 0.04 instruments, the distorted area ended closer to the tip ($P<0.05$). In 31% of all fractured instruments, the fragment was 7-8 mm long, more frequently in 0.04 tapers than in others. Most of the fractures were found adjacent to the twisted sector. Shear fracture was diagnosed in 22 (85%) and fracture by fatigue in 4 instruments (15%) ($P<0.05$). There was a marked increase in the amount of defects after the seventh (45.4%) and eighth (100%) use.

CONCLUSIONS: RaCe instruments fractured rarely but exhibited frequent unwinding defects after repeated use. The most common cause of separation was shear fracture.

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46 Xerostomia Initiative at Little Mountain Place

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OBJECTIVES: Xerostomia is prevalent among the residents of Little Mountain Place (LMP). The purpose of our project was to improve the quality of oral care at LMP by raising awareness of xerostomia and devising a staff protocol for recognizing and treating patients at risk.

METHODS: We assessed the xerostomia knowledge of care aides through a situational analysis and a pre-project survey. We raised awareness of xerostomia through an interactive presentation for the LMP staff, which included an opportunity for participants to try a variety of salivary substitutes. Because many residents are taking medications that increase their risk of developing xerostomia, we also devised a protocol for their recognition and treatment. This was done by identifying patients taking xerostomia-causing medications and arranging a method of communication between care aides, nursing staff, and other health care staff.

RESULTS: Our surveys indicated that the care aides lacked uniformity of knowledge about the treatment options for xerostomia. After our presentation, we found that the participants had an increased ability to list the signs and symptoms, treatment options, and consequences of xerostomia. Despite the success, there was a lack of interest in family members of the residents to attend another similar presentation. Since family members are involved in treatment decisions, their level of understanding on the topic may pose a problem for the project's sustainability. We detailed the roles of the pharmacists, care aides, key care aides, and nurses, as well as how they would communicate relevant information to other health care staff in a written and flow-chart format.

CONCLUSIONS: Based on the high level of participation by the staff and the post-presentation surveys, our presentation on xerostomia was educational and useful. At present, the effectiveness of the protocol we created has not been evaluated.

47 Can Hydrophilic PVS Impression Materials Dehydrate Dentin? A Pilot Study

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BACKGROUND: Polyvinyl siloxanes (PVS) are the most common elastomeric impression materials (IM) used by dentists. Currently, the majority of PVS have been rendered hydrophilic through the addition of surfactants, hydrophilicity being a desirable characteristic in the moist oral environment. The presence of surfactants raises the potential of a dehydrating effect on dentin that may result in tooth sensitivity and reversible/irreversible pulp damage.

OBJECTIVES: To test the hypothesis that hydrophilic PVS cause an increased outward fluid flow in dentinal tubules.

METHODS: A device described in detail by Derkson *et al*. (J Prosthet Dent 56:435-440, 1986) was used to determine flow rate based on the movement of an air bubble through a micropipette in a sealed fluid circuit under simulated physiological pressure. Recently extracted mandibular molars were cut at the furcation area of the root. Occlusal dentin was exposed by grinding with 600 grid SiC, acid etching for 15 seconds with 37% H_3PO_4, and rinsing. The sample was connected to the device and the dentin surface was covered with 1 of the following IM: Aquasil Light Body, Flexitime Correct Flow Light Body, Genie Light, or Impregum F, a naturally hydrophilic polyether IM. The flow rate was determined before and after the placement of each IM, during its setting, and after its removal.

RESULTS: No difference was identified in the flow rate among all IM during and after their setting. The scanning electron microscopy characterization of the samples showed that dentinal tubules were occluded with IM or smear layer-like materials.

CONCLUSIONS: Under the conditions of this pilot study, the hypothesis was rejected. Future experiments with a greater sample size and a grinding technique that more closely mimics that of the high-speed air handpiece may change the outcome.

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48 Barriers to Smoking Cessation in Patients with High-Risk Oral Lesions

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BACKGROUND: Oral cancer is a devastating disease with a global incidence of over 300,000 new cases every year. Oral cancer is, for the most part, preventable, with tobacco and alcohol consumption contributing to about three-quarters of the cases. Additionally, continuous smoking after surgery for high-risk oral lesions (HRLs) is associated with a risk of recurrence. However, little is known about the impact of smoking behavioural changes in patients with a diagnosis of HRLs or their barriers for tobacco cessation.

OBJECTIVES: The objectives of this study were: (1) to develop a tool to collect the behavioural modifications after diagnosis of an HRL; and (2) to identify possible barriers and facilitators in tobacco cessation.

METHODS: A survey-type questionnaire with open-ended questions is being developed for collecting both qualitative and quantitative data on smoking behaviours and cessation barriers. Patients with ever-smoking histories enrolled in the Oral Health Study of the BC Cancer Agency's BC Oral Cancer Prevention Program will be invited to participate in the study. A pilot cohort (n=10) has been interviewed to develop a refined questionnaire for a larger-scale study.

RESULTS: Initial results show positive feedback for the questionnaire. Interestingly, patients with a diagnosis of HRLs experience different smoking behavioural outcomes: some may experience depression and increase their cigarette habits, while others are able to quit immediately. All patients interviewed have a general understanding of the associations between tobacco consumption and its consequences on health. Over half of the patients admit that they have tried to quit smoking, but smoking recurs. The identified cessation barriers are mainly stress and nicotine addiction.

CONCLUSIONS: Incorporation of an open-ended interview questionnaire allows for better understanding of smoking behaviours and complex cessation barriers in patients with HRLs. Development of effective intervention strategies targeting these individuals may improve cessation success and reduce the risk of recurrence.

