

UNIVERSITY OF OTAGO
FACULTY OF DENTISTRY
SIR JOHN WALSH
RESEARCH INSTITUTE
TE POKAPŪ RAKAHAU OTĀ JOHN WALSH

Research Day

Wednesday 31 July 2013
Dunedin Public Art Gallery

Programme and Abstracts

Sir John Walsh Research Institute

The Sir John Walsh Research Institute, a Research Centre of the University of Otago, advances research and increases knowledge for the improvement of oral health in New Zealand. Its innovative, future-focused, interconnected research programmes cover the spectrum of oral health research, from the molecular level through biological systems to the health of populations. The Institute is part of New Zealand's only Faculty of Dentistry and its members have well-established productive collaborations across the University and with other institutions in New Zealand and worldwide. Among its research objectives is to develop clinical research that translates discoveries into measurable health improvements, and to maintain fundamental research that underpins teaching.



The Sir John Walsh Research Institute Research Day 2013 is made possible by the generous support of 3M ESPE.

Research Day Programme

Auditorium, Dunedin Public Art Gallery, Dunedin, 31 July 2013

| | | |
|---|--|---|
| 8.30am | Registration: | Auditorium, Dunedin Public Art Gallery, Dunedin |
| 9.00am | Introduction: | Professor Jules Kieser, Director – Sir John Walsh Research Institute |
| 9.05am | Māori Welcome: | Professor John Broughton, Director – Ngai Tahu Māori Health Research Unit |
| 9.20am | Opening Address: | Professor Richard Blaikie, Deputy Vice-Chancellor – Research and Enterprise |
| 9.35am | Dean's Address: | Professor Gregory Seymour, Dean, Faculty of Dentistry |
| Session 1 9.45 – 11.00am Chair: Professor Jules Kieser | | |
| 9.45am | Keynote Speaker: Associate Professor Jan Koolstra | Department of Functional Anatomy, Academic Centre for Dentistry Amsterdam, The Netherlands <i>Biomechanical analysis of fractures in the mandibular neck (collum mandibulae)</i> |
| 10.15am | Keynote Speaker: Professor Richard Cannon | 2011 Sir John Walsh Research Award Winner <i>Overcoming antifungal drug resistance</i> |
| 10.45am | Student Guest Speaker: Carolina Loch | <i>Morphology, structure and evolution of teeth in fossil and modern odontocetes (Cetacea)</i> |
| Morning Tea | 11.00 – 11.45am | Refreshments in the Otago Daily Times Gallery with our sponsor 3M's representative and display |
| Session 2 11.45am – 1.15pm Chair: Dr Neil Waddell | | |
| 11.45am | | 3M ESPE Presentation from Stephen Langdon, Scientific Affairs Manager |
| 12.15 pm | Jennifer Lee | <i>Development, Validation and Preliminary experiments of A Novel Indwelling Wireless Intraoral pH Telemeter</i> |
| 12.30pm | Victoria Beck | <i>Factors Associated with Orthodontic Pain</i> |

| | |
|------------------|--|
| 12.45pm | Arun Natarajan <i>Characterization of Molar Incisor Hypomineralization using Raman Spectroscopy and Energy Dispersive X-ray Spectroscopy/Scanning Electron Microscopy</i> |
| 1.00pm | Diogo Zanicotti <i>Human adipose-derived stem cells on titanium surfaces</i> |
| Lunch | 1.15 – 2.15pm To be held in the Otago Daily Times Gallery with our sponsor 3M's representative and display |
| Session 3 | 2.15- 4.30pm Chair: Dr James Smith |
| 2.15pm | Kathryn Newsham-West <i>Overcoming the antifungal drug resistance of biofilms on dental acrylic</i> |
| 2.30pm | Stephanie Shkrum <i>The value of radiography to the diagnosis of dental caries and periapical lesions in archaeological remains</i> |
| 2.45pm | Ratu Osea Gavid <i>Comparison on prevalence of oral squamous cell carcinoma in New Zealand and Fiji Islands (2000-2010)</i> |
| 3.00pm | Ellie Knight <i>Quantifying the diabetes-periodontitis association</i> |
| 3.15pm | Jenny Liu <i>Novel Bone Substitute Material in a Sheep Extraction Socket Model</i> |
| 3.30pm | Joseph Antoun <i>Why the long face? – A Genetic Perspective</i> |
| 3.45pm | Yeen Lim <i>Analysis of saliva proteins from head and neck cancer patients</i> |
| 4.00pm | Jon Campbell <i>Pilot Study Monitoring Oral pH in Mouths Showing Signs of Dental Erosion</i> |
| 4.15pm | Joanne Choi <i>Pressed ceramics onto zirconia: Intrinsic properties and influence of cooling rate on residual stresses</i> |
| 4.30-5.00pm | Closing remarks from Professor Jules Kieser, Director, Sir John Walsh Research Institute Announcement of the Best Student Presenter, awarded by Stephen Langdon, Scientific Affairs Manager, 3M ESPE Drinks in the Otago Daily Times Gallery |

