Sir John Walsh
Research Institute

Research Day 2018

Abstracts of staff and student oral research presentations
Staff and student oral presentations

Abstracts and biographical details for invited keynote and sponsor presenters are provided in the printed SJWRI Research Day programme booklet.

THEME: UNDERSTANDING THE ORAL HEALTH OF NEW ZEALANDERS

Chair: Professor Murray Thomson

9.15am – 9.20am
Professor Murray Thomson  Programme Leader, Dental Epidemiology and Public Health
Featured research programme introduction: Dental epidemiology and public health

KEYNOTE PRESENTATION

9.20am – 9.50am
Professor Marco Peres  Director, ARCPOH | Adelaide Dental School, University of Adelaide
Population-based oral health studies in Australia: from surveillance to hypothesis-driven research

9.50am – 10.10am
Professor Murray Thomson  Department of Oral Sciences, University of Otago
Medication use and xerostomia among dependent older New Zealanders: findings from a national survey

WM Thomson1, MB Smith2, CA Ferguson2, N Kerse3, BJ Gribben4
1. Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago
2. Department of Public Health, University of Otago, Wellington
3. Faculty of Medical and Health Sciences, Auckland University
4. CGB Health Research Ltd, Auckland

Aims: To investigate polypharmacy and xerostomia among older New Zealanders in aged residential care.

Methods: National survey of oral health in aged residential care throughout New Zealand, using intra-oral examinations and a computer-assisted personal interview. Medication data were recorded at the time of the assessment, with medications subsequently allocated unique 5-digit numeric codes for analysis. Xerostomia was measured using a standard single item (“How often does your mouth feel dry?”), with those responding ‘Frequently’ or ‘Always’ categorised as xerostomic. Following the computation of descriptive statistics, Automatic Interaction Detection (AID) analysis in SPSS was used to identify combinations of medications which were associated with xerostomia. Dummy variables for those were then constructed and used in a logistic regression model to determine the combinations which were associated with xerostomia (controlling for sex, age and dependency level), applying survey weights in Stata.

Results: Data were available for 2033 persons, representing a source population of 27,951. The prevalence of xerostomia was 29.0% (95% CI 26.1, 32.1). The mean number of medications taken was 6.8 (range 1 to 20), with 73.0% (95% CI 69.9, 76.0) taking 5 or more, and 19.9% (95% CI 17.4, 22.5) taking 10 or more. Antihypertensives (taken by 70.1%) were the most common category, followed by analgesics (46.7%), anti-ulcer drugs (44.5%), aspirin (44.3%), laxatives (30.2%) and statins (30.1%). AID analysis showed xerostomia prevalence to be higher among those taking any of the following combinations: (a) MAOI antidepressants alone (42.2% with xerostomia); (b) SSRI antidepressants and hypnotics (57.9%); (c) the previous combination plus a calcium channel blocker antihypertensive (43.5%); and combination (b) plus a steroid (50.0%). The outcome of the multivariate analysis will be presented.

Conclusion: Polypharmacy among frail older people results in a high prevalence of xerostomia, with antidepressants and certain antihypertensives particularly at fault.
Unmet need for dental care is a matter of public debate and of keen interest to the dental profession. Aim: To describe trajectories of untreated dental caries experience to age 45 years. Methods: Longitudinal data from the Dunedin Multidisciplinary Health and Development Study from birth to age 45 (preliminary) years were analysed using group-based trajectory modelling. Longitudinal data on plaque, restorations, and caries-associated tooth loss were entered as time-varying covariates, while deciduous dentition caries experience, childhood IQ, and parental dental health and socioeconomic status (SES) when Study members were selected as trajectory risk factors. Results: Dental data were available at least three ages for 967 Study members and the final model (including covariates) included 844 (84%) of the surviving Study members. Trajectories of untreated dental caries were designated “high” (10%), “low” (33%), and “very low/nil” (57%). In the high trajectory, untreated dental caries peaked to a mean 11.5 surfaces at age 32 but dropped to 9.3 surfaces by age 45. In the low and very low/nil trajectories untreated dental caries peaked at age 26 years and subsequently decreased. Tooth loss and dental restorations were associated with lower trajectory slopes, while plaque was associated with higher trajectory slopes. IQ and female sex were associated with lower risk for a high or low trajectory (ref very low/none), while the converse was true for poor maternal self-rated oral health, low parental SES, and age 5 deciduous dentition caries. Conclusions: Untreated dental caries experience peaks in early adulthood and is driven by dental plaque while limited by the loss of teeth and restorative dental care. The early life factors associated with untreated dental caries during adulthood are unmodifiable but can identify risk. Factors acting throughout life (plaque levels and dental treatment) can mitigate this risk. Supported by the Health Research Council of New Zealand.
that may predict dental neglect among adults, how personality may affect dental neglect, or how dental neglect during early adulthood may affect oral health in mid-life.

Objectives: To (1) examine the association between Dental Neglect Scale (DNS) scores and personality traits, (2) investigate whether DNS scores predicted dental caries experience after controlling for personality characteristics, and (3) identify early life factors influencing dental neglect in adulthood.

Methods: Participants in the Dunedin Study completed self-report questionnaires, interviews, and dental examinations repeatedly up to age 38 years. Personality was measured using the Multidimensional Personality Questionnaire.

Results: DNS scores were available at ages 26, 32, 38 for 854 (85.1%) of the 1004 surviving participants at age 38. Trajectory modelling showed a high degree of stability of DNS scores over time. Generalised estimating equation modelling found that higher scorers on negative emotionality (NEM) had higher DNS scores. Higher NEM scores were associated with more missing teeth but fewer filled tooth surfaces. After controlling for personality traits in the final model, DNS scores remained a significant predictor of dental caries, particularly for untreated decayed surfaces (IRR=1.10; 95% CI=1.08-1.13). Early life factors such as tooth brushing habits at age 5, and the participants’ dental health-related beliefs in adolescence were associated with DNS scores over 30 years later, during adulthood.