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49 Regulation of TGF-β Activity by αvβ6 Integrin in Keratinocytes

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OBJECTIVES: The expression of epithelial αvβ6 integrin is induced during wound healing and in carcinomas. *In vitro* studies have shown that it can activate TGF-β1, a key cytokine involved in wound healing and malignant transformation. TGF-β1 is stored in the extracellular matrix via latent TGF-β binding protein-1 (LTBP-1) and needs to be released from this complex for activation. In the present study, we hypothesized that αvβ6 integrin regulates the abundance of matrix-bound TGF-β1.

METHODS: *In vivo*-like extracellular matrices rich in LTBP-1 were produced by CHO cells stably transfected with full-length TGF-β1 and LTBP-1 expression constructs. Wild-type (WT) and β6 integrin null (β6-/-) mouse skin keratinocytes were cultured on the matrices, followed by quantification of the TGF-β1 levels remaining in the matrix by ELISA. Keratinocyte integrin expression, growth rate, and TGF-β1 signalling were also analyzed. Human epidermal keratinocyte cell line, HaCaT, was used to investigate the effect of antibody blocking of αvβ6 integrin on the TGF-β1 levels in the matrix.

RESULTS: As expected, the β6-/- cells did not express β6 integrin. The expression of its binding partner αv was downregulated as compared to the WT cells, whereas the expression of other integrins was not altered. In the presence of WT keratinocytes, TGF-β1 levels in the TGF-β1/LTBP-1-rich matrix were significantly reduced in comparison to β6-/- keratinocytes. There was no difference in the final growth rates between the 2 cell lines. A function-blocking anti-β6 integrin antibody blocked TGF-β1 removal from the matrix by HaCaT cells but had no effect on TGF-β1 signalling.

CONCLUSIONS: Keratinocytes reduce matrix-bound TGF-β1 levels using a mechanism involving αvβ6 integrin without inducing significant TGF-β1 signalling or altering cell growth, suggesting that αvβ6 integrin protects keratinocytes from excessive TGF-β1 signalling. This mechanism may protect the cells from epithelial–mesenchymal transformation and tumour formation.

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50 Sleep Disordered Breathing Symptoms and Craniofacial Morphology in Children

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OBJECTIVES: The aim of this study was to assess children enrolled in an orthodontic teaching clinic with respect to the relationship between sleep disordered breathing (SDB) symptoms and craniofacial morphology with a standardized questionnaire, cephalograms, and study models.

METHODS: All parents were asked to complete an SDB questionnaire at the commencement of orthodontic therapy. Higher scores indicate a greater probability of disease and/or reduced quality of life. The UBC cephalometric analysis included upper, lower, and total face height, hyoid position, soft palate length, mandibular length, vertical airway length, overjet, and overbite. Measurements of the study models included upper and lower dental width, depth, and palatal height. The subjects were divided into 2 groups according to their dentition. Statistical analyses were performed with SPSS 10.0 software and Spearman rank correlations.

RESULTS: A total of 173 children (male 50.3%, mean age 10.1±1.7 years) had a completed questionnaire, cephalometric analysis (CA), and model analysis (MA). The questionnaire suggested that only 2 children in the orthodontic clinic (1.2%) had an increased chance of exhibiting SDB. However, loud snoring, mouth breathing, and difficulty awakening were reported in more than 20% of the children. Overall, a higher total score correlated with retroclined upper incisors (CA) and high palatal height (MA) ($p<0.05$). Although there was no significant score differences between the groups, a higher total score correlated with a long soft palate (CA) ($p<0.05$) in the deciduous dentition group and a high palatal height (MA) in the mixed dentition group ($p<0.05$).

CONCLUSIONS: The incidence of SDB in an undergraduate orthodontic teaching clinic appears to be relatively low at 1.2%. SDB symptoms were related to many cephalometric variables and study model measurements that differentiated between deciduous and mixed dentition groups. It appears that attributes of SDB in growing children may in part be related to specific craniofacial variables.

51 Faculty and Student Views of the Undergraduate Dentistry Curriculum at UBC

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OBJECTIVES: The dental educational literature identifies benchmark preferred curriculum qualities. The survey aimed to elicit full-time faculty and student perceptions of the DMD curriculum to determine the extent to which the UBC curriculum is perceived to achieve the benchmarks and to determine if there is a difference in the perception held by students compared to the perception held by faculty.

METHODS: The survey was delivered online in November 2007 to the full-time faculty and the DMD students. It used WebEval and consisted of 21 questions that addressed the 11 benchmarks of dental curriculum design as identified in the literature, along with 10 additional criteria specific to the UBC dental curriculum. For each question, participants were asked to provide 1 of 4 possible responses: (1) doing well (=very good); (2) trying, but not there yet (=good); (3) want to, but haven't started (=fair); or (4) not even trying (=poor).

RESULTS: Thirty-two faculty and 110 DMD students participated. Comparisons were made between faculty and students as well as within each group. For faculty, we looked at the influence of appointment (tenure-track *vs*. nontenure-track), focus (basic science *vs*. clinical), and teaching experience. For students, we looked at the influence of year in the program, gender, and program track (4-year, or 2-year international degree completion). Some differences (at the $p<0.05$ level) were identified within each of the faculty and student groups; however, there were many more differences between the faculty and the students, especially in areas related to curriculum redesign, collaborations with other health professions, preparation for independent practice, and creating a trust-based clinic environment.

CONCLUSIONS: It appears that faculty were more optimistic about our curriculum progress than students were. Improved communication of curriculum goals and explicit efforts at creating a safe and supportive learning environment for students could diminish these differences over time.