Biomechanical analysis of fractures in the mandibular neck (collum mandibulae)

Associate Professor Jan Koolstra

Department of Functional Anatomy, Academic Centre for Dentistry Amsterdam (ACTA), Universiteit van Amsterdam and Vrije Universiteit, Amsterdam, The Netherlands

Aim

Fractures in the mandibular neck generally occur as the result of accidents or fights. They are often treated by immobilising the dentition with splints that are slackened gradually after a short time. A common side effect of this treatment is the development of an open bite. The present study aims to discover the causes of the development of an open bite to enable possible improvements for treatment. Furthermore, the consequences for loading in the contralateral joint will be taken into account.

Methods

Dynamical biomechanical models have been developed to predict consequences of condylar neck fracture or its treatment for masticatory functioning. The morphology was based on an average of 7 cadavers. The jaw joints were modelled according to one normal cadaver. Muscle activation patterns mimicking habitual jaw opening and closing movements were applied.

Results

During fracturing the condyle on the affected side is dislocated either downwards or forward, herewith disturbing the normal articulation. Jaw movements become asymmetric and the closed position of the lower jaw mimics an open bite. After immobilisation of the dentition the mandibular condyle could still move out of its fossa in anterior direction. In the joint on the unaffected side increased loading was predicted.

Conclusion

Occurrence of an open bite after non-surgical treatment of a fractured mandibular neck is suggested to be a consequence of a failure to regain normal articulation in the joint on the affected side. Furthermore, mandibular fixation does not necessarily prevent the joint on the affected side to dislocate afterwards.

Overcoming antifungal drug resistance

Professor Richard Cannon

Director, Molecular Microbiology Research Programme

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

2011 Sir John Walsh Research Award Winner

Kyoko Niimi¹, Erwin Lamping¹, Franziska U. Huschmann¹, Masakazu Niimi¹, Mikhail V Keniya¹, Joel D.A. Tyndall², Ann R Holmes¹ and Brian C Monk¹.

Departments: ¹Oral Sciences; ²School of Pharmacy

Invasive fungal infections kill more people than tuberculosis or malaria. In addition, antimicrobial drug resistance is emerging as a major global health issue. Drug resistance is also a problem in fungi that cause oral infections. Of the limited number of antifungal agents available, polyenes have a relatively high toxicity, and resistance to azole and echinocandin drugs is present, and increasing, in certain patient populations. The objective of our research is to understand fungal drug resistance mechanisms and to discover ways of overcoming this resistance. Echinocandin drugs inhibit β -1,3-glucan synthase (GS) – an enzyme responsible for the biosynthesis of a major structural component of the fungal cell wall. We have discovered that for the oral fungal pathogens *Candida albicans* and *Candida glabrata* two mutations in GS are required for high-level echinocandin resistance. Azoles target the biosynthesis of the fungal sterol ergosterol and inhibit the enzyme lanosterol 14 α -demethylase (Erg11p). Two mechanisms for azole resistance in *C. albicans* are mutations in Erg11p and over-expression of plasma membrane proteins that efflux azoles from the cells. We have screened drug libraries and identified compounds that inhibit the main *C. albicans* efflux pump and make azole-resistant clinical isolates susceptible to azoles in a mouse model of oral candidosis. We have also purified, crystallised, and obtained structures for a fungal Erg11p. These structures show how azoles bind to the target and can inform the design of new drugs that can overcome azole resistance.

Morphology, structure and evolution of teeth in fossil and modern odontocetes (Cetacea)

Carolina Loch Santos de Silva

Department of Geology and Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

PhD candidate

Supervisors: Prof R. Ewan Fordyce (Geology), Prof Jules Kieser

Aim

Cetaceans are singular aquatic mammals with highly modified skulls and feeding apparatus. Teeth in living dolphins (Delphinoidea) differ from those of most mammals in being homodont, polydont and monophodont. The aim of this research was to investigate the morphology, structure and biomechanics of teeth of fossil and modern odontocetes.

