



Sir John Walsh
Research Institute
Research Day 2017

Tuesday 5 September
Dunedin Public Art Gallery

Programme and Abstracts

Sir John Walsh Research Institute

The Sir John Walsh Research Institute (SJWRI) advances research and increases knowledge for the improvement of oral health in New Zealand, and provides a national focus for dental research. The Institute's innovative, future-focused, interconnected research programmes cover the spectrum of oral health research, from the molecular, through biological systems to the health of populations.

The SJWRI is integral to New Zealand's only Faculty of Dentistry, ranked as one of the best dental schools in the world, and its members have well-established productive collaborations across the University and with other institutions in New Zealand and worldwide. Our mission is to undertake research that underpins our teaching and clinical practice, and that translates discoveries into measurable health improvements for all New Zealanders. The Institute is named after Sir John Walsh, Dean of Dentistry from 1946 to 1971, a strong advocate for research in dentistry and oral health.

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SJWRI



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SJWRI Research Day 2017 is made possible by the generous support of 3M Oral Care.



IADR

International Association
for Dental Research
Australian/New Zealand Division

SJWRI Research Day 2017 is supported by the New Zealand Section of the International Association for Dental Research ANZ Division.

Symposium programme

Tuesday 5 September

8.30am **Registration** (Auditorium foyer)

8.45am **Welcome**

SESSION CHAIR: PROF RICHARD CANNON

Professor John Broughton

ASSOCIATE DEAN (MĀORI), DENTISTRY

Professor Peter Crampton

PRO-VICE-CHANCELLOR, HEALTH SCIENCES

9.00am **Invited keynote presentations**

SESSION CHAIR: PROF MAURO FARELLA

Prof Peter Hunter

DIRECTOR, AUCKLAND BIOENGINEERING INSTITUTE, UNIVERSITY OF AUCKLAND

DIRECTOR, MEDICAL TECHNOLOGIES CoRE

Overview of the Physiome Project

9.30am **Prof Alan Brook**

UNIVERSITY OF ADELAIDE AND QUEEN MARY UNIVERSITY OF LONDON

The emerging fields of complex systems and networking have major implications for health research

10.00am **Sponsor presentation**

Stephen Langdon

SCIENTIFIC AFFAIRS MANAGER ANZ

3M ORAL CARE

10.15am **ORAL MOLECULAR AND IMMUNOPATHOLOGY I** (Auditorium)

SESSION CHAIR: PROF ALISON RICH

Invited speaker

A/Prof Roslyn Kemp

DEPARTMENT OF MICROBIOLOGY & IMMUNOLOGY, UNIVERSITY OF OTAGO

Immunology in cancer – using big data to improve outcomes

10.40am **Morning tea & poster viewing (30 min)** in the ODT Gallery

11.10am (Auditorium)

ORAL MOLECULAR AND IMMUNOPATHOLOGY II

SESSION CHAIR: PROF ALISON RICH

STUDENT PRESENTATIONS (12 MIN EACH)

Adil Alkharusi

Expression of STAT 3 and cytokines (IL22, IL23, IL17) within metastatic lymph nodes of Oral Squamous cell carcinoma (OSCC)

Nurul Ruziantee Ibrahim

Lymphangiogenesis in metastatic lymph nodes of oral squamous cell carcinoma

Hitesh Navani

Angiogenic growth factor expression in the apical papilla of immature permanent teeth

Nawal Abdul Rahman

Expression of the Lysyl Oxidase family in odontogenic lesions

12.00pm (Auditorium)

BIOMATERIALS I

SESSION CHAIR: A/PROF NEIL WADDELL

Dr Carolina Loch

Wild dentistry: dental wear and calculus deposits in New Zealand orca

12.15pm

Dr Joanne Choi

Bond strength between modern denture base acrylics and reline materials

11.10am (Conference room level 2)

CLINICAL AND TRANSLATIONAL RESEARCH

SESSION CHAIR: PROF WARWICK DUNCAN

Prof Warwick Duncan

Development of a novel animal model for testing antimicrobial agents against periodontitis and peri-implantitis

STUDENT PRESENTATIONS (12 MIN EACH)

Eugene Sheftel

Xenogenic and alloplastic materials for sinus floor elevation: a sheep study

Victoria Kashchuk

Effect of a chewable manuka honey tablet with xylitol, on oral health including dental plaque activity and gingival health in young adults

Assil Russell

The Butterfly Effect: An investigation of sealer penetration and adaptation in root canals

Soo-Wee Ong

Third Molar Surgery Outcomes: A Choice Between IV Sedation and General Anaesthetic

Adlin Suhaimi

Pre-radiation dental assessment of head and neck cancer patients

12.30pm Lunch & poster judging (60 min) in the ODT Gallery

1.30pm (Auditorium)

BIOMATERIALS II

SESSION CHAIR: A/PROF NEIL WADDELL

STUDENT PRESENTATIONS (12 MIN EACH)

Lisa Falland

Anatomical skin/skull/brain model to measure impact force transfer and displacement upon blunt force impact

Arun Ramawarrier

A novel biocomposite scaffold for regeneration of dental pulp and peri-apical tissues

Adeline Chai

Effect of incisal preparation design on porcelain laminate veneers

2.10pm (Auditorium)

MOLECULAR MICROBIOLOGY

SESSION CHAIR: A/PROF GEOFF TOMPKINS

Dr Nick Heng

*Characterisation of antimicrobial (bacteriocin) activity produced by *Streptococcus equinus* MDC1*

Dr Alia Sagatova

Expression and purification of a drug target squalene monoxygenase

Dr Hee Ji Lee

*Extracellular loop amino acid residues essential for *Candida albicans* Cdr1 multidrug efflux pump function*

STUDENT PRESENTATIONS (12 MIN EACH)

Golnoush Madani

*Purification of Cdr1 as a first step to overcome drug resistant *Candida* infections*

3.10 pm Afternoon tea & poster viewing (30 min) in the ODT Gallery

1.30pm (Conference room level 2)

FOCUS ON PAEDIATRIC DENTAL RESEARCH

SESSION CHAIR: PROF ALISON MELDRUM

STUDENT PRESENTATIONS (12 MIN EACH)

Dorothy Boyd

Clinical outcomes in New Zealand primary oral healthcare

Aravind Parachuru

Children's oral health-related quality of life five to seven years after comprehensive care under general anaesthesia for early childhood caries

William Fogarty

Adolescent oral health in New Zealand in 2009

2.10pm (Conference room level 2)

EPIDEMIOLOGY AND PUBLIC HEALTH

SESSION CHAIR: A/PROF JONATHAN BROADBENT

Dr Lee Smith

The barriers/enablers for general dentists' implementation of non/micro invasive measures to manage proximal caries lesions

A/Prof Abhishek Mehta

Prevalence of dental caries among Indian children in the era of economic liberalization- what are the trends in the last 25 years?

STUDENT PRESENTATIONS (12 MIN EACH)

Leonard Chia

Clinicians' perspective of special care dentistry in New Zealand

Nina Scott

Dental trauma in New Zealand adults: a secondary analysis of national survey and ACC data

3.30pm **CRANIOFACIAL RESEARCH**

SESSION CHAIR: PROF MAURO FARELLA

Invited speaker

Prof Stephen Robertson

DEPT OF WOMEN'S AND CHILDREN'S HEALTH, UNIVERSITY OF OTAGO

Bones under pressure – Understanding mechanosensing in bone

4.00pm **STUDENT PRESENTATIONS (12 MIN EACH)**

Fiona Firth

A human periodontal ligament cell mechanical strain culture model for the study of endoplasmic reticulum stress

Joanne Au

Three-dimensional lip change in response to simulated maxillary incisor advancement

Will Sew Hoy

Ecological momentary assessment of orthodontic pain in children and adolescents using a smartphone app: a pilot study

Austin Kang

Assessing tooth movements in three dimensions

4.50pm **Invited keynote presentation**

SESSION CHAIR: PROF RICHARD CANNON

Prof Mike Morgan

HEAD, MELBOURNE DENTAL SCHOOL

Reflecting on the past to imagine the future: would Sir John Walsh approve?

Conference wrap-up

Awards deliberation (session chairs and poster judges) in the ODT Gallery

5.20pm - Farewell drinks

6.00pm Awards presentation

Conference close

Abstracts

Auditorium sessions

INVITED KEYNOTE PRESENTATIONS

DPAG Auditorium (Level 1)

9.00 – 10.00am

Session chair: Professor Mauro Farella



9.00 – 9.30am

PROFESSOR PETER HUNTER

Overview of the Physiome Project

AUCKLAND BIOENGINEERING INSTITUTE, UNIVERSITY OF AUCKLAND

Multi-scale computational models of organs and organ systems are being developed under the umbrella of the Physiome Project of the International Union of Physiological Sciences (IUPS) and the Virtual Physiological Human (VPH) project funded by the European Commission. These computational physiology models deal with multiple physical processes (coupled tissue mechanics, electrical activity, fluid flow, etc) and multiple spatial and temporal scales. They are intended both to help understand physiological function and to provide a basis for diagnosing and treating pathologies in a clinical setting. A long term goal of the project is to use computational modeling to analyze integrative biological function in terms of underlying structure and molecular mechanisms. It is also establishing web-accessible physiological databases dealing with model-related data at the cell, tissue, organ and organ system levels. The talk will discuss the current state of the standards, databases and software being developed to support robust and reproducible multiscale systems biology models for the VPH/Physiome project.



9.30 – 10.00am

PROFESSOR ALAN BROOK

The emerging fields of complex systems and networking have major implications for health research

UNIVERSITY OF ADELAIDE AND QUEEN MARY UNIVERSITY OF LONDON

In publications beginning in 2011 Brook and co-workers have explored Complex Systems and Networking in dental development, in the mature dentition and in health care research and teaching. This presentation concentrates on dental development, which is a valuable and accessible paradigm for general development.

Complex Adaptive Systems have specific characteristics that can be demonstrated in the long and detailed process of dental development. This commences with interactions between genetic, epigenetic and environmental factors. Reiterative interactions between these factors in the epithelium and mesenchyme lead to organisation of the cells into the cap, bell and bud stages of morphogenesis. Within this tooth germ the cells differentiate and new genetic-epigenetic-environmental interactions influence further development, mineralisation and eruption. The Complex Adaptive System characteristics seen include self-organisation, emergence, criticality and robustness.

From an epidemiological study of variations in tooth number, size and shape, that arise during morphogenesis, a unifying aetiological model with thresholds at critical points for variation. Subsequent clinical studies have produced results compatible with this model. Genetic findings in animals illustrate the mechanisms underlying this association between variations in tooth number, size and shape.

To further investigate the genotype to phenotype pathways studies of a Romano-British cemetery and of the Adelaide Twin collection have explored the role of particular environmental and epigenetic factors. These include lead toxicity, recurrent infections, poor nutrition and male hormones. Using these results a novel model has been proposed of how environmental factors interact with one another and with body systems, such as the immune system, to cause epigenetic changes that in turn lead to alterations in gene expression. This model illustrates the interactions of a Complex Adaptive System and the network formed from the individual components.

Current research and publications are extending this work by exploring hypodontia as a complex adaptive system from genotype to phenotype using the growing Otago collection. This multidisciplinary, multicentre study already involves colleagues from New Zealand, UK, Australia and Hong Kong.