ACKNOWLEDGEMENTS: This survey was supported by the UBC Faculty of Dentistry Dean's Office.

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52 Cathepsin K and Bone Remodelling in Mucopolysaccharidoses

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OBJECTIVES: Mucopolysaccharidoses (MPS) are a group of lysosomal storage diseases characterized by the build-up of certain glycosaminoglycans (GAGs). As GAGs are abundant in bone, we investigated whether the accumulation of heparin and dermatan sulphate found in MPS1 disease could affect cathepsin K activity.

METHODS: An MPS1 murine model and wild-type mice were used to investigate the expression and co-localization of GAGs and cathepsin K in the growth plate area. Bones were fixed and fluorescently stained for heparin and dermatan sulphate, cathepsin K, and a marker for cleavage of collagen type II by cathepsin K. Mature osteoclasts from MPS1, wild-type, and cathepsin K-deficient (ctsk-/-) mice were isolated and plated on either collagen type I or cathepsin K pre-digested collagen type I for actin ring assays.

RESULTS: We found a significant decrease in collagen resorption in MPS mice. Fluorescent co-localization studies of the MPS1 growth plate revealed a significantly higher amount of spatial overlap between cathepsin K and heparin sulphate compared to wild-type. The MPS1 growth plate also displayed a significant reduction in type II collagen degradation by cathepsin K. Isolated MPS1 and ctsk-/- osteoclasts displayed fewer actin rings and formed fewer resorption pits on dentine discs compared with wild-type. The presence of dermatan sulphate or a cysteine protease inhibitor decreased the presence of actin rings in wild-type osteoclasts. The presence of actin rings in MPS1 or ctsk-/- osteoclasts was not further decreased by the addition of a cysteine protease inhibitor and, in both, the actin ring presence was increased by plating the osteoclasts on cathepsin K pre-digested collagen.

CONCLUSIONS: The accumulation of dermatan and heparin sulphate in MPS1 bone has an inhibitory effect on cathepsin K activity. This results in impaired osteoclast activity and may contribute to the bone pathology seen in MPS disease.

ACKNOWLEDGEMENTS: This study was supported by a research grant from the National Institutes of Health.

53 Integrin αvβ6 Suppresses Keratinocyte Proliferation and Induces Hair Follicle Regression

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OBJECTIVES: Integrin αvβ6 is an epithelial-specific receptor that is absent from the normal epidermis but its expression is temporarily induced during wound repair. Persistent expression of αvβ6 has been associated with human chronic wound healing. β6 integrin knock-out (β6-/-) mice exhibit an accelerated wound repair compared to wild-type (WT) mice and show an increased number of proliferating hair follicle keratinocytes in a compromised wound healing model, suggesting that αvβ6 integrin may regulate hair follicle regeneration. To test this hypothesis, we investigated the function of αvβ6 integrin in keratinocytes during hair follicle regeneration *in vivo*.

METHODS: A standardized mouse model of depilation-induced hair cycling was established to trigger hair follicle regeneration in both WT and β6-/- mice. The hair cycle stages were assessed at different time points by histology. Expression of αvβ6 integrin was studied in regenerating hair follicles by immunohistochemistry. Catagen development was compared in the WT and β6-/- mice by quantitative histomorphometry and keratinocyte proliferation was assessed by immunostaining of the cell proliferation marker Ki67.

RESULTS: The αvβ6 integrin was present in hair follicles of normal skin, and its abundance was strongly upregulated during the hair follicle regeneration and was hair cycle-dependent. The strongest immunostaining of αvβ6 integrin was noted during the onset of hair follicle involution. At day 20 after depilation, hair follicles in β6-/- mice were still in the early catagen, whereas hair follicles of WT mice had already entered late catagen and the subsequent resting phase (telogen), suggesting that deletion of αvβ6 integrin leads to the retardation of hair follicle regression. β6-/- mice displayed more Ki67-positive cells than comparable catagen follicles from WT mice.

CONCLUSIONS: These data suggest that αvβ6 integrin suppresses keratinocyte proliferation and induces hair follicle regression *in vivo*. Therefore, αvβ6 integrin antagonists may provide useful therapeutic tools for human hair growth disorders.

ACKNOWLEDGEMENTS: This work was supported by grants from the Canadian Institutes of Health Research (CIHR), CIHR Skin Research Training Centre, and a UBC Faculty of Dentistry Joseph Tonzetich Fellowship.

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54 Surface Topography Affects Bone Marrow Mesenchymal Stromal Cell Gene Expression

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OBJECTIVES: Cell interactions with micro-patterned substrata have been extensively studied and shown to affect diverse cell behaviours such as adhesion, proliferation, migration, orientation, and differentiation. Bone marrow mesenchymal stromal cells (BM-MSCs) constitute a multi-potent population. We hypothesized that micro-fabricated surface topography would affect rat BM-MSCs lineage-specific gene expression.

METHODS: BM-MSCs isolated from Sprague Dawley rats were CD45 depleted, expanded, and plated at $5x10^4/cm^2$ on the following epoxy micro-fabricated surfaces: (1) 17 μM wide and 10 μM deep pillars (W17D10); (2) 55 μM wide and 10 μM deep squares (W55D10); (3) 30 μM deep grooves with a 45 μM pitch (D30P45); (4) 60 μM deep grooves with a 95 μM pitch (D60P95); or (5) smooth surface in BM-MSC expansion, osteogenesis, or chondrogenesis media. Zero, 1, 2, and 3 week cell cultures were collected for quantitative RT-PCR, immunostaining, and scanning electron microscopy. We examined the relative gene expressions of RunX-2, alkaline phosphates, osteocalcin, osteopontin, Sox-9, type II collagen, and aggrecan against GAPDH control.