Methods

A multidisciplinary approach involving morphological description and basic morphometric measurements, as well as SEM imaging, nanoindentation, geochemical analyses and Micro-CT was adopted.

Results

Cetacean adaptation to an aquatic lifestyle has produced a rich morphological diversity in feeding and sensory systems, presumed to reflect diverse niches and food sources. The ultrastructure and mechanical properties of cetacean dental tissues also show adaptive changes. In early cetaceans with heterodont teeth (differentiated tooth function), enamel was organized in Hunter-Schreger bands, while most living delphinoids showed a radial or even prismless enamel structure. In delphinoids, simplified tooth function (lack of occlusion and food processing) was reflected in lower hardness and elastic modulus values for dolphin enamel and dentine than in other mammals. Chemical analyses revealed a typically-mammalian tooth chemistry based on calcium and phosphate. Micro-computed tomography was useful as a non-destructive method for morphological analysis of extant teeth, but it was less so in fossils due to burial-related alteration.

Conclusion

The multidisciplinary approach adopted here allowed a broader characterization of the evolutionary changes and constraints in the structure of the teeth and feeding apparatus of dolphins, contributing to the understanding of their functional morphology, general biology and evolution.

Development, validation and preliminary experiments of a novel indwelling wireless intraoral pH telemeter

Jennifer Lee

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

DClinDent (Orthodontics) candidate

Supervisors: Prof Mauro Farella, Prof Jules Kieser, Prof Bernadette Drummond

Aim

The aim was to develop wireless intraoral pH telemetry device and corresponding software on a smart phone, to validate the measurement of an antimony electrode and to gather preliminary data using the developed device

Methods

A number of preliminary *in vitro* and *in vivo* (although in one participant) experiments have been carried out to validate the measurements of the wireless device. *In vitro* experiments included determination of drift over 24 hours and temperature effects to validate the pH probe. *In vivo* experiments investigated measurements during the daytime and sleep as well as following swallows of acidic drinks.

Results

Among various appliances constructed, the clear-retainer type appliance turned out to be of the most time-efficient and successful way of enveloping the wireless device. A distinct difference was observed between the pHs of the upper and lower arches. During sleep, there was a great deal of fluctuations of the pH values in the upper arch, while the recordings from the lower arch showed little change. When an acidic drink was introduced, a pronounced drop in pH in the upper arch was obvious with gradual increase to normal level, compared to minimal changes in the lower arch. An excellent cross-correlation was demonstrated between the conventional pH measurement system and the wireless device.

Conclusion

The developed wireless device can be implemented to advance research in the areas of erosive tooth wear, GERD and orthodontics.

Factors associated with orthodontic pain

Victoria Beck

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

DClinDent (Orthodontics) candidate

Supervisors: Prof Mauro Farella, Prof W. Murray Thomson, Prof Jules Kieser, A/Prof Nick Chandler

Up to 95% of orthodontic patients report pain during orthodontic treatment, with up to 10% of patients interrupting their treatment due to the pain experienced. Pain is highly subjective: there is a range of pain response among individuals undergoing orthodontic treatment, with some patients feeling high levels of pain and others just mild discomfort. The reasons for this variability are largely unknown.

Aim

To investigate factors that may be associated with orthodontic pain experience.

Methods

First, 107 participants were screened for pain response over 48 hours following placement of orthodontic elastomeric separators. Second, the highest (n=10) and lowest (n=10) pain responders were identified and then used to obtain data on age, ethnicity, sex, anxiety, mood, dental anxiety and fear, catastrophising, general sensitivity (cold) and tooth sensitivity. They also provided a saliva sample for COMT gene sequencing.

Results

Statistically significant differences between high and low pain responders were identified with the Pain Catastrophising Scale (PCS), Dental Anxiety Scale (DAS) and Cold Pressor Tests. Multivariate analysis was carried out using GLM. The empty model showing that 39.3% of pain response type (high or low) is explained by the magnification subcategory of the PCS; once all other variables were controlled for, the adjusted model explained 80% of the variance in the magnification subscale of the PCS. Of the three SNPs of the COMT gene analysed, only rs6269 showed an association with pain responders' haplotypes (albeit marginal).