3M ORAL CARE PRESENTATION



10.00 – 10.15am

STEPHEN LANGDON

Innovation Inspired Dentistry

SCIENTIFIC AFFAIRS MANAGER ANZ, 3M ORAL CARE

At 3M we understand the power of new ideas. Sometimes the results are evolutionary, while other times they are truly revolutionary. The collaborative culture of 3M enables the 3M Oral Care scientists to access a range of diverse technologies that allows us to strive and develop innovative products and solutions. This allows us to continue to set trends in the dental market. In this presentation Stephen Langdon will give you a brief update on some exciting trends that are with us right now and some insight into the future. Stephen has over 30yrs experience in the dental industry, initially as a qualified Dental Technician, then moving into sales. In 1990 he took over responsibility as Business Technical Manager for 3M Australia P/L and in 2000 until present, holds the position of Scientific Affairs Manager for the 3M Oral Care Division specifically responsible for the Indirect, Preventive & Local Anaesthetics categories. Over this time he has developed extensive technical expertise across the full range of product / equipment offerings and has presented on numerous occasions in both Australia & New Zealand on various subject matters. Stephen's role also includes responsibility for the resourcing of Key Opinion Leaders and responsibility for local Clinical research and product evaluation programs.

ORAL MOLECULAR AND IMMUNOPATHOLOGY

DPAG Auditorium (Level 1)

10.15am – 12.00pm

Session chair: Professor Alison Rich

10.15 – 10.40am

ASSOCIATE PROFESSOR ROSLYN KEMP

Immunology in cancer – using big data to improve outcomes

DEPARTMENT OF MICROBIOLOGY AND IMMUNOLOGY, UNIVERSITY OF OTAGO

Immune cells in tumours are associated with good outcome in people with colorectal cancer (CRC). We use a new technology, mass cytometry, to study the immune system in CRC at an unprecedented level of detail. We compare immune cells in the tumour with those in the circulation of people with CRC, and also determine the detailed localisation of multiple cells within the tumour – where they are and how they interact with neighbouring cells. These data are associated with patient data, including stage of disease and ultimately, survival. This approach represents a new view of systems immunology that can easily be incorporated into clinical research.

11.10am – 12.00pm

Student presentation session

ADIL ALKHARUSI

DClinDent candidate (Oral Medicine)

Expression of STAT 3 and cytokines (IL22, IL23, IL17) within metastatic lymph nodes of Oral Squamous cell carcinoma (OSCC)

A Alkharusi¹, HM Hussaini¹, Roznah Binti Zain², AM Rich¹

1. SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

2. ORAL CANCER RESEARCH COORDINATING CENTRE, UNIVERSITY OF MALAYA

Metastasis is defined as the spread of a cancer from one organ (the primary site) to a distant organ (the secondary site) when there is no direct contact between the two sites. Lymph nodes present in the neck are usually the first sites of metastasis from oral squamous cell carcinoma (OSCC). This process is mediated by interactions between cancer cells and the immune system and current thought is that at some critical stage the immune system can get hijacked by the cancer cells which allows them to spread and grow. The immune system plays part of its role through cytokines, small proteins which function as signalling molecules. Some cytokines have been linked with the process of metastasis in different types of cancer. Cytokines exert their effect by using another protein called STAT3. STAT3 mediates the expression of a variety of genes which are key players in many cellular processes such as cell growth and cell death. Our study is designed to compare the expression of STAT3 and specific cytokines (IL22, IL23, IL17) between histologically positive lymph nodes (LN) and LN without evidence SCC (negative nodes).

The ability to produce a pro-inflammatory response is paramount in eliminating early tumour invasion. We postulate the modulation process by cancer cells occurs early in the process of lymph node metastasis and there may be previously unrecognised evidence of this activity in histologically negative nodes. Our results showed that IL22, IL23 and STAT3 were upregulated in negative lymph nodes compared to the positive nodes. This confirms our hypothesis and highlights the importance of these cytokines in facilitating metastasis process in OSCC.

NURUL RUZIANTEE IBRAHIM

DClinDent candidate (Oral Pathology)

Lymphangiogenesis in metastatic lymph nodes of oral squamous cell carcinoma

NR Ibrahim, HM Hussaini, B Seo, AM Rich

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Background: Regional lymph node metastasis is a crucial negative prognostic factor in oral squamous cell carcinoma (OSCC) which significantly reduces survival rates in patients affected. Whilst angiogenic and lymphangiogenic factors have been extensively investigated in primary OSCC, their expression in metastatic lymph nodes remains uncertain.

Objective: To investigate the expression of markers associated with lymphangiogenesis (vascular endothelial growth factor (VEGF)-C, D, VEGF receptor 3 (VEGFR3) and prospero homeobox 1 protein (PROX1)) in cervical lymph nodes from oral squamous cell carcinoma (OSCC) patients with and without metastatic deposits.

Method: Formalin fixed paraffin embedded (FFPE) blocks were accessioned from the Oral Cancer Research Coordinating Centre (OCRCC), University of Malaya, Malaysia. Samples were divided into two groups; Group A comprised cervical lymph nodes with histologically confirmed metastatic deposits from primary OSCC (n=17) and Group B, cervical lymph nodes from patients with primary OSCC without metastatic deposits, (n=17). Immunohistochemistry (IHC) was undertaken with antibodies against VEGF-C, VEGF-D, VEGFR3 and PROX1. Quantitative analysis using Image J was used to delineate the extent of positivity (proportion and intensity) and lymphatic vessel density (LVD).

Result: IHC results showed significantly greater VEGFC expression in Group A (mean 3.71, SD 1.4) compared with Group B (mean 2.06, SD 0.83) ($P < 0.05$). No statistically significant differences were observed in the expression of the other markers.

Conclusion: A different pattern of immunoexpression of lymphangiogenic markers was noted in the lymph node with metastases with significantly higher expression of VEGFC. This finding strongly suggests that VEGFC is an important growth factor involved in OSCC lymph node metastasis.

HITESH NAVANI

DClinDent candidate (Endodontics)

Angiogenic growth factor expression in the apical papilla of immature permanent teeth

H Navani, HM Hussaini, TJ Milne, AM Rich, LT Friedlander

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Aim: To investigate the distribution of angiogenic factors VEGF, ANG1, ANG2, receptor Tie2, and the cell-surface markers CD34 and CD45 in the apical papilla (AP) of immature permanent teeth using immunohistochemistry (IHC); and their mRNA levels in the AP compared with the coronal pulp using q-PCR.

Methodology: Ethical approval was obtained from the University of Otago Human Ethics Committee (H15/002). Ten unerupted immature third molar teeth were extracted, decalcified in 10% EDTA, and embedded in paraffin. Sections were stained by IHC using anti-VEGF, anti-ANG1, anti-ANG2, anti-Tie2, anti-CD34 and anti-CD45, and visualized using the chromogen DAB. A pyogenic granuloma served as a positive control, and non-specific anti-IgG was the isotype negative control. Slides were examined using light microscopy with the distribution of markers described and cell-counting performed. Eight additional extracted immature third molars were used for mRNA analyses. Teeth were sectioned transversely below the CEJ, and the coronal pulp and AP were removed for RNA extraction. mRNA levels for VEGF, ANG1, ANG2, Tie2, CD34 and CD45 were determined using TaqMan assays. Data analyses were performed with GraphPad Prism®, using Wilcoxon tests at $P < 0.05$.

Results: Endothelial cells were the main cell type expressing these markers centrally in the AP. VEGF (perivascular and extracellular), ANG1 (perivascular), Tie2 (cell surface), and CD34 (cell surface) showed more immunopositivity and higher cell-counts than ANG2 (intracellular) and CD45 (cell-surface). ANG1, ANG2, Tie2 (TEK) genes were predominately expressed in the AP; while VEGF, CD34 and CD45 genes were mainly expressed in the coronal pulp—these did not reach significance ($P > 0.05$).

Conclusions: The differential expression of VEGF and angiopoietins and their receptor mRNA and protein in the AP of immature teeth suggests the potential for these growth factors to contribute to physiological development and pulp healing following injury.

NAWAL ABDUL RAHMAN

DClinDent candidate (Oral Pathology)

Expression of the Lysyl Oxidase family in odontogenic lesions

NA Rahman, B Seo, H Hussaini, AM Rich

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Background: Lysyl oxidase (LOX) and LOX-like (LOXL) 1-4 are enzymes whose primary function is to maintain connective tissue homeostasis but they have been linked to aggressive behaviour in some disease processes.

Objective: To determine the expression of LOX family proteins in locally aggressive odontogenic lesions (ameloblastoma and odontogenic keratocyst (OKC)) in comparison with non-aggressive developmental odontogenic lesions (dentigerous cyst (DC) and hyperplastic dental follicle (DF)).

Method: FFPE tissue samples of ameloblastoma (n=10), OKC (n=15), DC (n=6) and DF (n=9) were used to perform immunohistochemistry (IHC) with antibodies against LOX and LOXL1-4. Automated quantitative assessment of digitised IHC images was performed using Image J software. Namely, the extent of positive reaction and intensity of staining were examined in 3 representative areas of the epithelium and connective tissue in each specimen at 400x magnification.

Result: LOXL-4 showed significantly higher expression in OKC within the epithelium compared with other LOX proteins. Expression of LOX family proteins in the DC connective tissue showed a significant variation compared with other lesions. No difference was detected between AM and DC.

Conclusion: 1) LOXL-4 is overexpressed only in the epithelium of OKC, which may suggest the aggressive behaviour of this lesion. 2) DC serves as an appropriate control compared to DF. 3) AM and DF show no difference in the protein expression which may reflect the rudimentary nature of these lesions.

BIOMATERIALS

DPAG Auditorium (Level 1)

12.00 – 2.10pm

Session chair: Associate Professor Neil Waddell

12.00 – 12.15pm

DR CAROLINA LOCH

Wild dentistry: dental wear and calculus deposits in New Zealand orca

C Loch¹, K Stratford¹, J Wakefield², R Oliphant-Stewart³, S White⁴, S Wilson⁴, I Visser⁵

1. SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

2. ORAKA APARIMA RUNANGA, RIVERTON

3. TE KAUIKA TANGAROA, OKARITO

4. DEPARTMENT OF GEOLOGY, UNIVERSITY OF OTAGO

5. ORCA RESEARCH TRUST, TUTUKAKA

Dental wear and calculus deposits are normal physiological processes and commonly seen in clinical practice. They are prevalent in humans and other mammals, including domesticated and sometimes wild species. In February 2014, a stranding of nine orcas (killer whales) on a remote boulder beach in Te Waewae bay, Southland, New Zealand, included five females and four males. Skulls and teeth were retrieved from all animals, handled in collaboration with Oraka Aparima Runanga, the local Māori tribal authority, following traditional protocols. Teeth were studied for patterns of dental wear and calculus buildup, being visually inspected and photographed to identify wear facets and assessed for type, location and intensity of wear. The surface area of calculus deposits was calculated from the images using ImageJ software. The chemical composition of calculus was determined using energy dispersive x-ray spectroscopy (EDX). All animals studied had worn teeth, involving 72 to 100% of the dentition. Simultaneous apical and lateral wear facets occurred in 62% of the teeth. Despite the high prevalence of wear, most teeth were worn superficially (53%), while only 21% had severe wear. No exposed pulp cavities were observed. Mandibular teeth consistently had higher wear scores than upper teeth. There was no significant difference in dental wear prevalence between males and females; but more moderate to severe wear was associated with larger body sizes. Calculus deposits were present in 8 animals and covered from 6% to 24% of the surface area of the teeth. Upper teeth had more calculus deposits than lower teeth (17% vs. 12%), and mesial and buccal surfaces were more commonly affected. Minerals such as Na, Mg, P, Ca, Sr and F were identified in calculus deposits. Future studies on dental wear and pathology in wild animals can inform management practices with captive animals and applied human dentistry studies.