RESULTS: In BM-MSC expansion media, at 1 week on W55D10, Sox-9 expression was significantly higher than that on other surfaces at all time points. In chondrogenesis media, at 3 weeks on W55D10, type II collagen expression was significantly upregulated compared to smooth surface, whereas in osteogenesis media, at 3 weeks on D30P45, osteocalcin expression was significantly increased compared to smooth surface. In addition, immunostaining with type II collagen or osteocalcin antibody verified qRT-PCR results.

CONCLUSIONS: With the precisely micro-fabricated substrata, we have demonstrated that W55D10 and D30P45 provided micro-environments for BM-MSCs which enhanced differentiation into cartilage or bone lineage as assessed by both qRT-PCR and immunostaining measures.

ACKNOWLEDGEMENTS: This project was supported by a grant from the Canadian Institutes of Health Research.

55 Cathepsin K, TGF-β, and Airway Remodelling

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OBJECTIVES: Cathepsin K is a mammalian papain-like cysteine protease with potent collagenase and elastase activity. Although the predominant site of expression for cathepsin K is in bone osteoclasts, the protease is expressed in lungs as well. However, little is known about its function in the lung. Therefore, we compared the phenotypes of lungs from wild-type and cathepsin K-deficient (ctsk-/-) mice.

METHODS: The morphology and integrity of 2-month-old wild-type and ctsk-/- mice were compared. The thickness of airway epithelium and the content of smooth muscle cells were determined by quantitative histochemistry and immunofluorescence staining. The collagen content was analyzed by masson trichrome staining and hydroxyproline determination. Furthermore, lung homogenates were used to study content of the actin and TGF-β1 by Western blotting, and the elastin content was measured by ELISA.

RESULTS: Whereas the airway epithelium in wild-type lungs was rather thin and well-organized, the airways in ctsk-/- mice were hypertrophic and disordered. Quantitative analysis of small airways showed that the airway epithelium, actin content, the size of smooth muscle cells, as well the TGF-β1 content were increased in ctsk-/- mice when compared to wild-type mice. The collagen and desmosine content were also significantly increased when compared with the wild-type litter mates. Furthermore, we demonstrated that TGF-β1 is degraded by cathepsin K and TGF-β1 is an important regulator of extracellular matrix expression.

CONCLUSIONS: We suggest that cathepsin K is required for tissue homeostasis in the lung. It is required for the degradation of excess extracellular matrix and may regulate the formation of the extracellular matrix by degradation of TGF-β1.

ACKNOWLEDGEMENTS: This study was supported by a research grant from the BC/China Innovation Fund.

56 Dentin Enhances the Antibacterial Effect of MTA and Bioaggregate

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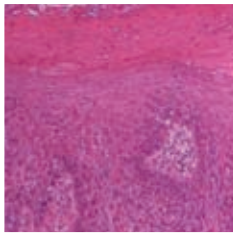
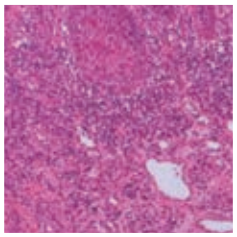
OBJECTIVES: The antimicrobial activity of Mineral Trioxide Aggregate (MTA) has been tested in several previous studies. Bioaggregate (BA) is a new bioceramic material intended for perforation repair and as a retrograde filling material. In the present study, the antimicrobial effectiveness of BA and MTA against *Enterococcus faecalis* was evaluated *in vitro*.

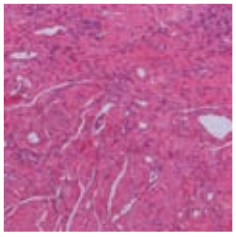
METHODS: Fresh BA and MTA powders, crushed powders from set materials, and pieces of set uncrushed cements were suspended in autoclaved water at concentrations of 10-100 mg/ml for direct exposure test. *E. faecalis* VP3-181 isolated from a case of persistent apical periodontitis was used as a test organism. Bacterial suspensions were mixed with the cements of different concentrations in equal volumes. At different incubation intervals, the survival of the bacteria in the solutions was assessed by ten-fold serial dilutions and culture on TSA plates. Colonies on the plates were counted and the CFU/ml was calculated. The mean values of Log_{10} CFU with the standard deviation were calculated. Statistical analysis was performed using one-way ANOVA followed by the least significant difference test for multiple comparison. The antimicrobial effect of the cements mixed with equal amounts of human dentin powder was also tested.

RESULTS: BA and MTA powder were equally effective in bacterial elimination and caused a significant decrease in bacterial viability within 6 minutes. Crushed set powders were either equally or more effective than fresh powders in killing the bacteria. The addition of an equal amount of dentin powder to the suspension of either BA or MTA powder (both fresh and set) resulted in faster elimination of the bacteria ($P<0.05$).

CONCLUSIONS: The results of the present study showed that bioaggregate and MTA have comparable, strong antimicrobial activity against *E. faecalis*. The presence of dentin powder further enhances the elimination of *E. faecalis* by both bioaggregate and MTA.