Conclusion

Pain catastrophising, dental anxiety, and cold sensitivity appear to modify orthodontic pain experience. A few simple screening questions may help to identify patients at risk prior to commencing orthodontic treatment, so that patient-specific management strategies can minimise the occurrence of orthodontic discomfort.

Characterization of molar incisor hypomineralization using raman spectroscopy and energy dispersive x-ray spectroscopy/scanning electron microscopy

Arun Natarajan

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

DClinDent (Paediatric Dentistry) candidate

Supervisors: Prof Bernadette Drummond, Prof Michael Swain, Dr Chris He (dec'd), Dr Rami Farah, A/Prof Warwick Duncan

Aim

1. To investigate the molecular and elemental makeup of the enamel lesions in hypomineralised first permanent molar teeth affected by molar-incisor hypomineralization (MIH).
2. To evaluate the use of Raman spectroscopy and energy dispersive X-ray spectroscopy/scanning electron microscopy (EDS-SEM) in determining the chemical characteristics of enamel affected by MIH.

Methods

Cut sections of three different MIH lesions (white, yellow, and brown) were mapped by measuring Raman spectra using a Raman microscope and EDS-SEM was used to determine the corresponding elemental make up of those lesions.

Results

The mapping image of phosphate in the hypomineralised enamel region revealed a heterogenous low Raman spectrum intensity of phosphate compared with the adjacent normal enamel; this finding is consistent with experimental findings of published studies on MIH. In contrast to the decrease in Raman spectrum intensity of phosphate, the intensity of amide I increased mainly in the low-phosphate area. The increase in protein content was directly related to the increase in severity (white -> yellow -> brown). In addition, the border between hypomineralised and normal enamel was clearly distinguished by the mapping image using Raman spectrum of phosphate, carbonate, and amide I. Image comparison between Raman spectroscopy and EDS-SEM revealed that Raman spectroscopy showed phosphate distribution of the MIH teeth in greater detail. EDS-SEM experiments showed the corresponding calcium levels of the tested samples.

Conclusion

Raman spectroscopy and EDS-SEM are useful tools for analysing the molecular structure of healthy and enamel affected with MIH.

Human adipose-derived stem cells on titanium surfaces

Diogo Godoy Zanicotti

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

PhD candidate

Supervisors: A/Prof Warwick Duncan, Dr Dawn Coates, Prof Gregory Seymour

Aim

1. Examine the capacity of adipose-derived stem-cells (ADSCs) to multi-differentiate.
2. Determine the effects of turned and sandblasted titanium surfaces on the proliferation, mineralised matrix deposition, and gene expression of ADSCs, in serum-free and osteogenic differentiation conditions.

Methods

Confocal microscopy was used to measure the roughness of turned and sandblasted titanium discs (10mm diameter x 1.5mm thickness). Human ADSCs (Invitrogen) were tri-lineage differentiated. Osteogenic differentiation of ADSCs, on the titanium discs, was evaluated by immunofluorescence, anti-Runx-2 at 7 days and an anti-Osteocalcin antibody at 21 days. A proliferation assay on the discs was performed using AlamarBlue and the production of mineralised matrix was quantified by spectrophotometry after 21 days. Gene expression was performed with RT²-qPCR.

Results

ADSCs were successfully differentiated into osteoblasts, chondroblasts, and adipocytes. ADSCs cultured in serum-free and osteogenic media expressed Runx-2 on both types of titanium surfaces. Osteogenically-differentiated cells on both titanium surfaces expressed Osteocalcin. Cells in serum-free media proliferated more than in osteogenic media, regardless of the titanium surface type ($p < 0.01$). Osteogenically-induced ADSCs produced significantly more mineralised matrix at 21 days than cells in serum-free media, regardless of the titanium surface type ($p < 0.0001$). Gene expression assays showed that osteogenic associated genes were differentially regulated in ADSCs in response to the culture surface and conditions.

Conclusion

ADSCs were successfully differentiated into osteoblasts on titanium surfaces. Culture media had more effect on mineralised matrix production than the roughness of the titanium surfaces. Multipotent ADSCs showed potential for bone regeneration and repair adjacent to titanium devices.