Conclusion: Early life behaviours and personality traits in early adulthood are associated with dental neglect during adulthood. Dental neglect is also associated with later oral health. Early life modifiable risk factors such as self-care behaviours might be good targets for interventions to reduce dental neglect.

11.40am – 11.50am

Poppy Horne	DClinDent candidate (Periodontics)

Psychosocial aspects of periodontal disease diagnosis and treatment

PE Horne, LA Foster Page, JW Leichter, WM Thomson, ET Knight
Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

Background and Aim: Patient-reported outcomes (PROs) have attracted interest in periodontal research as our focus shifts from clinician-centric endpoints. PROs generate meaningful insight into the impact of a condition on patients. This mixed-methods study aimed to develop an understanding of the psychosocial impact of periodontitis diagnosis and treatment.

Methods: Fourteen adult patients with moderate-severe chronic periodontitis—and who had been referred to a university clinic—kept diaries about their experiences. The diary information was then used as a framework for semi-structured qualitative interviews conducted at the completion of their non-surgical therapy. Inductive thematic content analysis with NVivo® was employed. Data on clinical periodontal status and the condition’s impact (the latter determined with the short-form Oral Health Impact Profile, or OHIP-14) were collected at baseline and follow-up to supplement the qualitative data.

Results: Three themes, which described the detrimental impact of periodontal disease on the participants’ psychosocial wellbeing, were identified: ‘concealment’, ‘having a guilty conscience’ and ‘patient comfort as paramount’. These were related to a core underlying concept: ‘progression to a more positive outlook’, which described how the participants became more optimistic as they progressed through diagnosis and treatment. While most considered the treatment to be unpleasant, the participants not only perceived improvements in their symptoms, but described broader positive influences on their self-esteem, mood, work, relationships and future outlook. These findings were not reflected in the quantitative data, with a slight increase in the mean OHIP-14 score between baseline and follow-up (14.0 and 15.4 respectively). However, changes in self-reported periodontal status suggested greater periodontal awareness.

Conclusions: This study illustrates the broad impact of periodontitis, and gives clinicians valuable insights into the idiosyncratic experiences of our patients, to which we are not frequently exposed. An understanding of patients’ perspectives may improve our delivery of periodontal care.
**11.50am – 12pm**

**Abbey Corbett**  
DClinDent candidate (Paediatric Dentistry)

*Understanding restorative treatment decisions in the management of children and adolescents in New Zealand*

A Corbett, B Drummond, N Chandler, L Foster Page, A Meldrum, M Brosnan  
*Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago*

**Aim:** To examine restorative treatment decisions made by NZ Oral Health Practitioners in their management of dental caries affecting children and adolescents, and to explore factors that influence these decisions.

**Methods:** Two sampling frames were used to identify Oral Health Practitioners registered in: Dental Therapy Practice; General Dental Practice and Paediatric, Public Health and Special Needs Dentistry Specialist Practice. Questionnaires were distributed to participants using REDCap software. The questionnaire collected practitioner and practice demographics and presented clinical scenarios across approximal and occlusal lesion management in the primary and permanent dentition.

**Results:** From 2844 practitioners sampled, 638 (22.4%) responded. In the management of proximal caries, 17.3% of participants selected to restore a lesion within enamel when managing primary teeth. This constituted 15.6% when managing permanent teeth. Participants most frequently selected to restore proximal lesions using a slot preparation and resin composite. In the management of occlusal caries, 21.8% of participants would operatively intervene for a lesion confined to enamel in a primary tooth. This increased to 37.3% in the management of a permanent tooth. Almost all participants would remove carious tissue only, with few opening the whole fissure. Participants showed variation in their selection of restorative material in occlusal lesion management. Restorative treatment decisions demonstrated statistically significant associations with a number of practitioner and practice characteristics.

**Conclusion:** NZ Oral Health Practitioners appear to intervene early in the caries continuum when managing children and adolescents. Future research should focus on understanding the factors that influence treatment decisions and the barriers to instituting treatment strategies based on contemporary caries management philosophies.

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**12pm – 12.10pm**

**Shaikha Al Samahi**  
PhD candidate

*Increased expression of advanced glycation end-products (AGE) and its receptor (RAGE) in normal dental pulp of Type 2 diabetics*

S Al Samahi, T Milne, HM Hussaini, A Rich, I. Friedlander  
*Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago*

Type 2 diabetes (T2D) is a chronic systemic disease and growing global health problem that is characterized by hyperglycemia. It predisposes individuals to complications affecting many body organs and oral health. Hyperglycemia leads to generalized damage by increasing protein glycation and leads to the gradual build-up of advanced glycation end products (AGEs) in body tissues. AGEs exert noxious effects on tissues through a specific receptor (RAGE). This cell surface receptor is expressed on smooth muscle cells, endothelial cells, fibroblasts, lymphocytes and monocytes/macrophages. While there is evidence AGE and RAGE are associated with periodontal disease in diabetics, their expression in the dental pulp of diabetics has not been described. This project will provide knowledge about AGE and RAGE expression in normal uninflamed pulps and provide a platform for further work on inflamed pulps.

**Aims:** (a) To evaluate potential histological differences between ‘normal’ dental pulp in diabetics and non-diabetics  
(b) To examine the protein expression of AGE and RAGE in the ‘normal’ dental pulp.  
**Methods:** Clinically healthy teeth were collected from T2D participants (n=10) and non-diabetic participants (n=10) and cut transversely at the level of the cementoenamel junction. They were formalin fixed, decalcified in 10% EDTA, and paraffin embedded. Sections were stained with haematoxylin and eosin and Massons Trichrome for histological evaluation. Immunohistochemistry was used to detect the presence of AGE and RAGE and slides were analyzed using light microscopy.

**Results:** Teeth with inflamed pulps were excluded from the study. Histological differences were observed between diabetic and non-
Diabetic dental pulps. T2D samples had decreased cellularity, increased connective tissue and calcified deposits, and fewer blood vessels. AGE and RAGE were detected in both control and T2D samples with increased intensity in latter. RAGE positive staining was associated with endothelial cells.