RESEARCH SUPPORTERS

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- iMATRIX RESEARCH CLUSTER
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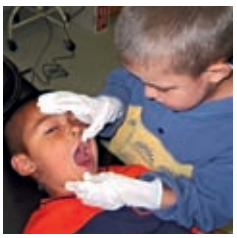


To advance oral health through outstanding education, research, and community service.



iMATRIX RESEARCH CLUSTER

iMatrix is an interactive research cluster within the Faculty of Dentistry at the University of British Columbia combining the research interests of 11 highly-active laboratories in oral and biomedical sciences. Our research is supported by more than 20 grant awards and our findings have been published in more than 200 journal articles and book chapters within the last 5 years. We are located in the J.B. Macdonald Dentistry Building and the Life Sciences Centre on the main UBC campus. Highly-motivated undergraduate and graduate students, post-doctoral fellows and other trainees, as well as interested collaborators, are welcome to contact our member laboratories.

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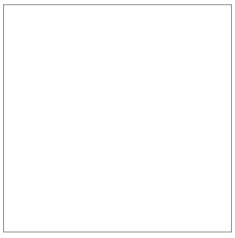
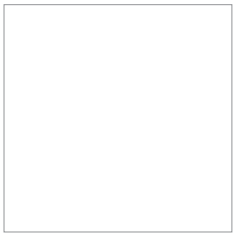
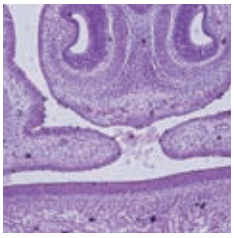
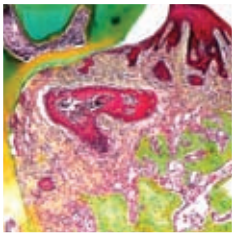
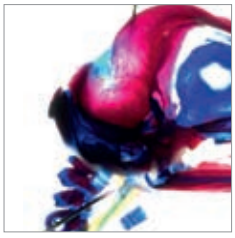

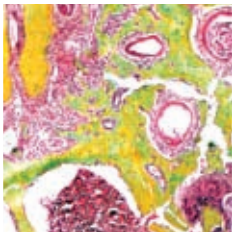
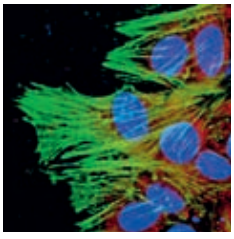

CLINICAL RESEARCH, TECHNOLOGY TRANSFER & DENTAL MATERIALS SCIENCES RESEARCH CLUSTER

This cluster encompasses groups engaged in research on dental sleep medicine; new diagnostic tools for cancer research at the molecular, histological and clinical levels for new treatment strategies; prevention through outreach programs; strategies for eradicating dental biofilms; fracture mechanisms and fatigue characterization of dental instruments and materials; hard tooth tissues; dental adhesives interfaces; interactive dental anatomy; dental hygiene; systematic review in diagnostic radiology; and forensic dentistry. Members actively collaborate with other researchers at UBC, across Canada and internationally. Research funding comes from royalty income, industry, Michael Smith Foundation for Health Research, Vancouver Coastal Health Research Institute, Canadian Institutes for Health Research, Mathematics of Information Technology & Complex Systems, and Natural Sciences & Engineering Research Council. Our research findings are published in international journals, book chapters and congress abstracts.
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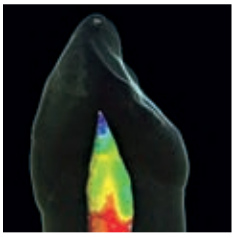
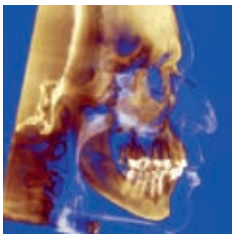
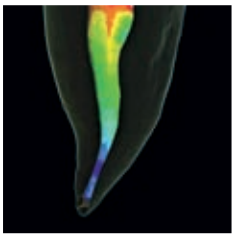
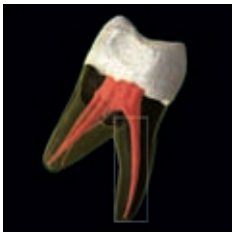
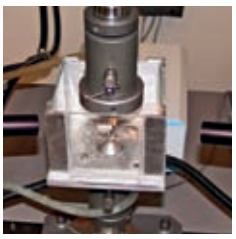
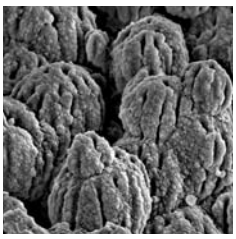

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UBC Faculty of Dentistry students are invited to apply to these summer research opportunities:

Community service learning: The Professionalism and Community Service (PACS) module

PACS is going into its third year at the UBC Faculty of Dentistry in 2009 – 2010 and has community service learning (CSL) as its main experiential learning pedagogy in and out of the classroom. Dr. Brondani and the PACS team are interested in ongoing research on the role of reflection as a venue for learning in the context of CSL; the impact of CSL in the community; and the longitudinal and sustainable effect of PACS on students' views of, and engagement in, different communities, especially after graduation. There are opportunities for undergraduate summer students and/or graduate students to get involved in one or more of these projects, from conceptualization and implementation to data collection and evaluation. Duties and the time commitment can be discussed with Dr. Brondani.

Contact: Mario Brondani, brondani@interchange.ubc.ca

Oral health and cardiovascular disease

Bacteremia resulting from dental therapies and tooth brushing (in the presence of gingivitis and periodontitis) can have systemic implications and can constitute a risk factor for cardiovascular disease. In fact, some streptococcus species have been identified in periodontitis and are also known as pathogens in endocarditis. Despite the epidemiological potential associations between oral and heart disease, people in general and those at high risk for cardiovascular infection might not be aware of these associations and the importance of the mouth to general health and well-being. Dr. Brondani is conducting a research study to gather information on the values and beliefs people hold about the linkages between oral health and cardiovascular disease, and the importance of the mouth to well-being. This research also has a clinical component involving oral examination (levels of gum inflammation, periodontal condition, and teeth status) and blood pressure and body mass index assessment. There are opportunities for undergraduate summer students and/or graduate students to get involved in this research study, from implementation to data collection, evaluation, and reporting of the findings. This opportunity will allow students to fully engage in the research enterprise. Duties and the time commitment for this study can be discussed with Dr. Brondani.