12.15 – 12.30pm

DR JOANNE JUNG EUN CHOI

Bond strength between modern denture base acrylics and reline materials

J Choi, TE Ng, CK Leong, HS Kim, P Li, W Jansen van Vuuren, N Waddell

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Objectives: To evaluate the tensile bond strength of three soft denturerecline materials, bonded to three types of polymethyl methacrylate (PMMA) denture base materials.

Methods: Three soft denturerecline materials (Ufi Gel SC; SilagumComfort; Vertex Soft) were used to reline each denture base PMMA. A heatcured PMMA (Vertex Rapid Simplified), a selfcured PMMA (Vertex Self Curing), and a CAD/CAM PMMA (IvoBase CAD) was used for the study. Following manufactures' instructions, testing specimens were prepared for each reline material and each denture base acrylic to create nine test groups. A layer of reline material (3mm thickness) was used to reline between two 10mm x 10mm x 20mm acrylic rectangular cuboids (n = 10). Prior to testing, half of the specimens for each test group were thermocycled. The specimens were then brought to failure in tension, using a universal testing machine. Modes of failure was assessed using light microscopy and scanning electron microscopy. Statistical analysis was performed using mixed (multiple) linear regression, one-way ANOVA, Tukey Post Hoc test, and Kruskal Wallis test.

Results: The mean tensile bond strength results ranged from 0.36 MPa (± 0.13) to 1.51 MPa (± 0.46). The CAD/CAM denture base materials showed the lowest range of bond strength to soft reline materials (0.36 0.42MPa). There was no statistically significant difference ($p= 0.74$) between any of the thermocycled ($0.71 \text{ MPa} \pm 0.23$) and nonthermocycled groups ($0.74 \text{ MPa} \pm 0.21$). All three types of modes of failures (adhesive, cohesive, and mixed mode) were observed.

Conclusions: Silicone based soft reline materials produced the highest tensile bond strength to all denture bases. Soft liners bonded to CAD/CAM denture bases produced the weakest tensile bond strengths. Thermocycling did not produce statistically significant results on the tensile bond strength of the softliners to the denture base resins.

1.30 – 2.10pm

Student presentation session

LISA FALLAND

PhD candidate

Anatomical skin/skull/brain model to measure impact force transfer and displacement upon blunt force impact

L Falland-Cheung, JN Waddell, KC Li, DC Tong, PA Brunton

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Upon blunt force impact to the head, there are several mechanical responses that may result from the forces involved, including the absorption of impact forces. The purpose of this study was to develop an anatomical head model to measure force transfer through its various layers and their displacement when subjected to short duration high velocity impacts.

Previously validated simulant materials were used to construct the head model: epoxy resin for the skull, polyvinyl siloxane for the scalp, an agar/glycerol/water mixture for the brain, and modified intravenous fluid for the cerebrospinal fluid. An array of accelerometers with different acceleration ranges was incorporated into the various layers of the head to measure forces in x- (anterior/posterior), y- (left/right) and z- (up/down) direction. A weight (750g) was dropped from a height of 0.5m (n=20). Impact forces (z-axis) of 1107.05N were recorded on top of the scalp, with decreasing values through the layers (bottom of skin 78.48N, top of skull 319.82N, bottom of skull 87.30N, top and middle of brain 47.09N and base of brain 78.41N). Forces in the x- and y-axes were similar to those of the z-axis. With the base of the brain still receiving 78.41N, this highlights the potential danger of repetitive impact forces to the head. Upon impact the layers of the head are displaced in all directions, with the highest values shown in the z-axis. This study identified the importance of considering short duration high intensity impacts to the head and impact transfer/displacement on the underlying tissues.

ARUNJITH RAMAWARRIER

PhD candidate

A novel biocomposite scaffold for regeneration of dental pulp and peri-apical tissues

A Ramawarrier¹, A Ali², GJ Dias³, RM Love⁴

1. SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO
2. CENTRE FOR MATERIAL SCIENCES AND TECHNOLOGY, UNIVERSITY OF OTAGO
3. DEPARTMENT OF ANATOMY, UNIVERSITY OF OTAGO
4. SCHOOL OF DENTISTRY AND ORAL HEALTH, GRIFFITH UNIVERSITY

Regenerative dentistry aims to replace damaged or lost dental tissue with healthy tissue by application of exogenous scaffolds. We developed a novel biocomposite scaffold comprising Keratin-Chitosan-Tricalcium Phosphate (KCTPs) and additives such as barium sulphate (radiopacifier) and glycerol (plasticizer). Extracted keratin proteins were reconstituted into a favourable three-dimensional matrix that allows for attachment and proliferation of cells. Chitosan has been introduced for targeting antibiotic resistant microorganisms due to its broad spectrum of antimicrobial activity and biocompatibility. Tricalcium phosphate (TCP) used in the matrix to maintain structural integrity and a source for calcium ions. Low molecular weight keratins were extracted from sheep wool using a novel cost effective chemical free method. The electrophoresis patterns of the keratin powder showed intense bands of high protein density in the low fraction range (3.5-15 kDa). The FTIR spectra inferred that keratin adopts α -helical conformation with admixture of β -sheet. KCTP composites consisting of different ratios of keratin, chitosan and TCP were fabricated by solution casting and drying methods. Scanning Electron Microscopy (SEM) revealed well- connected nanostructures 3D matrix of KCTPs with irregular shaped crystals of TCP dispersed among them. Micro-CT detected interconnected porous structure. Cytocompatibility of scaffold was analyzed with Odontoblast like cells (MDPC 23) and Cementoblast like cells (OCCM 30) according to ISO 10993-Part 5 using direct testing method. The scaffold successfully induced proliferation and differentiation of these cells as indicated by the results of cell proliferation assay, Alkaline phosphatase assay, Alizarin red staining and immunocytochemistry. The minimum bactericidal concentration (MBC) of

KCTPs against *Streptococcus mutans* was assessed visually by using MTT calorimetric assay which displayed a bactericidal activity at a concentration of 3600 µg/ml. The present study reported fabrication of a novel KCTP biocomposite by a relatively low cost method and established its biocompatibility and antimicrobial efficacy, making it a promising scaffold for application in regenerative dental therapy.

SY YIN (ADELINE) CHAI

DClinDent candidate (Prosthodontics)

Effect of incisal preparation design on porcelain laminate veneers

SY Chai¹, V Bennani¹, J Aarts¹, K Lyons¹, B Lowe², R Das³, A Gray⁴

1. DEPARTMENT OF ORAL REHABILITATION, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

2. DEPARTMENT OF APPLIED SCIENCES, UNIVERSITY OF OTAGO

3. DEPARTMENT OF MECHANICAL ENGINEERING AND CENTRE FOR ADVANCED COMPOSITE MATERIALS, UNIVERSITY OF AUCKLAND

4. DEPARTMENT OF PREVENTIVE AND SOCIAL MEDICINE, UNIVERSITY OF OTAGO

Aims: To evaluate the stress distribution of ceramic veneers with feathered edge and butt joint incisal preparation designs under standardised loading conditions

Methods: A photoelastic analysis was conducted to evaluate the stress distribution of ceramic veneers. Six photoelastic models were fabricated with epoxy resin (West System 105/205) and loaded at different loading angulations and points (45° and at incisal edge, 45° and 1.5mm from incisal edge, 90° and 1.5mm from incisal edge, along long axis of tooth). The stress pattern was recorded with photographs and analysed qualitatively.

Results: Photoelastic analysis showed that the butt joint incisal preparation design has greater stress distribution compared to the feathered edge design. The feathered edge incisal preparation group showed stress concentration at the palatal concavity and the buccal interface between the veneer and the photoelastic model. Loading angulations and points affect the stress distribution within the model.

Conclusion: Preliminary results from photoelastic analysis suggest that butt joint incisal preparation design has the most favourable stress distribution compared to the feathered edge design. Loading angulation and points affect the stress distribution.

MOLECULAR MICROBIOLOGY

DPAG Auditorium (Level 1)

2.10 – 3.10pm

Session chair: Associate Professor Geoff Tompkins

2.10 – 2.25pm

DR NICK HENG

Characterisation of antimicrobial (bacteriocin) activity produced by Streptococcus equinus MDC1

NCK Heng¹, MD Christophers²

1. SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

2. KAVANAGH COLLEGE, DUNEDIN

Aims: Streptococci are bacteria that inhabit humans and other animals, with some oral species being prolific producers of proteinaceous antibiotics (bacteriocins). During a survey of oral streptococci from domestic pets, strain MDC1 (isolated from a healthy dog) not only possessed unusual growth characteristics, e.g. appearing as mucoid colonies on mutans selective agar, but also exhibited antibacterial activity against *Micrococcus luteus* in a bacteriocin bioassay. The latter observation indicated the production of a lantibiotic bacteriocin by strain MDC1, subsequently identified by 16S rRNA gene sequencing as *Streptococcus equinus*, a species usually found in horses. The primary objective of this study was to investigate the bacteriocin-like inhibitory substance (BLIS) produced by *S. equinus* MDC1.

Methods: *S. equinus* MDC1 was subjected to bacteriocin assays against a variety of indicator bacteria including streptococci and other gram-positive species. The genome of MDC1 was also sequenced using the high-throughput, ultra-long-read Pacific Biosciences Single Molecule Real-Time (SMRT) DNA sequencing technology.

Results: The BLIS of *S. equinus* MDC1 kills a variety of pathogenic streptococci including *Streptococcus pyogenes*, but not the caries-causing *Streptococcus mutans* or the endodontic pathogen *Enterococcus faecalis*. *Streptococcus uberis* ATCC 27958, which produces the lantibiotic nisin U, was not inhibited, indicating that the *S. equinus* BLIS may be a new member of the nisin class. Indeed, a genetic locus encoding a new nisin variant, called nisin E, was subsequently found in the MDC1 genome sequence.

Conclusions: *Streptococcus equinus* MDC1, which produces nisin E, is the first lantibiotic-producing streptococcus of canine origin to be reported. The strain is also the first of its species to have its genome sequenced completely. Further analysis of the MDC1 genome sequence will determine if the strain qualifies as a candidate oral probiotic for human or animal use.