Conclusion: T2D affects the morphology of normal dental pulp and the increased expression of AGE and RAGE in the presence of T2D may reflect and contribute to the altered immune response in this condition.

C. Lawrence, L. Mainvil, J. Antoun, L. Mei, M. Farella

Introduction: Oral health can be markedly affected by ethnicity and socioeconomic status. The aim of this study were: 1) to describe self-reported oral health, caries experience, tooth wear and dietary sugar intake in a Māori sample; and 2) to investigate for possible associations between oral health and sugar consumption.

Methods: This pilot study was designed as a cross-sectional, family aggregation study. Forty-three Māori families (41 parents and 90 children) residing in Northland, New Zealand, were recruited from three primary health care services. Study participants were firstly asked to fill in a questionnaire on self-reported oral health and dietary intake of sugar by beverage and food. Participants also underwent a clinical dental examination, received an intraoral scan, and provided a hair sample for an objective measure of dietary sugar consumption. Oral hygiene was measured using Greene's simplified oral hygiene index (S-OHI). Dental caries experience was assessed using the Decayed Missing Filled Teeth Index (DMFT/dmft), while tooth erosion was assessed by the Basic Erosive Wear Examination (BEWE). Data were analysed by a mixed model. Family pattern were investigated using intraclass correlation coefficients (ICCs).

Results: About 95% of study participants lived in an area with high deprivation scores (NZDep=8-10). Self-reported caries experience was high in parents, as the vast majority of them received dental restorations (90.2%) and/or tooth extractions (65.9%). Oral hygiene was fair in both parents and children (Mean S-OHI levels £ 1.3). The mean DMFT/dmft (± SD) for parents and children were 9.8 (± 5.6) and 2.3 (± 2.1), respectively. Tooth wear levels were mostly confined to enamel in both parents (S-OHI=0.9±0.7) and children (S-OHI=1.3±0.5). Oral hygiene, as represented by S-OHI, was significantly associated with both DMFT/dmft (IRR=1.39;P=0.006) and BEWE scores (P=0.028). Sugar intake, as represented by SSB, SSF, and 13C hair content, was not significantly associated with DMFT/dmft and BEWE scores. Weak family patterns were identified for both caries experience and erosion (ICC £0.23).

Conclusion: This small sample of Northland Māori had high deprivation scores and modest-to-low oral health conditions. Caries experience and tooth erosion were significantly associated with oral hygiene, but not with dietary sugar intake. It is evident, however, that oral health disparities still exist in New Zealand, and also affect Māori.

D. Ramanan, S. Palla, A. Polonowita, M. Farella

Abstract: Introduction: Myogenous pain is a subgroup of temporomandibular disorder (TMD). It is a complex condition not fully understood at this time. One possible causal factor of myogenous TMD may be overloading of the jaw joint and muscles as a result of
prolonged low level clenching. This includes behaviours such as clenching and grinding, which may be observed during awake hours. The use of surface electromyography allows for the objective collection of jaw muscle activity allows comparison of masticatory muscle activity between patients with myogenous TMD, and pain-free controls.

Methods: Female cases (N=29, mean age 27.4 yrs) diagnosed with myalgia or myofascial pain with referral were age matched with TMD-free controls (N=26, mean age 28.0 yrs). A single examiner completed a standardised TMD examination on all participants, to confirm eligibility for the study. Participants were fitted with a minimally invasive, wireless EMG sensor on the skin surface overlaying the masseter muscle on their preferred chewing side. Participants wore the EMG sensors while awake, over two consecutive days.

Results: The vast majority of the participants in the case group had myalgia affecting the masseter muscles. Maximum unassisted mouth opening was comparable between the two groups. The maximum voluntary contraction for the masseter muscle (MVC) was 1102.7 ± 546.2 in the case group and 1202.5 ± 424.5 in the control group. There was no significant difference in the MVC between the groups (p=0.29). The frequency, duration and amplitude of masseter contraction episodes were calculated. Most masseter contraction episodes of both cases and controls were of relatively low amplitude (< 10% MVC) and short duration (<10 seconds).

Conclusion: Wireless electromyography in participants with myogenous pain can be used to assess parafunctional behaviour during awake hours in the natural environment.

12.30pm – 12.40pm
Elizabeth Williams, DClinDent candidate (Oral Pathology)

Investigation of the presence of human papillomavirus in verrucal-papillary lesions of the oral cavity

E Williams, B Seo, H Hussaini, D Coates, AM Rich
Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

Background and objective(s): Human papillomavirus (HPV) is known to cause skin and mucosal infections, showing tropism for squamous epithelium. Verrucal-papillary lesions of the oral cavity (OVPL) include a spectrum of benign, potentially malignant and malignant epithelial lesions, thought to be induced by HPVs. The purpose of this study was to investigate the presence of HPV antigen and nucleic acids (DNA) in OVPLs using immunohistochemistry (IHC) and PCR.

Methods: Forty-one archival formalin-fixed paraffin-embedded (FFPE) tissue samples were obtained from four specific histopathologically confirmed groups of OVPLs and related lesions: squamous papilloma (SP; n=10), verrucous hyperplasia (VH; n=15), verrucous carcinoma (VC; n=6) and oral squamous cell carcinoma (OSCC; n=10). Cervical carcinoma tissue samples were used as positive controls (n=2). Anti-p16 and anti-pan HPV antibodies were used for the IHC. Quantification and detection of high risk-HPV [12 types] (HR-HPV) DNA was carried out using qRT-PCR TaqMan assays.

Results: Expression of p16 was detected in the following: SP 6/10 (60%), VH 13/15 (86%), VC 2/6 (33%) and OSCC 6/10 (60%). HPV was detected with the anti-pan HPV antibody in the cervical control specimen and in one OSCC sample. This positive OSCC sample was also positive for p16. HR-HPV DNA was not detected in any of the OVPL FFPE tissue specimens using qRT-PCR. Endogenous controls detected human DNA in all samples with Cq values of <35 indicating good levels of DNA. HR-HPV DNA was detected in the internal controls as well as both positive control cervical tissue samples with Cq values of 28.89 and 29.96.