Contact: Mario Brondani, brondani@interchange.ubc.ca

Oral sex, oral cancer, and human papillomavirus (HPV)

HPV infection has been associated with the development of some types of oral cancers. But what does the public know about such associations? Dr. Brondani is looking for undergraduate summer students and/or graduate students who are interested in a qualitative (focus group discussions and individual interviews) and quantitative (questionnaire surveys) research study to explore the health values, beliefs, and behaviours of lay and health professional men and women about these linkages and the role of physicians and dentists in fully discussing oral cancer risks with their patients. Duties include helping with webpage development and a literature search and compilation of relevant references; assembling and assisting with the group discussions and questionnaire distribution; and participating in data analysis and reporting. Students can propose and engage in related projects under this topic. Other duties and the time commitment for this study can be discussed with Dr. Brondani.

Contact: Mario Brondani, brondani@interchange.ubc.ca

Effect of passive and active irrigation on predentin and deep dentin layers behind the smear layer on instrumented and uninstrumented parts of the dental root canal system

Cleaning and disinfection of the dental root canal system is a key part of successful endodontic treatment of infected teeth. Earlier studies have focused mainly on the effect of irrigating solutions on the smear layer which is created during instrumentation and consists of organic (collagen) and inorganic components of the root canal and dentin. New studies have indicated that large areas in various parts of the root canal system remain untouched by endodontic instruments and therefore do not have a smear layer. The effect of irrigating solutions on this part of the canal has been poorly studied. The aim of this project is to compare the effect of known and novel irrigating solutions on all parts of the root canal system using classical manual and new variable pressure irrigating systems. Light microscopy and scanning electron microscopy will be the main tools in the analysis of the effects of the irrigating solutions.

Contact: Markus Haapasalo, markush@interchange.ubc.ca

Cellular and molecular mechanisms of scar-free wound healing in gingiva

Wound healing is a complex process that often results in excess scar formation. For example, 67% of burn patients develop hypertrophic (HT) scars. This can have devastating consequences ranging from tissue disfigurement to organ dysfunction, emphasizing the need for better understanding and prevention of wound healing problems. Remarkably, gingival wounds resemble fetal wounds and heal by regeneration without scar formation. Understanding the mechanisms of gingival healing could provide valuable information about the factors that regulate scar formation. Our general hypothesis is that the inherently different composition of the extracellular matrix (ECM) and/or phenotypically different cells that reside in gingiva or skin determine the outcome of the healing. The hallmark of scar formation is the abnormal accumulation of ECM, including type I collagen, as a response to increased transforming growth factor-β (TGF-β) activity. The small leucine-rich proteoglycans (SLRPs) form a family of molecules that are important structural components in the ECM. We have shown that SLRPs decorin, biglycan, fibromodulin, and lumican interact with type I collagen to coordinately regulate collagen fibrillogenesis in gingiva. SLRPs also bind to TGF-β, reducing its activity. Recently, we demonstrated that decorin is also a signalling molecule that regulates cell growth. We hypothesize that the differential expression of TGF-β isoforms and their inhibitors, SLRPs, by fibroblasts in early gingival and skin wounds determine whether regeneration or HT scar formation results. SLRPs released from existing ECM also serve as signalling molecules and may regulate cell-ECM interactions, ECM turnover and organization. To study these processes, we use immunohistochemistry, electron microscopy, various cell culture and animal models, and biochemical and molecular biology tools.

Contact: Lari Häkkinen, lhakkine@interchange.ubc.ca

Preventing dental caries in preschool Filipino immigrant children: An innovative approach using social networking Internet sites

A summer research student is requested to assist with a project that will develop and evaluate the use of Internet-based social networking sites as a component of a dental health education program targetting immigrant Filipino families. Social networking is the most common activity for Filipino Internet users and they have been singled out as the most active users on a number of social networking sites such as Friendster and Multiply. This project will develop dental health education materials in multimedia formats that will be available for distribution via Internet-based social networking sites (*e.g.,* Friendster, Facebook). Formative evaluation of dental health content and format will be done using qualitative methods involving interviews with a sample of Filipino immigrant parents and childcare providers. Process and outcome evaluations will be undertaken to assess the impact of the use of social networking sites in delivering dental health education. Both quantitative (*e.g.,* website traffic statistics) and qualitative methods (website visitors' and community residents' feedback) will be used in process and outcome evaluations. A first-year student will be well able to make a significant contribution to this project. The student will work with Dr. Carino to develop materials, to arrange in-person and Internet-based interviews with users, and to track and analyze data related to users of the sites.

Contact: Rosamund Harrison, rosha@interchange.ubc.ca

Program evaluation: The UBC Special Children's Dental Program

A summer research student will be involved in the Evaluability Assessment phase of a proposed evaluation of the UBC Special Children's Dental Program. An Evaluability Assessment is a systematic process which describes a program's structure (*i.e.*, objectives, logic, activities, and performance indicators) and analyzes the plausibility and feasibility of the structure for achieving objectives, its suitability for intensive evaluation, and its acceptability to program managers, policy makers, and program operators. The student will have the opportunity to work with investigators involved in community-based health promotion and program evaluation research. A first-year student will be well able to make a significant contribution to this project. The student will work with Dr. Marano in conducting the Evaluability Assessment. The work will involve a literature search and review, including analysis of the scientific and "grey" literature on the topic of program evaluation; a review of charts, records, and program documents; and assistance with developing the logic model for the evaluation.