2.25 – 2.40pm

DR ALIA SAGATOVA

Expression and purification of a drug target squalene monooxygenase

AA Sagatova, MV Keniya, BC Monk

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Heart disease and cancer are leading causes of death. Fungal infections afflict billions and these “hidden killers” are lethal for almost 1.4 million people per annum, especially those with co-morbidities or immune deficiencies. The membrane protein squalene monooxygenase (Erg1) is a key enzyme in all three diseases. It catalyses a committed early step in cholesterol synthesis of mammals and ergosterol synthesis of fungi and is a validated drug target. Inhibition of fungal Erg1 by terbinafine is widely used to treat dermatophytoses but its narrow spectrum of action precludes treatment of lethal systemic infections by other fungi. Human Erg1 (HsErg1) is a validated target for inhibitors to succeed side-effect prone cholesterol-lowering statins and sterol-reducing anticancer drugs. In the absence of published crystal structures for Erg1, homology models using the structure of the soluble *Pseudomonas fluorescens* p-hydroxybenzoate hydroxylase provide limited insight.

We have used our patented yeast expression system to express Erg1 from humans, the model yeast *Saccharomyces cerevisiae* and the fungal pathogens *Candida glabrata* and *Candida albicans*. Codon optimised *CaERG1* and *HsERG1* genes incorporating hexahistidine affinity tags were commercially synthesised. Functional expression of ScErg1, CgErg1 and HsErg1 has been confirmed using microdilution drug susceptibility assays with terbinafine. Only CaErg1 expression was insufficient to confer resistance. The full-length hexahistidine-tagged ScErg1 has been solubilized using the detergent n-Octyl- β -D-Glucopyranoside and purified by Ni-NTA affinity and size exclusion chromatography. The purification, biochemical characterization and X-ray crystallography of the full-length Erg1 enzymes will allow the identification of membrane interactions required for metabolic regulation and drug binding sites needed for structure-based drug design. The project will yield new knowledge of membrane protein structure, advance target-based drug discovery and ultimately provide new therapeutic options for patients with heart disease, cancer, and for superficial and potentially lethal disseminated fungal infections.

2.40 – 2.55pm

DR HEE JI LEE

Extracellular loop amino acid residues essential for Candida albicans Cdr1 multidrug efflux pump function

HJ Lee, E Lamping, RD Cannon

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Cdr1 is a major *Candida albicans* multidrug efflux pump. Cdr1 belongs to the pleiotropic drug resistance (PDR) family of ATP-binding cassette (ABC) transporters and uses ATP hydrolysis to transport substrates across the plasma membrane. Although overexpression of Cdr1 is the most common mechanism of azole resistance in clinical *C. albicans* isolates, little is known about its structure and mechanism of action. Distinctive features of PDR

transporters are two large (~100 amino acids) extracellular loops, EL3 and EL6. EL3 includes PDR transporter-defining motifs PDRA and PDRB and EL6 contains an EL6 motif and EL6 helix. The role of these conserved motifs in Cdr1 pump function was examined by replacing each of the 48 amino acids using alanine scanning mutagenesis and heterologous expression in *Saccharomyces cerevisiae*. The effect of alanine substitution on pump function was measured in terms of ATPase activity and the drug resistance conferred on *S. cerevisiae*. Alanine substitution of two invariable residues in the PDRA and EL6 motifs significantly reduced substrate transport indicating that these hydrophobic residues may interact with each other to form a 'lid' during the Cdr1p transport cycle. Substituting these interacting amino acid pairs with alanine (double mutants) caused an even greater reduction in drug resistance. Furthermore, when three residues in the same helical face of the PDRB motif, one being 100% conserved and negatively charged, were individually substituted with alanine the substrate transport function of Cdr1 was dramatically reduced. The importance of the negative charge on the helical face of PDRB was further evaluated by substituting the negatively charged residue with differently charged amino acids. Replacing the negatively charged residue with positively charged amino acids reduced pump function, whereas substituting with other negatively charged or neutral residues partially restored function. In conclusion, this study has shown six invariable EL residues are essential for Cdr1p function.

2.55 – 3.10pm

Student presentation session

GOLNOUSH MADANI

PhD candidate

Purification of Cdr1 as a first step to overcome drug resistant Candida infections

G Madani, E Lamping, RD Cannon

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

One of the most important global health concerns is microbial drug resistance. *Candida albicans* is a major fungal pathogen of immunocompromised individuals that can cause serious, life threatening and invasive infections, and it can become resistant to azole antifungal drugs. The main mechanism of *C. albicans* multidrug resistance is overexpression of the plasma membrane ATP-binding cassette (ABC) transporter Cdr1 which pumps azole drugs out of the cell.

To improve the treatment outcomes for patients with *Candida* infections, a deeper knowledge of the Cdr1 pump structure is needed. To gain insights into the Cdr1 structure, it is necessary to solubilize and purify Cdr1 in a stable and homogenous state, prior to crystallization and x-ray crystallography. Cdr1 was cloned and heterologously expressed in *Saccharomyces cerevisiae*. *S. cerevisiae* cells expressing Cdr1 were disrupted and membranes isolated. A panel of 18 different detergents was investigated, and *n*-Dodecyl β -D-maltoside was found to solubilize Cdr1 in a stable form. Solubilized Cdr1 was then purified by Ni-affinity chromatography followed by size exclusion chromatography. The purified protein can now be used for crystallization trials. Having an atomic resolution structure of Cdr1 will assist in the development of novel efflux pump inhibitors to successfully combat drug resistant *Candida* infections.

CRANIOFACIAL RESEARCH

DPAG Auditorium (Level 1)

3.30 – 4.50pm

Session chair: Professor Mauro Farella

3.30 – 4.00pm

PROFESSOR STEPHEN ROBERTSON

Bones under pressure – Understanding mechanosensing in bone

DEPARTMENT OF WOMEN'S AND CHILDREN'S HEALTH, UNIVERSITY OF OTAGO

Bone anabolism is intrinsically linked with mechanical forces in its environment. A lack of mechanical loading on bone leads to osteopenia while increased amounts leads to bone anabolism. Clearly understanding these processes will be important to formulating strategies to maintain bone mass over the lifespan and in the infirm. Here I will describe our work on a group of syndromes that represent models of a deficiency (or a surfeit) of force sensing in bone. Discovering the molecular basis for these conditions opens a window onto the molecular architecture of force sensing in bone.

4.00 – 4.50pm

Student presentation session

FIONA FIRTH

DClinDent candidate (Orthodontics)

A human periodontal ligament cell mechanical strain culture model for the study of endoplasmic reticulum stress

F Firth, T Milne, B Seo, M Farella

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

A balanced cellular homeostatic response is essential for safe and controlled orthodontic tooth movement. The endoplasmic reticulum (ER) plays a major role in maintaining homeostasis, with ER stress activating the unfolded protein response (UPR), potentially resulting in apoptotic cell death. This study examines human periodontal ligament cell (hPDL) viability, apoptosis, and the mRNA expression levels of strain-responsive and UPR/ER stress genes when cultured under mechanical strain.

Methods: Three primary hPDL cell lines were cultured as a monolayer or encapsulated in a cross-linked hydrogel, and were cultured on flexible-bottomed culture plates for 7 days before being mechanically strained at a constant level for 24 hours. Proliferation was measured over the 7 days and cell viability, caspase activity and mRNA quantity levels were measured following strain.

Results: The number of viable hPDLs in monolayer culture increased to a greater extent compared to cells cultured in hydrogel, which initially decreased in viability from day 1 to 3 (-34%; $P = 2 \times 10^{-8}$ before recovering from day 5 to 7 (+12%; $P = 1 \times 10^{-4}$). Cell viability significantly reduced following strain in monolayer cultures ($P = 0.043$), while in hydrogel constructs no significant differences in the number of cells, caspase activity, or the measured mRNA quantity levels when compared to the unstrained controls were found.

Conclusions: hPDLs cultured as monolayers proliferate rapidly and exhibit reduced viability in response to 24-hour mechanical strain; cells cultured in a hydrogel however, take longer to start proliferating and are not significantly affected by 24-hour strain. Both monolayer and hydrogel cultured cells reach a similar number of cells after 7 days; suggesting hPDLs proliferate rapidly once attached. The failure to detect a gene response for the encapsulated cells suggests that hydrogel dampens the propagation of mechanical strain. Future experiments should include longer strain times and increased strain magnitude for encapsulated hPDLs.

JOANNE AU

BDS (Honours) candidate

Three-dimensional lip change in response to simulated maxillary incisor advancement

J Au, A Kang, F Bennani, M Farella, L Mei

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Upper lip change in response to orthodontic movement of the maxillary incisors varies largely across individuals. Lip change is affected by multiple variables, particularly soft tissue characteristics. Research on this topic has been predominantly conducted using lateral cephalograms, hence current knowledge is limited to two-dimensional changes at the midline of the lip.

Objectives: To assess 3D lip changes in response to simulated maxillary incisor advancement and to determine if individual soft tissue characteristics can predict upper lip change in response to incisor advancement.

Methods: A convenience sample of 20 orthodontics patients of the University of Otago Faculty of Dentistry not in active treatment (without brackets bonded) was taken. Incremental maxillary incisor advancement was simulated by placing wax of increasing thickness on the participants' incisors (+2mm, +4mm and +6mm) and the induced lip changes recorded using 3D digital stereophotogrammetry. Induced displacement of lip landmarks was quantified using 3D image analysis software and correlated with individual soft tissue characteristics as measured on participants' lateral cephalograms. Averages and standard deviations of all measurements were calculated and a repeated-measures analysis of variance (ANOVA) was performed. Pearson's correlation coefficients were calculated

Results: A large standard deviation was observed. Most points moved outwards and antero-superiorly, except the midpoint and corners of the lip. Landmarks further from the midline displayed greater values of displacement. Greater movement was observed in the antero-posterior plane, followed by vertical and transverse planes. The vertical and transverse lip displacement recorded was less than 50% of the simulated maxillary incisor advancement for all three increments of wax thickness (+2mm, +4mm, +6mm).

Conclusions: Maxillary incisor advancement induces upper lip change in 3 planes of space. Further investigation is needed to correlate findings with soft tissue characteristics to more fully explain the large variability observed in response to induced changes.

WILL SEW HOY

DClinDent candidate (Orthodontics)

Ecological momentary assessment of orthodontic pain in children and adolescents using a smartphone app: a pilot study

W Sew Hoy¹, J Antoun¹, N Chandler¹, T Merriman², M Farella¹

1. SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY

2. DEPARTMENT OF BIOCHEMISTRY, UNIVERSITY OF OTAGO

Aims: Up to 95% of patients experience pain during orthodontic treatment. Previous studies have utilised paper-based surveys to monitor pain following orthodontic adjustments.

However, the validity of this approach is questionable, as patients tend to forget to fill in the forms, or fill in the forms retrospectively. The purpose of this pilot study was to determine the feasibility of a newly developed smartphone application to assess pain levels in real life, and to test their association with gender, age, time in orthodontic treatment, and type of orthodontic adjustment.

Methods: Eighty-two children and adolescents who had commenced, or were about to commence orthodontic treatment with braces, were recruited. A mobile phone application was then used to assess pain scores at regular intervals in the three days after the participants' braces were adjusted. Pain was measured using sliding digital visual analogue scales. Resting pain at the teeth, as well as pain at the teeth on chewing gum, were the two forms of pain that were measured.