Conclusion: p16 was highly expressed in 65.8% of the OVPLs using IHC. HR-HPV DNA was not detected in OVPLs and only one OSCC sample was positive for HPV using IHC. Hence this study showed that p16 is not a useful surrogate marker for HR-HPV associated with OVPLs.

12.40pm – 1.30pm
Lunch and poster judging (ODT Gallery)
Dental tissue regeneration: What are the modifying factors and how could a conducive environment for healing be generated?

STAFF PRESENTATIONS (15 MINUTES EACH)

2pm - 2.15pm

Dr Tanmoy Bhattacharjee  Postdoctoral Fellow

Tissue elasticity measurements using UltraD3 device

TT Bhattacharjee1, KC Li1, I Sinno2, P Harris2, R Petherick2, N Waddell1, WJ Duncan1
1. Sir John Walsh Research Institute, Faculty of Dentistry
2. Sensing and Automation, Callaghan Innovation

Background: Periodontitis affects 743 million people worldwide. Early diagnosis is imperative for better management of this disease. We are developing an ultrasonic hand-held device (“UltraD3”) to aid early diagnosis based on tissue elasticity. A desktop prototype UltraD3 was built to demonstrate proof of principle.

Aims: To validate the measurement of tissue elasticity using ultrasound palpation using the prototype UltraD3.

Methods: UltraD3 was validated against the Instron Universal Testing Machine (UTM). Pig belly purchased from the supermarket. Unfixed skin samples approximately 4x2cm were defatted to 2mm thickness. Elasticity of samples was measured using UltraD3 mounted in a desktop support and captured using custom software on a laptop computer. Samples were clamped in a custom 3-D-printed jig and stretched in the Instron UTM. Separate samples received compressive measurement. Elastic modulus using UltraD3 was compared with the curve obtained using the Instron UTM. To model inflammatory changes, further samples were allowed to decompose for 2 weeks at room temperature in saline or fresh water and measured daily. Stretched versus un-stretched and decomposed versus fresh UltraD3 measurements were compared using T-test. After all measurements, samples of tested tissues were formalin-fixed, embedded and 4µm H&E-stained-sections examined at up to 20x magnification.

Results: Elasticity measurements were obtained rapidly and reproducibly using UltraD3, with curves comparable to Instron measurements. Elasticity increased after stretching, but decreased after compression. Decomposing tissue also showed loss of elasticity in fresh water but not saline. Histological evidence suggested loss of ground substance around collagen fibre bundles as the main cause of changes in tissue elasticity.

Conclusion: UltraD3 was validated as a means to measure tissue elasticity and seemed sensitive enough to capture biological processes. Unexpectedly, potential uses in the field of forensic investigation also became apparent. Further studies will aid fine-tuning final product design and parameters for in vivo measurements using the 2nd generation intra-oral device.

Supported by MBIE grant # UOOX1504
2.15pm – 2.30pm
Dr Jithendra Ratnayake  Assistant Research Fellow
Ionic substituted bovine-derived hydroxyapatite bone grafts for dental surgery applications

J Ratnayake1, M Gould2, G Dias2
1. Sir John Walsh Research Institute, Faculty of Dentistry
2. Department of Anatomy, University of Otago

Introduction: Hydroxyapatite (HA) is the main mineral constituent of bone and teeth. Biologically derived hydroxyapatite is of great interest due to its superior biocompatibility and osteoconductivity. A xenograft material, bovine hydroxyapatite (BHA) has been developed. The aim of the present study was to modify the BHA using ionic substitutions to improve its bioactivity.

Method: Fluoride and silicate ions were successfully substituted into BHA using a modified sol-gel process to produce bovine-derived fluorapatite (BFA) and silicon-substituted bovine hydroxyapatite (SiBHA). The two materials were chemically, physically and structurally characterised. The biological properties of the materials in terms of cytocompatibility and differentiation were investigated using in-vitro experiments.

Results: Fourier transform infrared (FTIR) spectroscopy confirmed that fluoride and silicate ions were substituted into the hydroxyapatite lattice with the presence of carbonate, hydroxyl and phosphate functional groups which is associated with HA. X-ray diffraction analysis further confirmed the substitution of fluoride and silicate ions into the HA lattice. EDX analysis showed that the inorganic phases of BFA and SiBHA were mainly composed of calcium and phosphorus with trace amounts of sodium, magnesium and potassium. Scanning electron microscopy and micro-CT analysis showed the scaffolds exhibited an interconnected porous architecture with a pore diameter ranging from 100-700 μm with a total porosity of 70-73%. Thermogravimetric analysis showed that the two materials remained stable up to 1000°C losing only ~2% weight. Both BFA and SiBHA exhibited superior mechanical properties to BHA. In-vitro experimentation demonstrated that BFA and SiBHA scaffolds exhibited superior biological properties compared to BHA in terms of cell viability and proliferation and promoted in-vitro osteogenic differentiation of SaOS-2 cells.

Conclusion: BFA and SiBHA materials possessed superior mechanical and biocompatibility properties compared to BHA. However, further research is necessary to evaluate the clinical feasibility of the xenografts as a bone graft substitute material.