Contact: Rosamund Harrison, rosha@interchange.ubc.ca

Role of αvβ6 integrin in enamel biomineralization

Enamel that covers the crowns of teeth has the highest degree of biomineralization of all the hard tissues of the body. During the secretory stage, epithelial-derived ameloblasts deposit an extracellular matrix (ECM) that undergoes enzymatic modification, resulting in almost total degradation during the maturation (mineralization) stage of enamel formation. Ameloblast plasma membrane has direct contact with the matrix and its mineralizing crystallites. Ameloblastin has been reported to serve as an important adhesion molecule for ameloblasts. However, the receptors of ameloblasts that mediate the ameloblast-matrix adhesion, organization, and signalling are not well characterized. Integrins mediate cell-matrix adhesion and signalling in most cell types. Ameloblasts are known to express α2, α6, β4, and β1 integrin subunits, but the details of how these and other integrins participate in enamel formation are not known. We have recently observed that ameloblasts express epithelial-specific αvβ6 integrin, which is known to bind to the RGD-motif (also present in ameloblastin) of integrin ligands. Furthermore, αvβ6 integrin binds to the RGD-motif of latent TGFβ1 and activates it. This integrin-mediated activation mechanism of latent TGF-β1 seems to serve a crucial role in TGF-β1 activation *in vivo*. Moreover, TGF-β1 signalling is required for biomineralization of enamel. We have further observed that β6 integrin-null mice present with severe enamel defects, including reduced biomineralization of enamel, altered surface structure, and increased attrition. Ameloblasts in β6 integrin-null animals appear to abnormally accumulate ECM facing the mineralizing enamel but also inside the ameloblast layer itself. Therefore, it seems likely that β6 integrin-null mice either produce excessive amounts of ECM or possess decreased proteolytic activity. The goal of this research proposal is to characterize the enamel defect in more detail and to dissect the molecular mechanisms underlying the enamel phenotype. Our overall hypothesis is that αvβ6 integrin regulates biomineralization by modulating cell adhesion-dependent matrix organization and/or by regulating TGF-β1 activation.

Contact: Hannu Larjava, larjava@interchange.ubc.ca

A study in knowledge transfer

The ELDERS group at UBC consists of three academics committed to the effective management of oral health in old age. They work with colleagues in several other faculties (including geriatricians, nurses, psychologists, sociologists, social workers, and statisticians) and they interact with various sectors of the community. The ELDERS group at UBC was one of the first to document the distribution of oral health problems in long-term care facilities, and to explore different methods of managing the problems. We have investigated preventive strategies ranging from antibacterial agents to the education of care aides. The ELDERS group webpage was developed as a way to transfer knowledge about the research activities and results to a wide audience in Canada and abroad. It is also used as a way to arrange oral health care services and educational programs within the community. The research project for the summer student would be to revise and test the ELDERS webpage to enhance its appeal and usefulness in meeting the overall educational, research, and service responsibilities of this interdisciplinary group.

Contact: Michael MacEntee, macentee@interchange.ubc.ca

Role of epithelium in maintaining expression of transcription factor *TBX22* during palate development

Genetics plays an important role in the etiology of clefting; therefore, there is a major effort to identify the genes and regions of the human genome that increase susceptibility to orofacial clefts. One approach is to look at syndromes with clefts, since the causative genes are likely to play some role in face formation. Some of the genes that cause syndromes with clefts are *IRF6*, *MSX1, PVRL1,* and *TBX22*. In this project we are focussing on the T-box transcription factor, *TBX22*, which is mutated in X-linked cleft palate and ankyloglossia (CPX, OMIM 303400). The protein product of the *TBX22* gene binds to target genes that contain a particular sequence of DNA and turns off or represses their transcription. It is now known that in human CPX syndrome there are mutations in the sequence of *TBX22* that reduce the ability to bind to target genes. All of the mutations are predicted to result in a loss of function. The student in this project will analyze the role of epithelium on the expression of *TBX22* in the normal, developing chicken secondary palate. The epithelium will be enzymatically removed and the palate mesenchyme cultured in organ culture dishes. Individual beads soaked in growth factors will be added back to determine which epithelial signals are required to maintain expression.

Contact: Joy Richman, richman@interchange.ubc.ca

Underlying research: $50 million
Saving a life: Priceless

Backed by Over $50 Million In Research

Over the past several decades, **tissue fluorescence visualization technology** has benefited from over $50 million in research funded by the NIH and other respected organizations. Applying this technology to the oral mucosa was the brainchild of LED Dental and the British Columbia Cancer Institute.

The result was the **VELscope system**, which is cleared by Health Canada and the FDA as an adjunct for clinicians to enhance the visualization of oral mucosal abnormalities, such as oral cancer and premalignant dysplasia, which may not be visible to the naked eye.The VELscope is also cleared to help surgeons determine the appropriate surgical margin when excision is warranted.

Thousands of clinicians are reporting that VELscope system exams are easy to perform, extremely comfortable and affordable for their patients, and very profitable for their practice. Most important, the exams are helping them discover abnormalities they otherwise would have missed, and save lives along the way.

We'd say that's a pretty good return on investment.