Results: Of the 82 participants, 56.1% were female, with a mean age of 15.2 years (SD = 1.6 years). The mean time in treatment was 12 months (SD = 8.4 months). Resting pain at the teeth, and pain triggered by gum chewing, rose steadily from baseline, peaked at approximately 19 hours, then decreased gradually over the next two days. The total pain experienced at the teeth in the three days following adjustment of braces was associated with what was performed at the adjustment visit. Participants that were just starting orthodontic treatment experienced significantly more pain when compared to routine orthodontic adjustments ($P < 0.009$). Pain levels were not significantly associated with age, gender, or time in treatment.

Conclusion: Our smartphone app shows promise in measuring orthodontic pain in the real world. This will aid future research projects which aim to investigate various factors that could influence pain severity.

AUSTIN KANG

DClinDent candidate (Orthodontics)

Assessing tooth movements in three-dimensions

A Kang, L Mei, J Antoun, M Farella

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

During orthodontic treatment, a highly complex force system is applied to the teeth, which is the result of different *archwire activations*. The effect of these activations on tooth movements can be described via simulations tools, such as the wax typodont. By embedding individual artificial tooth into a wax base, tooth movements by orthodontic activations can be simulated when wax is softened. However, a major limitation of this tool is the inability to *quantify* the resultant movements.

The aim of this project was to develop an E-typodont system which allows three-dimensional quantification of tooth movements observed in wax typodonts. Using this system, tooth movements resulting from a number of commonly used orthodontic activations were tested and analysed.

Method: CAD/CAM technology was used to develop an E-typodont simulation system. The system was used to quantify movements associated a number of standardised orthodontic archwire activations. The tested activations included archform reshaping (Tapered, Square, Expansion, Asymmetrical) and reversing the Curve of Spee. Each activation was repeated three times and the resulting movements were averaged.

Results: The E-typodont was successfully developed and could reliably be used to quantify tooth movements in 3D. Squaring and expanding the archform was accompanied with retraction of the anterior teeth, whereas tapering the archform resulted in a proclination of anterior teeth. The transversal-to-sagittal movement ratio ranged from 1:1 to 4:1 depending on the activation. Asymmetrical archform caused a shift in the midline (~1.5mm) and a change in the lateral overjet pattern.

Reversing the curve of Spee led to slight intrusion of incisors and second molars (<1.0mm) and had pronounced first and third order effects on most teeth.

Conclusion: The E-typodont is a promising tool to assess orthodontic tooth movements. Reshaping of the archwires have 1st, 2nd, and 3rd order implications which should be taken into account when planning tooth movements.

INVITED KEYNOTE PRESENTATION

DPAG Auditorium (Level 1)

4.50 – 5.20pm

Session chair: Professor Richard Cannon



PROFESSOR MIKE MORGAN

Reflecting on the past to imagine the future: would Sir John Walsh approve?

MELBOURNE DENTAL SCHOOL, UNIVERSITY OF MELBOURNE

To complete the Research Day and to honour Sir John Walsh, I will reflect on my own journey through dental education and the key role that the Faculty of Dentistry at The University of Otago played in influencing my career options. As part of this journey I will look back to where I think dental education and research was placed, at a time when Sir John's influence was strong. This personal view will form the basis for considering what the future of dental education, research and community access to oral health care might be – and try to imagine what Sir John Walsh might think!

Conference room sessions

CLINICAL AND TRANSLATIONAL RESEARCH

DPAG Conference Room (Level 2)

11.10am – 12.30pm

Session chair: Professor Warwick Duncan

11.10am – 11.25am

PROFESSOR WARWICK DUNCAN

Development of a novel animal model for testing antimicrobial agents against periodontitis and peri-implantitis

W Duncan¹, C Loch Santos De Silva¹, G Cotton², G Tompkins¹, D Schwass¹, C Meledandri²

1. SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

2. DEPARTMENT OF CHEMISTRY, UNIVERSITY OF OTAGO

Aim: Accepted preclinical models for testing novel peri-implant & periodontal treatments involve surgical and/or ligature-induced lesions in dogs or monkeys, which is ethically and economically prohibitive. This pilot project investigated delayed & immediate implant placement in sheep, followed by induction and treatment of peri-implant and periodontal lesions.

Methods: 24 sheep had 3 mandible premolar teeth extracted unilaterally. 4 sheep received one Southern Implants (blasted surface) & one Nobel TiUnite (oxidized) as immediate, one-stage placement & were euthenased after 16 weeks. 20 sheep received paired implants into healed extraction sites after 12 weeks by two-stage submerged protocol; these were exposed after 10 weeks, a 5mm-deep peri-implant trough created by trephine bur, healing abutments fitted & implants ligated. Simultaneously, a trough was created around contralateral 1st & 2nd mandibular premolars & silk ligatures placed. Sites were irrigated with *P gingivalis* pure culture. Ligatures were removed after 7 weeks and test implants and teeth were scaled and treated with chemotherapeutics. All sites were radiographed, sampled microbiologically and had attachment levels recorded at all time points. 2 test & 2 control sheep were euthenased after a further 1, 2, 4, 8 and 16 weeks.

Results: Periodontopathogens increased after lesion surgery. 7/40 implants failed at ligature removal and 4 more after treatment. Survival rate was 85% for test (treated) and 60% for control (untreated) implants. No teeth were lost. Attachment levels for teeth did not change over time but improved for implants. The model for immediate implant placement was successful.

Conclusions: This is the first attempt to create a split-mouth, surgical, ligature-induced periodontitis and peri-implantitis model in sheep. Peri-implant disease was **too severe**, since treatment did **not** include surgical repair and grafting (recommended for severe peri-implant disease in humans). The periodontal lesions were **insufficiently severe** and showed spontaneous healing. Future development of the model is warranted.

11.25am – 12.30pm

Student presentation session

YEVGENY (EUGENE) SHEFTEL

DClinDent candidate (Periodontology)

Xenogenic and alloplastic materials for sinus floor elevation: a sheep study

Y Sheftel¹, J Leichter¹, PR Schmidlin², WJ Duncan¹

1. SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

2. CLINIC OF PREVENTIVE DENTISTRY, PERIODONTOLOGY AND CARIOLOGY, UNIVERSITY OF ZURICH

Introduction: Sinus floor elevation (SFE) may be required for implant placement in the severely resorbed posterior maxilla. Although often successful, autologous bone grafting requires a donor site and may lose substantial volume while remodelling. Bone replacement graft (BRG) materials were developed to overcome these limitations. Our study investigated three novel grafting materials: 1) equine collagen cone (CN), 2) equine collagen cone filled with biphasic calcium phosphate particles (CO), 3) deproteinized bovine bone particles coated with polylactic acid and poly ϵ -caprolactone (SB). These were compared with the most commonly-used bovine bone BRG, Geistlich™ Bio-Oss® (BO).

Methods: The extra-oral access sinus grafting model from Haas et al. (1998) was used in 11 cross-bred female sheep. Two experimental sites on each side of the animal were prepared. CN, CO, SB, BO were each placed through separate 10 mm access window in the antral wall, under the elevated Schneiderian membrane. BO sites were covered with a porcine collagen membrane (Geistlich™ Bio-Gide®), while for CO, SB, BO sites the equine collagen membrane (Resorba™ Parasorb®) from the manufacturer of these experimental materials was used. The animals were euthanised after 16 weeks. New bone, residual graft particles and connective tissue areas were measured on un-demineralised resin-embedded sections.

Results: One sheep did not survive the surgery. All sites in remaining ten sheep healed uneventfully. The CN and SB grafting materials resorbed completely and failed to form new bone. BO and CO particles were bridged by the new bone, the new bone fraction was 10% ($\pm 9\%$) for BO and 4% ($\pm 4\%$) for CO. The differences were not statistically significant.

Conclusion: CN and SB cannot be recommended for sinus grafting, based on this model. BO and CO have demonstrated comparable histologic and histomorphometric outcomes.

This abstract is based on research that was funded by RESORBA Medical GmbH, Nuremberg, Germany.

VICTORIA KASHCHUK

DClinDent candidate (Paediatric Dentistry)

Effect of a chewable manuka honey tablet with xylitol, on oral health including dental plaque activity and gingival health in young adults

VY Kashchuk*, D Boyd, GR Tompkins, BK Drummond

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Aim: To compare the effects of a chewable Manuka honey tablet containing xylitol, with a xylitol tablet on dental plaque pH, salivary characteristics, gingival health and dental plaque accumulation.

Design: The project was undertaken in two parts.

Part I. Cross-over, randomised control trial involving 12 healthy participants over five appointments (each 7 days apart). Dental plaque pH was measured for 40 minutes after consuming the honey-xylitol tablet, xylitol tablet, Manuka honey, or sucrose (10% w/v, 20 mL).

Part II. A randomised control, single blind, parallel group trial involving 32 healthy participants over 56 days. Participants chewed either a honey-xylitol tablet or a xylitol tablet three times daily for 28 days.

Oral health and dental plaque pH changes (following 10% sucrose), were measured at Day 0, 14, 28 and 56.

The minimum pH reached, area under the pH curve (AUC) and maximum decrease in pH were recorded. Linear mixed models were used to compare treatment groups for both parts.

Results: Part I. Minimum pH (mean \pm SD): honey-xylitol tablet (5.3 ± 0.3) vs sucrose (4.9 ± 0.2 ; $p < 0.001$); vs xylitol (6.3 ± 0.4 ; $p < 0.001$); and vs Manuka honey (5.0 ± 0.4 ; $p < 0.001$). The AUC (mean \pm SD) was larger for sucrose (13.3 ± 11.6) than xylitol (0.1 ± 0.2 ; $p < 0.05$), but did not differ between sucrose and either Manuka honey (16.5 ± 15.6 ; $p = 0.506$) or honey-xylitol tablet (4.9 ± 9.6 ; $p = 0.124$).

Part II. The mean plaque pH, following challenge with sucrose, decreased below the critical pH (pH 5.7) for both groups. No differences were evident between groups in any test parameters.

Conclusion: While the honey-xylitol tablet reduced the pH decrease, the plaque pH (following sucrose challenge) dropped below the critical pH, and therefore the honey-xylitol dietary supplement should be used with caution in individuals at high caries-risk.

This project was funded by Manuka Health New Zealand Ltd.

ASSIL RUSSELL

DClinDent candidate (Endodontics)

The Butterfly Effect: An investigation of sealer penetration and adaptation in root canals

AA Russell, NP Chander, LT Friedlander

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Aim: The butterfly effect is an optical phenomenon seen in some root cross-sections. The aim was to investigate depth of penetration and adaptation of 4 root canal sealers into the bucco-lingual and mesio-distal aspects of roots with and without the effect.

Methodology: 120 teeth were decoronated at the cemento-enamel junction and coded according to presence of the effect. Preparations involved ProTaper Next instruments and 100 roots were randomly assigned to 5 obturation groups: gutta-percha (GP) with AH Plus, GP with EndoREZ, GP with Kerr Pulp Canal Sealer, GP with MTA Fillapex and ProRoot MTA alone. Groups contained 10 butterfly and 10 non-butterfly roots. Controls confirmed smear layer removal. Roots were sectioned to yield coronal and mid root samples. Penetration was measured with confocal laser scanning microscopy and Image J. Scanning electron microscopy analysis of dentine-sealer adaptation were recorded as good, reasonable, poor or absent. Analysis used Stata 13.1.