2.30pm – 2.45pm
Dr Nick Heng  Senior Lecturer
Dysgalacticin and Sanguinicin K11, two novel antimicrobial proteins (Bacteriocins) targeting important pathogens

NCK Heng1, JDF Hale2,3, PM Swe2,4, DA Power2, JR Tagg3
1. Sir John Walsh Research Institute, Faculty of Dentistry
2. Department of Microbiology and Immunology, University of Otago
3. Blis Technologies Ltd, Dunedin
4. QIMR Berghofer Medical Research Institute, Brisbane, Queensland, Australia

Some members of the genus Streptococcus can cause serious disease in humans, for example Streptococcus pyogenes (strep sore throat, rheumatic fever) and Streptococcus agalactiae (neonatal sepsis, mastitis). Therefore, there is great interest in developing novel effective antibiotics, especially those that specifically target these pathogens. This presentation focuses on the novel and unusual antimicrobial proteins (“bacteriocins”) produced by two oral streptococcal strains, Streptococcus dysgalactiae subsp. equisimilis W2580 and Streptococcus sanguinis K11. S. dysgalactiae W2580 produces dysgalacticin, a large 21.5-kDa protein that is predicted to resemble a “molecular hand grenade” with a N-terminal “safety pin” attached to the C-terminal “grenade”, but apparently kills S. pyogenes strains without blowing the cells apart. Sanguinicin K11, on the other hand, is a small 5.1-kDa peptide antibiotic produced by S. sanguinis K11 that inhibits all S. agalactiae strains (human and animal origin) and a proportion of S. pyogenes. Interestingly, whilst dysgalacticin and sanguinicin K11 are quite different structurally, they both possess a disulphide linkage that is essential for biological activity. The biosynthetic (genetic) loci of both bacteriocins presentation are also quite different. Whereas dysgalacticin is encoded by a single gene on a plasmid and the protein exported by the cell’s common secretory pathway, the sanguinicin K11 genetic locus comprises six
chromosomally-located genes that encode the sanguinicin precursor peptide, a dedicated export system, a modification protein and two immunity proteins. The last part of this presentation will describe how dysgalacticin could possibly be enhanced to either (i) kill \textit{S. pyogenes} more effectively, or (ii) have an expanded spectrum, i.e. be able to inhibit other pathogenic streptococci such as the caries-causing \textit{Streptococcus mutans}.

### 2.45pm – 3pm

**Associate Professor Dawn Coates**
**Research Associate Professor**

**Regulation and control of stem cells**

**DE Coates, DG Zanicotti, Z Dong, NY Naung, M Alansary, TJ Milne, WJ Duncan**

\textit{Sir John Walsh Research Institute, Faculty of Dentistry}

Stem cells are a diverse set of cells and understanding the role of stem cells niches, their regulation, and then differentiation to defined lineages is important if these cells are to be used in clinical applications. The aims of this research are: 1/. to introduce deer antler as a model mammalian system for stem cell regeneration; 2/. to investigate the location, phenotyping, regulation and application of mesenchymal stem cells derived from fat, tooth pulp and palatal periosteum.

This research investigates deer and sheep model systems along with human derived stem cells. Differential protein expression was investigated using 2D-DIGE and the role of pleiotrophin and its receptors investigated with immunohistochemistry. Adipose-derived stem cells were obtained from human and sheep sources and grown in STEMPRO medium prior to tri-lineage differentiation, qRT2-PCR, and placement in critical sized bone defects. Human palatal periosteum and tooth pulp stem cells have been grown in E8 medium with \textit{in vitro} assays including: qRT2-PCR, FACS, differentiation, protein detection, inhibition and proliferation.

Stem cells have been isolated from adipose, periosteum, and tooth pulp. When cultured in xeno-free medium they tri-lineage differentiated into adipocytes, chondroblasts and osteoblasts. Human tooth pulp cells were differentiated into ectodermal, endodermal and mesodermal lineages. Palatal periosteum stem cells were identified \textit{in vivo} and \textit{in vitro}, and the role of HGF and MET in osteogenesis investigated. Adipose-derived stem cells were isolated, labelled, and transplanted into critical sized defects in sheep. Proteomics on antler stem cell niches has identified a number of pathways critical to maintaining stem cells including pleiotrophin and its receptors.

Stem cells for clinical use must be harvested and amplified in a xeno-free environment which retains their ‘stemness’. The identification of stem cell niches and the molecules that maintain and then differentiate these cells is of critical importance for successful tissue repair and regeneration.

### STUDENT PRESENTATIONS (10 MINUTES EACH)

### 3pm – 3.10pm

**Zhen Dong**
**PhD candidate**

**A model research platform to investigate stem cell-based regeneration - deer antler proteomics**

**Z Dong\textsuperscript{1,2}, C Li\textsuperscript{1,2}, H Sun\textsuperscript{2}, D Coates\textsuperscript{1}\**

1. \textit{Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago, New Zealand.}
2. \textit{Institute of Special Wild Economic Animals and Plants, Chinese Academy of Agricultural Sciences, China}

The ability to activate and control stem cells during tissue repair and regeneration is an emerging theme bringing innovative approaches to clinical medicine. Animal models can provide important insights into stem cell activation and control. The regenerative capacity of metazoans and some amphibians has been well documented, however in mammals, stem cell niches that drive organ regeneration are rare. Deer antler is unique in providing a mammalian model of complete organ regeneration based on stem cells.
This model allows the discovery of mechanisms and proteins underlying the activation of stem cell niches involved in regeneration of a complex organ.

The present study investigated the differentially expressed proteins between different antler stem cell niches and facial periosteum cells as the control. All groups were investigated as biological replicates (N=3) using two-dimensional fluorescence difference gel electrophoresis to yield quantitative proteomic data. Western blotting was used to validate the proteomics result. In addition mesenchymal stem cells (MSCs) in the antler tips (N=3) were localised through immunohistochemical (IHC) staining of MSCs markers – CD73, CD90 and CD105.

Comparative proteomics resulted in protein profiles which were similar for the biological replicates but different between two of the stem cell niches and facial periosteum. Ninety-two up- and down-regulated proteins were identified by MALDI-TOF MS. The proteomics result was confirmed via western blot analysis. All the three MSCs stem cell markers localised to a stem cell niche and pericytes in the antler tip.

The location of all three MSC markers in the antler tip confirmed the central role of stem cell activation in development of this mammalian organ. Proteomics on antler stem cells revealed that many biological processes and signal pathways participate in antler generation and regeneration. This work provides new insights into the underlying mechanisms in stem cell-regulated regeneration and provides new directions for future research.