Get it early. Get it all.™

VELscope®
The Oral Cancer Screening System

Screen your patients for oral cancer effectively

with the first Clinical Practice Guideline for early detection.

This year, 3,200 Canadians will be diagnosed with oral or pharyngeal cancer – 84 per cent could potentially be detected by a dentist.

The College of Dental Surgeons of British Columbia is dedicated to setting standards for dental professionals in B.C. and helping dentists to combat this devastating disease through early detection.

Developed by the BC Oral Cancer Prevention Program of the BC Cancer Agency in partnership with the College of Dental Surgeons, the Clinical Practice Guideline provides scientifically based, practical recommendations. It is the expectation that a head, neck and oral soft tissue exam is completed on all patients over age 40 at the time of the new patient exam and at general dental recall.

The Guideline recommends four essential steps:

1. **Patient History** – habits and lifestyle
2. **Visual Screening Examination** – extraoral and intraoral examination, lesion inspection and documentation of findings
3. **Optional Screening Adjuncts** – as complementary to, not as a replacement for, the patient history and the visual and manual head, neck and oral exam
4. **Diagnostic Biopsy or Referral** – to a BC Oral Cancer Prevention Program clinic or experienced practitioner

Find the Guideline on the College website at: **cdsbc.org/pdf/OC_Guideline_Final_2008.pdf**

For additional video resources on the early detection of oral cancer, visit **bccancer.bc.ca/PPI/Screening/oral/earlydetection.htm**

College of Dental Surgeons of British Columbia

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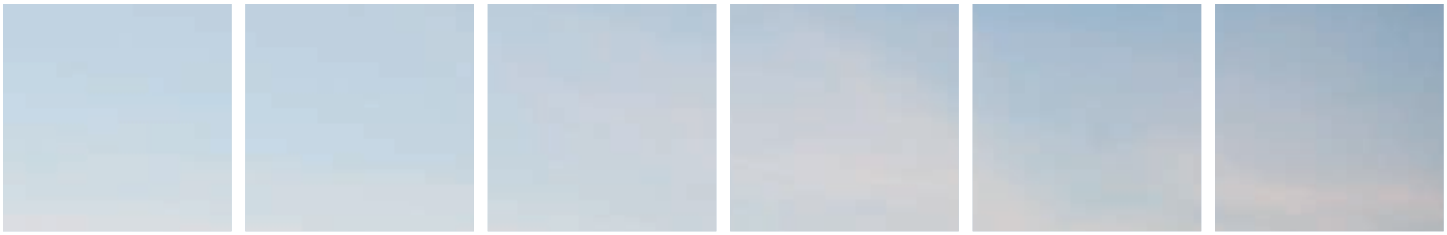

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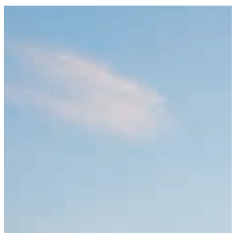


UBC DENTISTRY | THE UNIVERSITY OF BRITISH COLUMBIA

UBC DENTISTRY
GRADUATE/POSTGRADUATE STUDIES

GRADUATE PROGRAMS

MSc and PhD

These programs are research-oriented with no clinical components. The MSc degree normally requires two years full-time study and can also be taken part-time. The PhD degree requires a minimum of three years full-time study. Both offer research training in craniofacial sciences (cellular molecular, clinical trial, or population health). **Application Deadline: January 31.**

COMBINED MDSc AND DIPLOMA PROGRAM IN PERIODONTICS

This program offers a combined MDSc degree and Diploma in Periodontics. This three-year program is recognized by the American Dental Association and the American Academy of Periodontology. The combined program will require a minimum of three years to prepare a student for clinical practice in periodontics and to provide research experience. Applicants must hold a DMD or its equivalent. **Application Deadline: October 1.**

COMBINED MDSc AND DIPLOMA PROGRAM IN ENDODONTICS

This program offers an MDSc degree and a Diploma in Endodontics. The combined program will require a minimum of three years to prepare the student for clinical practice in endodontics and to provide research experience. Applicants must hold a DMD or its equivalent.
Application Deadline: October 1.

For more information on graduate programs visit www.dentistry.ubc.ca
or contact: Viki Koulouris, vickybk@interchange.ubc.ca
T 604 822 4486 F 604 822 3562

POSTGRADUATE PROGRAMS

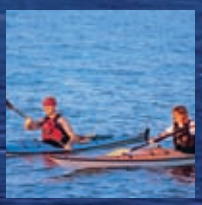
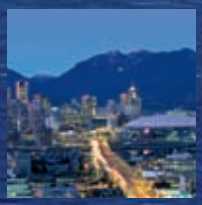
ORAL MEDICINE AND ORAL PATHOLOGY RESIDENCY PROGRAM

This postgraduate residency training in Oral Medicine and Oral Pathology is offered in conjunction with University-affiliated teaching hospitals. It consists of a three or four -year hospital-based, stipended residency in one of three pathways: Oral Medicine, Oral Pathology, or both specialties combined.

GENERAL PRACTICE RESIDENCY PROGRAM

In conjunction with University-affiliated teaching hospitals and community clinics, the Faculty offers positions in a one-year dental residency program beginning July 1. These residency positions include pediatric dentistry.

For more information on postgraduate programs visit www.dentistry.ubc.ca
or contact: Dorothy Stanfield, dstanf@interchange.ubc.ca
T 604 822 0345 F 604 822 4532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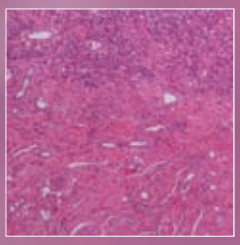

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