Results: Teeth with the butterfly effect had greater mean penetration bucco-lingually (766 μm) than mesio-distally (184 μm), ($P = 0.003$). Coronal sections had the best mean penetration (430 μm) compared to middle sections (247 μm), ($P = 0.006$). Sealer adaptation was better coronally, where 78% of sections were scored good or reasonable. Penetration depth and quality of adaptation varied between the 4 sealers and ProRoot MTA, but not significantly ($P > 0.05$).

Conclusion: The butterfly effect influences sealer penetration and adaptation. Superior bucco-lingual penetration may entomb bacteria, influencing treatment.

SOO-WEE ONG

DClinDent candidate (Oral Surgery)

Third molar surgery outcomes: a choice between intravenous sedation and general anaesthetic

S-W Ong, D Tong, WM Thomson, RK De Silva, HL De Silva

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Objective: To compare Intravenous (IV) sedation and general anaesthesia (GA) for third molar surgery in terms of patient anxiety, satisfaction, choice and, oral-health-related quality of life (OHRQoL).

Study Design: A quasi-experimental design was used, with a clinical convenience sample of patients requiring the removal of two mandibular third molar teeth. Each participant was consulted by an oral and maxillofacial surgeon or one of their surgical trainees, and they were given a free choice between IV sedation and GA for their operation. Participants completed a questionnaire before surgery and again 10-14 days afterwards. Data collected before surgery included baseline sociodemographic characteristics, OHRQoL, anxiety, aspects of personality (positive and negative emotionality) and history of pain. Data collected after surgery included the severity of pain, time taken for recovery, OHRQoL, anxiety, and satisfaction with the surgery.

Results: Of the 142 patients, 73 (51.4%) chose to have the operation under IV sedation and 69 (49.4%) underwent GA. Patients opting for GA scored more highly at baseline on negative affectivity and dental anxiety. After surgery, they reported taking more days off before returning to normal activities, as well as a higher incidence of sore throat and nausea.

Conclusion: Patients with negative affectivity and higher anxiety opt for their operation to be carried out under GA but this results in more post-operative side-effects and days off.

ADLIN SUHAIMI

DClinDent candidate (Special Needs Dentistry)

Pre-radiation dental assessment of head and neck cancer patients

A Suhaimi, J Broadbent, A Rich

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Aims: The aim of this study was to gather information about the approach taken by hospital dentists in New Zealand and Malaysia to dental assessment prior to radiotherapy for patients with Head and Neck Cancer (HNCA), in order to develop contemporary uniform guidelines for pre-radiation oral health management.

Methods: A set of questionnaires were emailed or posted to specialists and hospital dentists who were working in a hospital setting within New Zealand and Malaysia. Information was collected about knowledge of the effects of radiotherapy on oral and dental issues, current practice regarding the dental management of HNCa patients prior to radiotherapy, guidelines they were currently using and problems that they face treating HNCa patients.

Results: 100 questionnaires were distributed; 50 for each country and the response rate was 66%. The respondents were consultants/specialist (36.3%), specialist registrars (6.1%), general dentists (39.4%), house surgeons (16.7%) and other (1.5%). The majority of respondents stated that multidisciplinary meetings (MDM) were held at their centre (New Zealand- 63.3%; Malaysia - 52.8%) but the health practitioners attending the MDM varied. 50% New Zealand and 2.8% Malaysian respondents followed formal guidelines or protocols for dental assessment of HNCa patients. Problems that were highlighted included late referral from the medical team, lack of radiation information and inadequate knowledge among the dentists themselves in managing these patients.

Conclusion: This study highlights the need for developing clinical guidelines to support effective dental treatment and management strategies for this vulnerable population. Effective communication between health professionals and improved training could enhance patient outcomes.

PAEDIATRIC DENTISTRY RESEARCH

DPAG Conference Room (Level 2)

1.30 – 2.10pm

Session chair: Professor Alison Meldrum

1.30 – 2.10pm

Student presentation session

DOROTHY BOYD

PhD candidate

Clinical outcomes in New Zealand primary oral healthcare

D Boyd, L Foster Page, WM Thomson

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Background: In New Zealand, children's oral healthcare is mostly provided in primary oral health clinics in the community. Despite a high restorative index in these services, little is known about outcomes of care.

Aim: To investigate differences in outcomes of different primary molar caries treatments in a sample of children in NZ primary care clinics.

Design: Quasi-experimental study of children aged 5-8 years. Each child had one carious primary molar treated either with a plastic restorative material (PRM) or a preformed stainless steel crown using the Hall Technique (HT). After approximately 2 years, restorative outcomes were categorised as success, minor failure or major failure. Data were analysed using Chi-square tests.

Results: 147 (82%) children were followed up; mean follow-up period 25 months (range: 21 to 35 months). Failure was observed significantly more in the PRM group (32%) than the HT group (6%). When baseline carious lesions were radiographically deep with marginal ridge breakdown (MRB), there was a higher proportion of major failures than when the lesions were shallow without MRB (33% and 1% respectively; $p < 0.001$). Among the deep lesions, those treated with the HT showed better success than PRM.

Conclusions: There was a much higher success rate in the children treated with HT than PRM. Deep carious lesions may respond better to HT than PRM.

Funded by a Health Research Council of New Zealand Grant

ARAVIND PARACHURU VENKATA

DClinDent candidate (Paediatric Dentistry)

Children's oral health-related quality of life five to seven years after comprehensive care under general anaesthesia for early childhood caries

A Parachuru, BK Drummond, A Meldrum, N Heng

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Aim: To compare the oral health related quality of life (OHRQoL) in children five to seven years after they received comprehensive dental treatment and/or extractions for early childhood caries (ECC) under general anaesthesia (GA) with that of children who received dental restorations in the dental chair or children of the same age who are caries-free.

Methods: Following ethics approval, 346 children were invited to participate in this study. They included children who had comprehensive dental care or extractions only for ECC under GA, before five years-of-age in 2009 - 2011, age-matched children who had treatment for caries in the dental chair and children who were caries free. Participants were recruited into one of the four groups in depending on the type of dental care they had received. Following consent from participants and parents, participants completed the Impact 16-item Short-Form Child Perceptions Questionnaire (CPQ11-14), to evaluate their current OHRQoL.

Results: Of the 346 invited participants, 144 (42%) agreed to take part. Children who had comprehensive care under GA reported more negative OHRQoL with statistically a mean significantly higher CPQ score of 15.8 ($p < 0.014$) and with a higher score in the oral symptoms/functional limitations domain of 8.6 ($p < 0.007$). No statistically significant differences were found between children who had comprehensive care under GA or extractions only at GA. Moreover, children who had experienced severe caries requiring GA for treatment reported poorer OHRQoL in almost all domains of CPQ. Children who had restorative dental care in the chair reported that their life is affected by oral conditions when compared with other groups with a score of 4.0 ($p < 0.003$).

Discussion: Poorer OHRQoL in the middle mixed dentition period was reported by children who had had comprehensive care under GA for ECC when they were below five years-of-age. In addition, children treated in the chair also have poorer OHRQoL in the middle mixed dentition period. Further research is needed to evaluate tooth based causes and its association with OHRQoL to come to a proper conclusion.

WILLIAM FOGARTY

DClinDent candidate (Paediatric Dentistry)

Adolescent oral health in New Zealand in 2009

WP Fogarty, WM Thomson, MG Brosnan

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Background: Adolescence is an important developmental epoch, yet data on adolescent oral health are scarce. **Aim:** The aim of this study was to describe the oral health (and its associations) of New Zealand adolescents.

Methods: The New Zealand Ministry of Health conducted a national oral health survey in 2009. Data on adolescent oral health were gathered through interviews and dental examinations. The current study was a secondary analysis of data on the 354 12- to 17-year-old adolescent participants, representing 373,986 adolescents in the population at that time. Several oral health domains were investigated, including dental caries, periodontal disease, dental fluorosis, dental trauma, dental anxiety and oral hygiene. Analyses used survey weights and were conducted using Stata.

Results: The prevalence of dental caries in the 12- to 14-year-old and 15- to 17-year-old age groups was 45% and 66%, respectively. Their respective mean DMFT scores were 1.4 and 2.5. The prevalence of gingivitis was 72%; clinical attachment loss ≥ 4 mm was seen in 11% (gingivitis and periodontal attachment loss were recorded in the 15- to 17-year-old group only). Dental fluorosis was relatively uncommon, with respective prevalence estimates of 17% and 10%, and dental trauma prevalence was 29% and 18%, respectively. Only a few of the 15- to 17-year-olds were dentally anxious, and oral hygiene in the 12- to 14-year-olds was generally fair/good. Various putative risk factors/markers were identified for each domain.

Conclusion: This study gave an insight into the state of adolescent oral health in New Zealand in 2009, by describing several oral health-related domains, and identifying several putative risk factors/markers for each domain. More research is needed; however, the findings can be taken as starting points for further investigation.

EPIDEMIOLOGY AND PUBLIC HEALTH

DPAG Conference Room (Level 2)

2.10 – 3.10pm

Session chair: Associate Professor Jonathan Broadbent

2.10 – 2.25pm

DR LEE SMITH

The barriers/enablers for general dentists' implementation of non/micro invasive measures to manage proximal caries lesions

L Smith¹, L Foster Page¹, WM Thomson¹, F Schwendicke², M Fontana³, S Baker⁴

1. SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

2. CHARITÉ UNIVERSITÄTSMEDIZIN BERLIN

3. SCHOOL OF DENTISTRY, UNIVERSITY OF MICHIGAN.

4. UNIT OF DENTAL PUBLIC HEALTH, UNIVERSITY OF SHEFFIELD

In the final academic semester of 2016, a collaborative international study was taken, investigating how 12 general dentists in New Zealand, 12 in Germany, and 24 in the United States (the state of Michigan) managed non-cavitated proximal caries lesions confined to the inner third of the enamel or at the dental enamel junction (DEJ). After approval from the relevant institutional ethical boards/committees, individual telephone interviews were conducted, guided by a semi-structured interview schedule based on 10 of the 14 domains contained in the Theoretical Domains Framework (TDF). The TDF was originally developed by a team of international health professionals to help manage the multitude of psychological theories which are used to explain behavioural change in implementing best practice. The TDF also guided the analysis of the qualitative data.

A number of barriers and enablers to the implementation of non/micro-invasive measures for managing non-cavitated proximal caries lesions were identified, as were differences between participating countries in regard to the implementation of those measures. For instance, the lack of financial reimbursement for non-invasive preventive measures was more pronounced among the German and US participants, while the NZ participants were more likely to express a sense of anticipated regret; that is, anxiety about not restoring non-cavitated lesions at an early stage before they became large carious lesions. Other barriers and enablers to the implementation of non/micro invasive measures will be discussed in the presentation.