Overcoming the antifungal drug resistance of biofilms on dental acrylic

Kathryn Newsham-West

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

DClinDent (Prosthodontics) candidate

Supervisors: Dr Kyoko Niimi, Dr Donald Schwass, Professor Karl Lyons, Professor Richard Cannon

Aim

RC21v3 is an octapeptide derivative that inhibits the drug efflux pump that confers azole resistance on the yeast *Candida albicans*. The objectives of this research was to determine whether RC21v3 acts synergistically with fluconazole (FLC) to inhibit the growth of *C. albicans* cells in planktonic cultures and during growth as a biofilm.

Methods

Minimum growth inhibition concentration (MIC) assays were undertaken to measure the inhibitory effect of FLC or RC21v3 on *C. albicans* cells growing as planktonic cultures. Checkerboard MIC assays were used to measure the effect of combinations of FLC with RC21v3 on both planktonic and biofilm growth. The inhibition of *C. albicans* biofilm growth on denture acrylic was measured using crystal violet staining of biofilm cells. The effect of FLC and/or RC21v3 on biofilm structure was investigated using scanning confocal microscopy.

Results

Checkerboard MIC assays showed that RC21v3 acted synergistically with FLC to inhibit the planktonic growth of three *C. albicans* strains (MML610, MML611 and ATCC10261). In addition, the combination of RC21v3 with FLC in growth assays resulted in FLC becoming fungicidal to all three strains. A novel dental acrylic biofilm model was developed. As it demonstrated reproducible growth of *C. albicans*, it could be used to measure biofilm growth inhibition. FLC inhibited the growth of *C. albicans* biofilms and checkerboard assays showed that RC21v3 acted synergistically to reduce the growth of ATCC10261 biofilms.

Conclusion

This is the first demonstration that RC21v3 can chemosensitize *C. albicans* biofilms to FLC, and so may be of use in treatment of FLC-resistant biofilms on denture surfaces

The value of radiography to the diagnosis of dental caries and periapical lesions in archaeological remains

Stephanie Shkrum

Department of Anatomy, University of Otago

PhD candidate

Supervisors: A/Prof Nancy Tayles, Dr Sídn Halcrow, Prof W. Murray Thomson

Aim

The aim of the study is to assess the value of radiography to the study of oral health in archaeological remains by comparing visual and radiographic methods for detecting dental caries and periapical lesions in the dental remains from the prehistoric site of Ban Non Wat (1750 BC to 400 AD), Thailand.

Methods

The dental remains of adults (n=80) were examined both visually and radiographically. Standard periapical projections were taken using a portable dental X-ray system equipped with a digital intraoral sensor. Dental caries and periapical lesions were recorded using standard radiographic diagnostic criteria and compared with evidence from visual observations.

Results

For almost all lesions, the use of radiography resulted in significantly higher detection rates. The greatest discrepancy for dental caries was observed for approximal surfaces, with visual examination alone accounting for less than half (47.2%) of lesions detected. For periapical lesions, nearly two-thirds of lesions (62.2%) were undetected visually.

Conclusion

This study confirms the value of radiography for improving detection rates of dental caries and periapical lesions in archaeological remains. The prevalence estimates of dental caries and periapical lesions were systematically underestimated by visual examination alone. These results indicate that radiography contributes to more precise estimates of these conditions in a population and should be a routine part of oral health research in bioarchaeology.

Comparison on prevalence of oral squamous cell carcinoma in New Zealand and Fiji Islands (2000-2010)

Ratu Osea Gavidi

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

DClinDent (Oral Pathology) candidate

Supervisors: A/Prof Brian Cox (Preventive and Social Medicine); A/Prof Temalesi King (School of Dentistry and Oral Health, Fiji National University); Prof Alison Rich

Despite numerous studies on the prevalence of oral cancer in geographically diverse populations, there are no detailed data analyses on their incidence in the Fiji Islands. The most recent analysis for New Zealand was reported in 1995.

Aim

To compare the differences in prevalence of oral squamous cell carcinoma (OSCC) in Fiji and New Zealand and determine differences in variables such as gender, age groups affected and site of tumour.

Methods

Oral cancer data between 2000-2010 were obtained from the Cancer Registry of New Zealand, the Cancer Registry of the Fiji Islands, Medlab Dental Oral Pathology Diagnostic Service, University of Otago and Histology Departments at the three main referral hospitals in Fiji.