3.10pm – 3.20pm

Pip Greer DClinDent candidate (Oral Medicine)

A small molecule inhibitor of Galectin-1 and oral squamous cell carcinoma; in vitro studies on therapeutic potential

Greer, P, Rich AM, Coates D
Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

Galectin-1 is a carbohydrate-binding molecule that has been shown to be over-expressed in many types of cancer, including oral squamous cell carcinoma (OSCC). The higher the level of expression of galectin-1 by OSCC cells the greater the likelihood of invasion, distant metastasis and a poor survival rate.

Objectives: Investigation of the effect of galectin-1 in OSCC invasion, migration and epidermal-mesenchymal transition in vitro, and the effect of inhibition of galectin-1 using a small-molecule inhibitor (OTX008).

Results: One normal oral keratinocyte (NOK) cell line and three OSCC cell lines were cultured and the expression of galectin-1 protein in each quantified using an ELISA. All cell lines were found to express galectin-1, and one of the OSCC lines produced significantly more galectin-1 than the NOK cell line at 6, 24 and 48 hours.

All four cell lines were cultured with three concentrations of galectin-1 (50, 100 and 150 ng/mL) and four concentrations of OTX008 (12.5, 25, 50 and 100 μg/mL), and cell viability was assayed at 24, 48, 72 and 96 hours. Galectin-1 decreased cell viability at 24 hours in two of the OSCC lines, had no effect on the third, and increased cell viability in the NOK cells at 72 hours. OTX008 reduced cell viability in a dose-dependent manner in all cell lines, and this effect increased at each time point during a 96 hour culture period. OTX008 had the least effect on cell viability of the OSCC line with the highest galectin-1 levels compared to the other cell lines.

Conclusions: Galectin-1 is expressed by NOK and OSCC cell lines in vitro. OTX008 decreases the cell viability of OSCC and NOK cells in a dose-dependent manner, however.
Expression and purification of Candida albicans multidrug efflux pump Cdr1 for structural studies

G Madani1, E Lamping1, NC Ha2,3, AK Mitra3, RD Cannon1

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2. College of Agriculture and Life Sciences, Seoul National University, Seoul, South Korea
3. School of Biological Sciences, University of Auckland

Membrane proteins are notoriously difficult to study. However, recent advances in membrane protein purification technology and single particle cryo-EM (electron microscopy) have resulted in a rapid rise in the number of solved membrane protein structures. The aim of this project is to express, purify, and determine the high-resolution structure of the plasma membrane pleiotropic drug resistance (PDR) ATP-binding cassette (ABC) transporter Cdr1. Overexpression of the multidrug efflux pump Cdr1 is the main cause of the azole antifungal drug resistance of the major human fungal pathogen, Candida albicans. Functional Cdr1 with a C-terminally fused GFP followed by a 6His tag was overexpressed in the heterologous host Saccharomyces cerevisiae and Cdr1-containing plasma membranes were isolated by differential centrifugation. Amongst the 20 detergents tested, n-Dodecyl β-D-maltoside (DDM), at a detergent to protein ratio of 2 (w/w), was the detergent of choice for solubilizing Cdr1 in a stable form. The solubilized Cdr1-GFP-6His protein was purified by Ni-affinity chromatography followed by size exclusion chromatography (SEC). SEC with multi-angle light scattering (SEC-MALS) revealed Cdr1-GFP-6His to be a stable monomer. Protein with and without detergent exchanged for amphipols, was subjected to crystal trials, negative staining and cryo-EM. Preliminary negative staining and cryo-EM results demonstrate sample homogeneity and monodispersity, features that bode well for the structural resolution of Cdr1.

STUDENT PRESENTATIONS (10 MINUTES EACH)

Imad Al Lawati and Hind Al Maskari BDS students
I am a lefty in a right-handed world – Qualitative analysis of clinical learning experience of left-handed undergraduate dental students

I Al Lawati, H Al Maskari, S Ma
Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

Background: Left-handedness is the preferential use of the left hand in single-handed activities like writing (Porac, 2016). There are many studies in the literature on left-handedness in relation to professional sports, medicine and surgery. Although dentistry largely depends on manual dexterity and hand skills, there has been little research to investigate the correlation between handedness and clinical dentistry, particularly in Australasia.

Objective: To gain an insight into the clinical learning experience of left-handed undergraduate dental students at the Faculty of Dentistry, University of Otago.
Method: Purposive sampling of left-handed students were done within the BDS5 group and they were invited to participate in a semi-structured group interview to discuss their clinical learning experience at the faculty. Six participants agreed to participate and the interview was recorded and transcribed verbatim. Collected data were analysed using a thematic inductive analysis approach.

Results: All participants reported having clinical difficulties being left-handed students learning using right-handed equipment. There was a common theme of experiencing hand and wrist musculoskeletal problems as well as feeling of guilt causing patient discomfort during treatment. The majority of participants reported incidents where they were told by their supervisors to learn practising dentistry with their right hand and they felt that little guidance was given on how to operate as a left-handed clinician. All participants perceived that being a left-hand operator affected their performance and confidence level in their early clinical years.

Conclusion: Left-handed students have a strong sense of adaptability. However, in order to improve the learning experience regardless of the difference in the operator’s preference of dominant hand, students should be provided with appropriate equipment such as ambidextrous dental chairs and professional guidance especially during their early career.

4pm – 4.10pm
Danni Chen BDS student

Patient satisfaction and aesthetic outcome of single implant crown treatment completed in a University teaching setting

D Chen, CL Sim, S Ma
Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

Aims: To assess the level of single implant treatment provided at the university teaching setting and the patient satisfaction related to treatment outcome.

Materials and Methods: Out of 42 patients that completed single implant crown treatment in the maxillary esthetic zone (tooth 15 - 25) at the Faculty of Dentistry, University of Otago during 2011 - 2015, 29 patients agreed to participate in the study. Pink and white esthetic scores (PES/WES) were used to objectively measure the esthetic outcome of the treatment. Participants also completed a satisfaction survey.