2.25 – 2.40pm

ASSOCIATE PROFESSOR ABHISHEK MEHTA

Prevalence of dental caries among Indian children in the era of economic liberalization- what are the trends in the last 25 years? A retrospective analysis

DEPARTMENT OF PUBLIC HEALTH DENTISTRY, FACULTY OF DENTISTRY, JAMIA MILLIA ISLAMIA UNIVERSITY, NEW DELHI

Background: The economic liberalization which started in early 90s in India has led to increase in its GDP, decline in poverty and improvement in various health status indicators. As oral health is integral part of general health, it is expected that there shall be improvement in oral diseases morbidity indicators also, especially among the children who are born in this era.

Methods: A systematic literature search was conducted to find studies done on dental caries prevalence in children in India from the year 1992 to 2016. Mesh and free text terms “child”, “dental caries” and “India” were searched in databases – PubMed & PubMed Central. A total of 1468 titles were searched and 125 articles were shortlisted for further inspection. Sixty six articles were retrieved from Google scholar. Based on the established eligibility criteria 83 studies were found suitable for final analysis. Data was analyzed under two broad categories- age groups and year of publication at 5-year interval. Average proportion, standard error, confidence interval, weighed mean and Significant Caries (SiC) Index were calculated.

Results: The pooled prevalence of dental caries was found to be more than 50% with a range of 50.84 to 62.41%. Highest prevalence was seen in group year of 1997 to 2001. There was decline in caries prevalence in 0-5 and 11-15 year age groups whereas no clear pattern emerged in 6-10 years. Average mean (weighed) of 2.3 was obtained in the year groups’ category (range- 1.9 +/- 6.07 to 2.9+/- 5.3). Overall weighed mean of 2.4, 2.7 & 1.9 was observed in 0-5, 6-10 & 11-15 year age groups.

Conclusion: The present review suggests that more than half of Indian children have been affected by dental caries. High SiC index score suggest a skewed distribution of caries among Indian children. This data may aid in planning further exploratory research and oral health care services for children by the stakeholders.

2.40 – 3.10pm

Student presentation session

LEONARD CHIA

DClinDent candidate (Special Needs Dentistry)

Clinicians’ perspective of Special Care Dentistry in New Zealand

L Chia, DC Tong, WM Thomson, L Foster Page

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

The aim of this research was to explore the perspectives of Special Care Dentistry among specialists in New Zealand. A qualitative approach was used, and semi-structured interviews were conducted with nine registered Special Care Dentistry Specialists, a Dental Public Health Specialist, and a general dentist who predominantly practised Special Care Dentistry. Interview data were audio-recorded and transcribed. A general inductive approach was used to thematically analyse the data and emerging themes were identified. Three broad themes were identified: the profession; interprofessional interactions; and the evolution of Special Care Dentistry. Under each of these themes, subcategories were also identified. This study revealed that the participants preferred ‘Special Care Dentistry’ to ‘Special Needs Dentistry’, which challenges the current term and definition used in New Zealand. In addition, they provided insights into their career choices and their roles as Special Care Dentistry practitioners. They also highlighted the career and training prospects of Special Care Dentistry and its limitations in New Zealand. It was also perceived that the participants had better professional interactions with medical professionals than their dental colleagues did. Participants also revealed that there is a general reluctance of dentists to treat older people and patients who require special needs. The participants believed the main barriers were financial

hurdles, time pressure, and limited medical knowledge. Critical issues—such as older people’s oral health and increasing demand for Special Care Dentistry in public practice—suggested that there is a need to foster the provision of Special Care Dentistry at the primary health care level. Recommendations were proposed for the improvement of career and training pathways, Special Care Dentistry education among undergraduates and general dentists, and the promotion of the specialty within the medical and dental professions.

NINA SCOTT

DClinDent candidate (Endodontics)

Dental trauma in New Zealand adults: a secondary analysis of national survey and ACC data

N Scott, WM Thomson, P Cathro

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Aim: To determine the prevalence, characteristics and associations of dental trauma in NZ adults by analysing data from the 2009 NZOHS and the ACC.

Methods: Information about dental trauma in a representative sample of 2209 New Zealand adults was collected as part of the NZOHS. This included self-report information and a clinical examination of the 6 maxillary anterior teeth. Data were weighted and analysed using Stata. Information from the ACC on new dental injuries in adults in 2008 was analysed using SPSS.

Results: Of the approximately 40% who reported previous orofacial trauma, 70% (that is, 28% of the overall population) reported that this included a dental injury. More males than females had experienced orofacial trauma (51% and 31% respectively; $P < 0.05$) but there was no sex difference in self-reported dental trauma. The most common injury was a chipped or broken tooth (67%). Almost three-quarters had sought treatment for their dental injury. Clinical examination revealed an overall trauma prevalence of 23%, with more males than females affected (27% and 20% respectively). Almost 15% had one injured tooth; 7% had two injured teeth and 2% had three or more. The central incisors were the most frequently affected. The most common clinical dental trauma observation was evidence of treatment or an untreated enamel fracture, more common among males and those aged 35-44. Analysis of dental information from the ACC revealed that 32,110 adults and children sought treatment for orofacial trauma during 2008. Dental injuries to permanent teeth most commonly involved the central and lateral maxillary incisors. The 1325 adults who sustained dental trauma during June 2008 were followed for the subsequent 5 years. Generally, more severe injuries required more treatment.

Conclusions: Dental trauma in the NZ adult population constitutes an important public health issue, given that many will need life-long follow-up and treatment.

Poster session

DPAG ODT Gallery (Level 2)

Poster viewing: 10.40 – 11.10am and 3.10 – 3.30pm

Poster judging: 12.40 – 1.30pm

DR LEE ADAM

Undergraduate dental students' stress and resilience: predictors of success?

P Brunton, J Broadbent, L Adam, A Meldrum, A Rich

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

This longitudinal project aims to identify whether psychological measures can be used as a predictor of students' success, and thus be used as part of the selection process into the Bachelor of Dental Surgery programme at the University of Otago. A questionnaire, consisting of the Perceived Stress Scale (PSS), the Brief Resilience Scale (BRS) and the Profile of Mood States (POMS-Bi) instruments is being distributed to all undergraduate dental students twice yearly for each of the four years of their degree. At the beginning of the 2016 academic year, the mean PSS among the dental students was significantly greater than previously-reported scores among American college students (Cohen, Kamarck & Mermelstein, 1983) ($P < 0.0001$). By the first follow-up at the end of the 2016 academic year the mean PSS score was slightly greater, but this was not a statistically significant difference, although some individuals varied markedly. There was no difference between students entering the programme and students in later years of the programme. There was no statistically significant difference between baseline and follow up scores in the BRS. However, the BRS scores were lower than those found in other populations (Smith, Dalen, Wiggins, Tooley, Christopher & Bernard, 2008). No associations were identified between individual students' stress, resilience, and their academic and clinical performance. Future data collection will enable ongoing investigation.

PROFESSOR JOHN BROUGHTON

Dental students' reflections of clinical placements with Indigenous New Zealand oral health providers

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Objectives: To review the Māori community placement programme utilizing the students' written reports and reflections of their experience.

Experimental methods: Māori are the Indigenous people of New Zealand who do not enjoy the same oral health status as the majority non-Māori population. Consequently many Māori tribal organisations have established their own oral health services. These Māori oral health providers host final year dental students for a 5-week clinical placement.

On their return from their placement the students are required to submit a report of their experiences of their placement. These reports were the basis for this review.

Results: In 2016 84 students participated in this Māori community service learning programme being placed in 10 locations throughout New Zealand and the Pacific. Their reports included case histories, community-based activities, the application of the Māori model of health and well being, the application of the Articles and/or Principles of the Treaty of Waitangi and their personal reflections of their experiences.

Conclusions: The students' reports and their reflections revealed the valuable clinical experiences, the cultural experiences, and the increased confidence they had gained in these Māori community-based clinical settings. The reports clearly articulated that the one prime benefit from the placement was that the clinical settings and work undertaken were experiences that they would never otherwise have had within the confines of a dental school. The programme thus far has been very successful.

DR DAWN COATES

Moa-Bone® graft material in a sheep maxillary sinus model

DE Coates, MM Smith, WJ Duncan

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Background and aim: Deproteinized bovine bone particles such as Bio-Oss® are commonly grafted into maxillary sinuses, to act as a matrix for bone augmentation prior to dental implant surgery. This study investigated bone growth and remodeling around the novel bovine bone replacement graft (BRG) Moa-Bone® as compared to Bio-Oss®, in a sheep maxillary sinus model.

Methods: Surface morphology of Moa-Bone® and Bio-Oss® were investigated using scanning electron microscopy. For *in vivo* testing, six sheep had bilateral maxillary sinus grafting with each BRG, covered with BioGide® collagen membrane. After 4, 6 and 12 weeks the sites were harvested and divided in two. One side was resin-embedded for morphology and the other decalcified in EDTA and paraffin-embedded to enable detection of markers associated with osteogenesis. Osteoclasts were identified as multinuclear cells in resorption pits using Tartrate Resistant Acid Phosphatase (TRAP) staining. Pre-osteoblasts and osteoblasts were identified using immunohistochemistry for RUNX2, and proliferative cells with PCNA.

Results: Bio-Oss® was more globular and less porous compared to Moa-Bone®. At both 4 and 6 weeks large numbers of TRAP-positive multi-nuclear cells were located within resorption lacunae associated with Moa-Bone® but not Bio-Oss®. At 12 weeks, Moa-Bone® particles appeared reduced in size, however both materials were associated with maturing lamellar bone. During early osteogenesis RUNX and PCNA positive cells were more evident in association with Moa-Bone® compared to Bio-Oss® BRG material.

Conclusion: Moa-Bone® was investigated as a novel bovine BRG material and compared to Bio-Oss®. *In vivo* Moa-Bone® was associated with active osteoclast resorption at both 4 and 6 weeks. Bio-Oss® by comparison showed little osteoclast related activity. New bone and osteoblast activity was evident in association with both materials and maturing lamellar bone was evident at 2 months. Moa-Bone® thus demonstrated positive attributes for a maxillofacial grafting material that would warrant further research.

MAYKON DIAS

Bachelor of Dental Technology final year student

The efficiency of a novel temporary crown system (HI-tempo®) marginal seal and structural durability in terms of cyclic loading: A pilot study

M Dias, L Tykhonova, C Richardson, L Zhou, N Waddell, J Choi

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Objectives: To investigate and compare the marginal seal accuracy and the structural durability in terms of strength to cyclic load of a novel provisional crown material with that of bis-acrylic, Luxatemp®.

Methods: Two types of provisional crown systems (bis-acrylic and poly-lactic acid (PLA) based) were investigated. Conventional material (Luxatemp®) and a novel alternative (HI-tempo® preformed and window) were used for the study. A prepared maxillary abutment template (Ivoclar Vivadent IPS e-max training Kit) was CAD scanned, 20% reduced, 3D printed and used to uniquely transfer (Ceramill Base, AmannGirrbach) the tooth preparation over to bovine incisor teeth. Crowns were cemented following manufactures' recommended instructions. Prior to testing, specimens received reference marks to help gauge marginal change. The specimens were cyclic loaded (93.3N, 0.63Hz) for about 45,360 cycles (equivalent to approx. 3 weeks in vivo). Results were statistically analyzed. Marginal changes were also assessed under the light microscope and structural observations made by scanning electron microscopy.