Results

In the 10-year duration, a total of 2159 and 182 OSCC registered cases were retrieved and eligible for the study in New Zealand and Fiji consecutively. The prevalence of OSCC was 5.2 per 10,000 New Zealanders and 2.2 per 10,000 Fijians. 63.6% were New Zealand men and 36.4% were women (1.75:1) whilst in Fiji, 51.1% were men and 48.9% women (1.04:1). The overall mean age at diagnosis was 63 years in New Zealand and 57 years in Fiji. The tongue was the most commonly affected site for the Fiji population (74%) but only accounted for 42% of OSCC amongst New Zealanders.

Conclusion

There are differences in the demographic variables relating to OSCC in Fiji and New Zealand. These observations are useful in targeting prevention strategies in both countries.

Quantifying the diabetes-periodontitis association

Ellie Knight

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

DClinDent (Periodontology) candidate

Supervisors: Prof W. Murray Thomson, Dr Jonathan Leichter, Dr Andrew Tawse-Smith

Aim

To investigate the association between self-reported diabetes and periodontitis in the New Zealand (NZ) adult population.

Methods

Data from two NZ national surveys (n=2048) were analysed to compare estimates of the strength of the association between periodontitis and diabetes using two epidemiological approaches (cohort and matched case-control studies). This was possible because the first survey provided participants for the second survey. Severe periodontitis cases were chosen using six different definitions. The cohort study identified those who were diabetic in 2006/7 and those who had periodontitis in 2009, to determine the diabetics' relative risk for severe periodontitis, using logistic regression modeling (adjusting for smoking status, socio-demographic and dental characteristics). The matched case-control study identified cases of severe periodontitis in 2009 and compared their 2006/7 diabetic status with that of controls individually matched on age group, sex and socio-economic status. Conditional logistic regression modelling was used for the case-control study, adjusting for ethnicity, smoking status and dental characteristics.

Results

Depending on the definition of periodontitis used, there were different estimates of risk for periodontitis, ranging from 1.91 (P=0.011) to 3.51 (P=0.22) using the cohort study approach. No association was observed using the matched case-control study.

Conclusion

This study demonstrated that the determination of the strength of a putative association is method-dependent.

Novel bone substitute material in a sheep extraction socket model

Jinyi (Jenny) Liu

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

DClinDent (Periodontology) candidate

Supervisors: A/Prof Warwick Duncan, Dr Andrew Tawse-Smith, A/Prof Patrick Schmidlin

Bone substitute materials placed into tooth sockets after tooth extraction may preserve alveolar bone. It is desirable that these materials be completely resorbed and replaced by patient's own bone. Electrospun cottonwool-like nanocomposite (ECWN) is a novel synthetic bone substitute that incorporates amorphous tricalcium phosphate nanoparticles into a biodegradable synthetic copolymer poly(lactide-co-glycolide).

Aims

1. To develop a novel sheep mandibular tooth socket model.
2. To compare ECWN and bovine-derived xenograft (BX) in this model.

Methods

Sixteen cross-bred female sheep aged 4-5 years were used. Bilateral mandibular premolars were extracted atraumatically using Piezosurgery® unit. 2nd & 3rd premolar sockets were filled (Latin-square allocation) with BX, ECWN. Resorbable collagen membranes were placed and primary flap closure achieved. Eight sheep were sacrificed after 8 & 16 weeks respectively. Resin-embedded undemineralised sections were examined for descriptive histology and histomorphometric analyses.

Results

At 8 weeks, healing was composed mostly of woven bone with no distinct differences among the different sites. At 16 weeks, osseous healing followed a fine finger-like trabecular pattern in ECWN sites. Non-grafted sites showed thick trabeculae separated by large areas of fibrous stroma. In BX grafted sites, residual graft material was encapsulated by newly formed bone or fibrous connective tissue. There were no statistically significant differences in bone formation across the four groups at 8 or 16 weeks but ECWN sites had significantly less residual graft material than BX sites at 16 weeks ($p=0.048$).

Conclusion

This first description of a tooth socket model in sheep supports the utility of this model for bone graft research. The novel material ECWN did not impede bone ingrowth into sockets and showed evidence of material resorption.

Why the long face? – A genetic perspective

Joseph Antoun

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

PhD candidate

Supervisors: Prof Tony Merriman (Biochemistry), Prof W. Murray Thomson, Prof Mauro Farella

The long face morphology is a fairly common clinical presentation in orthodontic patient populations, although its exact aetiology is still unclear. Recent data suggests that the growth hormone receptor may play a role in vertical facial development.

Aim

To investigate the association between vertical craniofacial form and single nucleotide polymorphisms (SNPs) of the growth hormone receptor (GHR) gene.