Results: All 29 participants were classified as successful according to the implant success criteria. The mean total PES/WES score was 13.2/20 (range 4 - 17). The mean total PES score was 6.2/10 indicating favourable overall peri-implant soft tissues. The level of facial mucosa scored the highest (score = 1.6/2), while root convexity/soft tissue colour and texture had the lowest value at 1.10. The mean total WES (score = 7.1/10; range 3 - 10) was higher compared to the PES which was 6.2/10. Surface texture had the highest mean value at 1.8, while the lowest mean value was associated with the color (value) component (score = 0.79). The mean total patient satisfaction score was 40.7/45 with a range of 31 - 45 showing a favourable outcome from the patients' perspective.

Conclusion: Our results showed that the level of patient satisfaction was not significantly associated with the PES/WES unlike the duration of overall treatment. Restorations completed by undergraduate dental students had similar PES/WES and patient satisfaction level when compared to those completed by more experienced clinicians.
4.10pm – 4.20pm

Jodie Bryant    BDS (Hons) student

Comparison of using sodium hypochlorite with different immersion duration for decontaminating used implant healing abutments

J Bryant, G Tompkins, A Tawse-Smith, JN Waddell, S Ma
Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

Aims: To assess the effectiveness of using sodium hypochlorite (NaOCl) with different immersion duration to eliminate remaining contaminants on used healing abutments after routine sterilisation.

Methods: Fifteen used healing abutments which have been previously autoclaved at 132°C for 7 minutes were randomly divided into one control group (A) and four test groups (B - E). All healing abutments were photographed using a light microscope and capture system (Nikon SMZ800) at 2x magnification after which they were stained using Phloxine B (400g/mL). The used healing abutments were subsequently imaged again to assess the baseline amount of contamination present. The four test groups (B – E) underwent decontamination treatment using NaOCl (25g/L) for 10, 15, 20 and 25 minutes respectively. After each cycle, the healing abutments were rinsed twice in 40mL of distilled water at dried at 50°C overnight. The healing abutments were stained and imaged again to assess the effectiveness of different decontamination duration.

Results: The control group (A) showed a contamination level of 33.8% after autoclaving only. Group B showed a result of 2.0% residual contamination after 15 minutes in sonicated NaOCl solution. Group C showed a contamination level of 0% while Group D still had 0.2% residual contamination after 20 minutes of treatment. Addition 5 minutes of exposure to the NaOCl solution (Group E, 25 minutes) showed 0% contamination level.

Conclusion: Within the limitations of this study, immersing used healing abutments in sonicated NaOCl solution is a viable decontamination method. Increasing the time of exposure to NaOCl resulted in decrease in the amount of detectable residual contaminants. A further study involving a larger number of samples should be tested for the validity of this methodology.

4.20pm – 4.30pm

Ana Low   DClinDent candidate (Orthodontics)

Development of an in vivo model to investigate the effects of different adhesive removal methods around orthodontic brackets

A Low, J Antoun, G Tompkins, L Mei, M Farella
Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

Aims: Orthodontic fixed appliances, and particularly the excess adhesive around orthodontic brackets, create an environment that is conducive to bacterial accumulation in the form of a biofilm which may increase the risk of dental caries and periodontal disease. Several methods are employed in clinical practice to remove this excess adhesive during application of the brackets, however little is known about each method’s effect on the resultant biofilm. The purpose of this study was to develop a protocol to investigate the effect of different removal methods on initial biofilm accumulation around orthodontic brackets in vivo.

Methods: The prospective pilot study involved recruiting six healthy participants (n=6 mean age 29 years) at the School of Dentistry, University of Otago. Participants that met the inclusion criteria received a customised maxillary double vacuum formed retainer containing six bovine enamel discs with bonded orthodontic brackets (three per side). Each disc was randomly allocated to canine, premolar or molar sites using block randomisation. The adhesive was removed using either a scaler, tungsten carbide bur or it was left in situ. The participants wore the appliances for four consecutive days. Three outcome measures were investigated: pH, microhardness and elastic modulus and compared to controls (discs with bonded orthodontic brackets with no plaque accumulation). A novel pH assay was developed for the purposes of this study.
Results: All the interventions had a statistically significant difference in pH changes compared to the control (p<0.001, F = 44.4). The premolar site had the lowest final pH which was significant (p=0.023, F=4.3) There was no difference in final pH between method of removal of adhesive.

Conclusion: Location had a more significant effect on cariogenic biofilm accumulation around orthodontic brackets than method of adhesive removal. This research model has the potential for future intraoral biofilm research around orthodontic brackets.

**STAFF PRESENTATIONS (15 MINUTES EACH)**

4.30pm – 4.45pm  
Dr Li Mei  
Senior Lecturer  
**Efficacy of oral probiotics in managing biofilm formation in patients wearing fixed orthodontic appliances**

I. Mei1, G Benic1, RD Cannon1, N Heng1, X Morgan2, M Farella1  
1. Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago  
2. Department of Microbiology, University of Otago, New Zealand

Aim: Biofilm accumulation is a common problem in patients undergoing orthodontic treatment with fixed appliances. Probiotic bacteria may inhibit the growth of pathogenic microbes in these biofilms. This study investigated the effects of the oral probiotic *Streptococcus salivarius* M18 on dental biofilm, gingival inflammation, and oral malodour in patients wearing fixed orthodontic appliances.

Materials and Methods: The study was designed as a prospective, randomised, triple-blind, two-arm parallel group, placebo-controlled trial. Sixty-four patients undergoing fixed orthodontic treatment were randomly allocated to a probiotic (n = 32) or a placebo intervention group (n = 32). The oral probiotic or placebo intervention consisted of lozenges of identical shape, colour, smell and taste. Patients were asked to consume two lozenges per day for 1 month. Assessments were made at baseline, at the end of intervention, and after a 3 month follow-up. The outcome measures were plaque index (PI), gingival index (GI) and halitosis-causing volatile sulphur compounds (VSC) levels. The taxonomic profiles of dental biofilm before and after the intervention were analysed utilising next-generation sequencing of bacterial 16S rRNA genes.