Results: The mean marginal change in the HI-tempo® provisional crowns ($M=-142.46$, $SD=95.87$) were statistically different ($p=.016$) to that of conventional Luxatemp® ($M=229.36$, $SD=203.13$). Statistically significant marginal changes were limited to only the buccal and lingual margins. There was no statistically significant difference ($p=.065$) for the mesial margin. Marginal leakage was evident across all tested groups and marginal adaptation of the preformed PLA-based system proved to be more difficult than promoted by the manufacturer. All three materials demonstrated the ability to withstand occlusal loads and survive the expected short lifetime (approx. 2-weeks) of provisional crown systems.

Conclusions: Differences in marginal changes were significant across all three tested groups. The HI-tempo® preformed crown system demonstrated to be adequate in the temporization of abutment teeth for a period of at least two weeks. A larger sample size would be needed to confirm the results attained in this study.

LISA FALLAND

PhD candidate

Development of an anatomical skin/skull/brain model to measure impact forces associated with traumatic brain injury

L Falland-Cheung, JN Waddell, KC Li, DC Tong, PA Brunton

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Upon blunt force impact to the head, there are several mechanical responses that may result from the forces involved, including the absorption of impact forces. The purpose of this study was to develop an anatomical head model to measure force transfer through its various layers and their displacement when subjected to short duration high velocity impacts.

Previously validated simulant materials were used to construct the head model: epoxy resin for the skull, polyvinyl siloxane for the scalp, an agar/glycerol/water mixture for the brain, and modified intravenous fluid for the cerebrospinal fluid. An array of accelerometers with different acceleration ranges was incorporated into the various layers of the head to measure forces in x- (anterior/posterior), y- (left/right) and z- (up/down) direction. A weight (750g) was dropped from a height of 1m (n=20). Impact forces (z-axis) of 2982.20N were recorded on top of the scalp, with decreasing values through the layers (bottom of skin 115.39N, top of skull 496.86N, bottom of skull 140.52N, top of brain 59.51N, middle of brain 64.03N and base of brain 97.10N). Forces in the x- and y-axes were similar to those of the z-axis. With the base of the brain still receiving 97.10N, this highlights the potential danger of repetitive impact forces to the head. Upon impact the layers of the head are displaced in all directions, with the highest values shown in the z-axis. In conclusion, this study identified the importance of considering short duration high intensity impacts to the head and their effect on the underlying tissues.

DR ERWIN LAMPING

New structural and functional insights into the type II fungal ATP-binding cassette transporter Candida albicans Cdr1

E Lamping, HJ Lee, RD Cannon

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Background: ATP-binding cassette (ABC) transporters are one of the largest protein super-families found in all kingdoms of life. They are active transporters that can be divided into type I, type II, and energy-coupling factor (ECF) importers (only found in prokaryotes), and type I and type II exporters. *Candida albicans* Cdr1 is a member of the pleiotropic drug resistance (PDR) ABC exporter sub-family unique to plants and fungi. Overexpression of Cdr1 causes life-threatening drug resistance in clinical isolates of the opportunistic human fungal pathogen, *C. albicans*. PDR transporters typically have two large extracellular loops, EL3 and EL6, containing PDR transporter-defining motifs, PDRA and PDRB, and EL6-motif and EL6-helix.

Methods: The role of the four PDR-specific motifs in Cdr1 structure and function was investigated by alanine scanning mutagenesis and functionally overexpressing and characterizing individual mutants in the genetically modified heterologous host *Saccharomyces cerevisiae* AD $\Delta\Delta$.

Results: We discovered seven amino acids in PDRA, PDRB and the EL6 motif critical for pump function and identified three important extracellular disulfide bonds that are conserved in all fungal PDR transporters. Cdr1 has 23 cysteines, and progress has been made towards the creation of an entirely cysteineless, but functional, Cdr1 - an essential first step for cysteine-cross-linking studies to confirm predicted structural interactions.

Conclusion: The PDR motifs together with the two large extracellular domains of fungal PDR transporters are stabilized by three unique disulfide bonds, and the interaction between these motifs and the extracellular domains contribute to a transport mechanism that is unique to PDR transporters.

DR SUSAN MOFFAT

New Zealand's School Dental Service: Adapting to change

SM Moffat, RM Ahmadi

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Objective: To investigate the development of the New Zealand School Dental Service (SDS), focusing on its reaction to social, political, and economic change.

Methods: This research project used key historical sources (such as Government archives, the *New Zealand School Dental Service Gazettes* and dental nurse oral histories), as well as reviewing more recent literature, to trace the development of New Zealand's SDS.

Results: The SDS was established as a unique solution to an overwhelming health issue. Supported by New Zealand's welfare state policies, the Service went from strength-to-strength with its goal to extend care to all children, a resolve tested by economic depression, war, and the 'baby boom'. Despite these difficulties, the SDS developed innovative solutions to issues encountered, bringing more children under its care each year. Oral health surveys conducted during the 1970s, however, would reveal that New Zealand children had heavily-filled teeth and that adults were still losing their teeth at an early age. As a result, the SDS implemented a new caries diagnosis and preventive programme which rapidly reduced the filling rate. Unfortunately, it would face further problems over the next few decades, with funding cuts in the 1970s and 1980s leading to the Service becoming somewhat outdated, and major social and economic 'reforms' in the 1990s having a negative effect on children's oral health. In the last decade, oral health policy had changed once more, with the Government investing in the transformation of the school-based Service to a Community Oral Health Service (COHS) emphasising preventive care.

Conclusion: Since its establishment in 1921, the New Zealand SDS has proved adaptable and willing to change. While initial evaluations of the new COHS are positive, it still faces challenges in terms of addressing oral health inequalities and the recruitment and retention of dental therapists.

FRANCES RUDDIMAN

DClinDent candidate (Periodontology)

Comparing microbial colonisation at the implant-abutment interface and bone loss in original and aftermarket abutments in an ovine model

F Ruddiman¹, P Schmidlin², J Leichter¹, A Gray¹ and W Duncan¹

1. SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

2. CENTRE OF DENTAL MEDICINE, UNIVERSITY OF ZURICH

Introduction: Previous *In vitro* work suggests that implants restored with aftermarket (AM) abutments are more prone to leakage at the implant-abutment interface (IAI) compared with original equipment manufacturer (OEM) abutments. Abutment miss-fit may change microbial colonisation at the IAI, increasing peri-implant inflammatory cell accumulation and thus increasing bone loss around AM abutments. This study examined whether AM abutments result in microbial changes or increased bone loss around implants in a sheep model.

Methods: Sixty identical implants were placed into healed post-extraction posterior mandibles of 10 sheep. Abutments were placed immediately or by 2nd stage surgery after two months. Radiographs and microbial sampling were done at baseline, 2 & 4 months. Periopathogenic species were identified and quantified by PCR. For resin-embedded sections, bone-to-implant contact and distance to first bone contact were calculated from 2 images per implant using ImageJ software. Differences were examined statistically using regression analysis in Stata 14.1; $p < 0.05$ was considered statistically significant.

Results: Results summarised in Table 1. More implants restored with aftermarket abutments failed (14 vs. 8) but this did not reach statistical significance ($p=0.17$). There were no statistical differences between OEM vs. AM for %BIC, first bone contact, radiographic bone changes, or microbial colonisation.

	OEM Group	AM Group	p-value
%BIC (%)	79.4±7.63	76.6±12.8	0.889
First Bone Contact (mm)	-3.6±2.1	-3.7±2.0	0.303
Radiographic Bone Loss – mesial (mm)	-3.2±1.8	-3.4±1.6	0.102
Radiographic Bone Loss – distal (mm)	-2.8±1.7	-3.4±2.0	0.429
Survival (%)	22/30 (73.33%)	16/30 (53.33%)	0.169
Total Microbial Colonization (10⁶)	5.2±5.9	8.1±11.7	0.377

Conclusion: Statistical analysis was complicated by a higher-than-expected number of implant failures. No relationship was observed between microbial colonisation and implant outcomes. While some intriguing trends were noticed, a larger human study is now recommended to further explore this relationship.

ASHLEY THE

BOH student, NZDA R.C Tonkin Summer Scholarship recipient

Impacts of space disruptions on a Dental School learning environment

A The, L Adam (presenter), A Meldrum, P Brunton

SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

This project was a qualitative investigation into University of Otago Faculty of Dentistry student and staff experiences of their learning and teaching environments during a period of major building redevelopment. Currently, there is little research exploring the impact of disruptions to the learning environment on students' learning and staff teaching experiences. Data were collected in 2016 using an online survey and semi structured interviews/focus groups with students and staff. Data were analysed using a general inductive approach. Four broad themes emerged: i) students valued having a space for personal or collaborative work within the Dental School, ii) both staff and students positioned staff contributions to learning experiences above the role of the physical learning environment, iii) the majority of staff and students do not feel that the physical environment limits their clinical training iv) staff and students are able to adapt to the impact of building redevelopment through resilience and organisation. This research has informed the sourcing of spaces and systems that facilitate relationships and collegiality during the redevelopment process.

ASSOCIATE PROFESSOR NEIL WADDELL

Strength of novel glass etch and prime resin bonding system

JN Waddell, AM Yusof, KC Li, JJE Choi, L Jansen van Vuuren, W Jansen van Vuuren
SIR JOHN WALSH RESEARCH INSTITUTE, FACULTY OF DENTISTRY, UNIVERSITY OF OTAGO

Objective: To evaluate the bond strength of a novel glass etch and prime resin bonding system compared to a conventional hydrofluoric acid etch and prime system on two silica based ceramic materials.

Method: Beams (6mm x 6mm x 30mm) were prepared according to ASTM C1421-10 from lithium disilicate (Ivoclar Emax CAD) and leucite reinforced (Ivoclar IPS Empress CAD) blocks. Both materials were bonded (n = 10 per group) using a conventional hydrofluoric acid etch system (5% Hydrofluoric acid etchant, IPS Ceramic Etching Gel + Multilink Automix, Ivoclar Vivadent) and a novel glass etch and prime system (Monobond Etch & Bond, Ivoclar Vivadent). The specimens were brought to failure on a 3-point bending jig with a universal testing machine and fracture toughness values calculated. Statistical analysis was performed using one-way ANOVA and Tukey Post Hoc test.

Results: The mean fracture toughness values ranged from 1.05 (\pm 0.29) to 3.53 (\pm 0.89). The lithium disilicate + HF etch system showed the highest bond strength. Both ceramic materials bonded using Monobond produced lower fracture toughness values compared to HF groups. A statistical significance was found between lithium disilicate + HF etch system compared to all other groups ($p < 0.05$). A significant difference was found when leucite reinforced blocks were bonded using HF and Monobond ($p < 0.05$).

Conclusion: Fracture toughness values of the novel glass etch and prime resin bonding system were significantly weaker than the conventional hydrofluoric acid etch system of bonding for both silica based ceramic materials.

PRESENTATION OF AWARDS

5.20 – 6.00pm

DPAG ODT Gallery (Level 2)

Presented by Professor Richard Cannon, Director SJWRI

INSTITUTE AWARDS

Sir John Walsh Award for Research Excellence

Strategic Research Prize

Research Publication Awards

Student Research Publication Award

Research Supervisor Award

SYMPOSIUM AWARDS

Best student oral presentations (by session)

Best poster presentations (staff/student)