Results: PI and GI scores were not significantly influenced by the probiotic intervention (intervention × time: P > 0.05). The level of VSCs decreased significantly in both the probiotic group (VSC reduction = -8.5%, P = 0.015) and the placebo group (VSC reduction = -6.5%, P = 0.039) after 1 month. However, at the 3-month intervention-free follow-up, VSC levels of the placebo group returned to baseline levels whereas those of the probiotic group decreased further compared to baseline readings (-10.8%, P = 0.005). The relative abundance of bacteria genera in dental plaque was not influenced by the intervention.

Conclusion: Oral probiotic *S. salivarius* M18 can reduce the VSC levels in patients with fixed appliances but effects on plaque and gingival indices or dental biofilm composition are minimal.

4.45pm – 5pm  
Dr Arthi Senthilkumar  
Assistant Research Fellow  
**Challenges in clinical teaching investigated: towards sustainable staff recruitment and retention in dentistry**

A Senthilkumar1, L Adam1, C Loch1, BJ Howe2, P Brunton1  
1. Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago  
2. Department of Family Dentistry, College of Dentistry and Dental Clinics, University of Iowa, Iowa City, Iowa, USA

Aim: The study was conducted to identify factors that affect retention and recruitment of dental clinical teaching staff at the Faculty of Dentistry, University of Otago, New Zealand. The study has explored issues that influence the clinicians to take up teaching roles and possible barriers to continue in their current role.
Methodology: A short questionnaire survey was distributed to current dental clinical teaching staff to understand the retention strategies and barriers. The collected quantitative and qualitative data were analysed and presented.

Findings: The response rate was almost 96% with equal distribution of female and male clinicians. The majority of participants were European New Zealanders, followed by Asians. Themes identified to improve the retention strategies were the necessity of formal teaching skills, clinical teaching as a career pathway, pay progression, lack of support, and workload.

Conclusion: The study results suggested that the respondents were motivated to give back to their profession through engaging in dental clinical teaching. Clinical teaching staff can be retained by assigning a clear career pathway and encouraging career progression. The study identified barriers that should be addressed to sustain the teaching model in the future. Few studies have aimed to understand the barriers to dental clinical teaching staff continuing teaching. This study identified that lack of career pathway and minimal pay progression are major factors that impact the retention of dental clinical teaching staff.

5pm – 5.15pm
Dr Carolina Loch Santos da Silva  Lecturer
When whales had teeth: dental morphology and ultrastructure in ancestral cetaceans from Antarctica

C Loch¹, MR Buono²
1. Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago.
2. CENPAT/CONICET, Argentina

Modern whales have no teeth, using keratinized baleen plates to filter huge volumes of small prey from seawater, while dolphins possess a simplified, homodont and numerous dentition used to pierce and grasp fish and squid. However, cetacean ancestors had a heterodont dentition with complex and ornament teeth. This study describes the morphology of teeth and enamel ultrastructure in two ancestral cetaceans from Antarctica: a Basilosauridae archaeocete, representing a now extinct lineage, and Llanocetus sp., one of the oldest known ancestors of baleen whales. The Basilosaurid was collected from La Meseta Formation (middle Eocene) and Llanocetus sp. from Submeseta Formation (late Eocene), in Seymour Island, Antarctica. After being photographed and described, teeth were embedded in epoxy resin, sectioned, ground polished, etched and coated with gold palladium for SEM observation. The two teeth analysed were lower premolars, with a transversally compressed triangular crown with a main cusp and accessory denticles. The enamel of Basilosauridae and Llanocetus sp. is prismatic with decussating Hunter-Schreger bands (HSB) and an outer layer of radial enamel. In Basilosauridae, the enamel was relatively thin and measured 150-180 µm, while in Llanocetus it was considerably thicker, measuring 830-890 µm in the coronal area and 350-380 µm near the crown base. Structures resembling enamel tufts and lamellae were observed at the EDJ and extending along the thickness of the enamel layer, respectively. Despite the simplification or complete absence of teeth in modern whales, their basal ancestors had complex posterior teeth typical of most mammals. The same trend was observed in the ultrastructure of enamel, which is thin and either radial or prismless in most modern toothed cetaceans, but was moderately thick and with prominent HSB in basilosaurids and Llanocetus. The presence of HSB and biomechanical reinforcing structures such as tufts and lamellae suggest heavy occlusal loads during feeding.

5.15pm – 5.30pm
Presentation of SJWRI Awards and meeting close (ODT Gallery)
Poster presentations

Posters are available for viewing during the breaks between sessions. We ask that presenters put up their posters before the beginning of the morning tea break, and take them down at the end of the afternoon tea break.

Judging will take place during the lunch break.

**Posters to be presented** (at time of press – late submissions may be added to the programme)

Theme: New Technologies And Therapeutics

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<td>DClinDent</td>
<td>Clinical evaluation of modified GIC restorations applied using ART</td>
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<td>Chai SY</td>
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<td>Gee C</td>
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<td>Mei L</td>
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<td>Effect of non-fluoride agents on prevention of caries in primary dentition</td>
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<td>Mei L</td>
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<td>Ratnayake J</td>
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<td>Comparative efficacy of endodontic medicaments &amp; sodium hypochlorite against Enterococcus faecalis biofilms</td>
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Theme: Evaluating Our Teaching, Learning And Practice

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<td>Adam L</td>
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<td>Dental curricula implications of Dunedin early childhood teachers’ understandings of oral health</td>
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<td>Ali HM</td>
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<td>Ratnayake J</td>
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<td>A survey of general dental practitioners in New Zealand: Indirect restorations and fixed prosthodontics</td>
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<td>Senthilkumar A</td>
<td>Assistant Research Fellow</td>
<td>Do they stay or do they go? Practising destination of current students and past dental graduates in New Zealand</td>
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SJWRI Research Day 2018 is made possible by the continued generous support of 3M Oral Care.

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