Methods

Eighty cases with a distinctively long face (mandibular plane angle greater than two standard deviations, or 42 degrees) and eighty controls were matched on age, gender, and ethnicity. Subgroups of the long face phenotype were also constructed based on the sample's cephalometric data. Genomic DNA was extracted from blood and saliva samples. Cases and controls were genotyped for the rs6180 and rs6873545 polymorphisms using a TaqMan assay.

Results

The sample had a mean age of 13.8 years (SD = 4.1), with the majority of participants being female (65%), and of New Zealand European origin (91.3%). There were no significant differences in either the allele or genotype frequency between the cases and controls for the two SNPs ($P > 0.05$). In contrast, anterior open-bites in the long face group were associated with both the rs6180 ($P = 0.016$) and rs6873545 ($P = 0.003$) genotypes. After adjusting for potential confounders, only the association between rs6873545 and anterior open-bite remained significant ($P < 0.05$). The presence of a severely short ramus and obtuse gonial angle were also associated with rs6873545 ($P < 0.05$).

Conclusion

There is some evidence that polymorphisms of the growth hormone receptor gene are associated with specific subgroups of the long face morphology. Larger samples, however, are needed to investigate this further and to confirm genetic variants associated with the long face phenotype.

Analysis of saliva proteins from head and neck cancer patients

Yeen Lim

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

DClinDent (Prosthodontics) candidate

Supervisors: Prof Richard Cannon, Dr Ann Holmes, Prof Karl Lyons, A/Prof Patrick Dawes (Dunedin School of Medicine)

Aim

To investigate the role of saliva proteins in the colonisation of the oral cavity by *Candida albicans* in a group of patients that had received radiation therapy for head and neck cancer. In particular, to investigate whether there is an increased presence of the putative *C. albicans* receptor SPLUNC2 that may explain the increase in *C. albicans* colonisation in such individuals.

Methods

Patients were recruited from two clinics (Christchurch and Dunedin). Controls matched for age, sex and smoking history were also recruited. Following determination of the saliva flow rates of patients and controls, saliva wash samples were collected, treated with protease inhibitors and stored frozen for subsequent polyacrylamide gel electrophoresis (PAGE) and immunoblot analysis. Gels were stained with silver. Blots were probed sequentially with antibodies to two saliva proteins, SPLUNC2 and IgA. PAGE-separated polypeptide profiles, and immunoblot reactivities were compared using a specialised image analysis programme.

Results

All 17 patients had reduced saliva flow rates compared to controls and 7 of 17 patients could be classified as having dry mouth. Some differences between individual protein profiles were detected but were not consistent within the patient and the control groups. IgA was detectable in all samples, but SPLUNC2 expression was only detected in 6 patient samples and in 13 control samples.

Conclusion

No consistent saliva protein profile changes were detected in the patient group. SPLUNC2 expression varied between individuals and was not related to IgA expression. Therefore, the presence of SPLUNC2 could not be linked to susceptibility to *C. albicans* colonisation in this study.

Pilot study monitoring oral pH in mouths showing signs of dental erosion

Jon Campbell

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

DClinDent (Paediatric Dentistry) candidate

Supervisors: Prof Bernadette Drummond, Prof Mauro Farella

Aim

To develop a wireless pH telemetry device that can measure pH over the course of 24 hours, and to incorporate this device into an orthodontic appliance that can be worn in the mouths of children showing signs of dental erosion. Wireless pH telemetry would allow proper diagnosis of the source of acid causing dental erosion. This would enable preventive steps to be taken to stop the loss of tooth structure.

Methods

A wireless pH device was developed using a commercially available pH sensor and a battery powered electronic circuit to record the pH data. Preliminary testing was done to determine the ability of the device to record pH data and to confirm design of an intraoral appliance.

Results

Laboratory testing confirmed the ability of the wireless pH device to accurately measure pH in conditions similar to the mouth, and the feasibility of the oral appliance design.

Conclusion

It is possible to incorporate a wireless pH recording device into an appliance that may be worn in the mouth. Further studies will test the ability of the device to measure pH in the mouths of children showing signs of erosion.

Pressed ceramics onto zirconia: Intrinsic properties and influence of cooling rate on residual stresses

Joanne Choi

Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago

Bachelor of Dental Technology with Honours candidate

Supervisors: Dr J. Neil Waddell, Prof Michael Swain

Aim

The aim of this study was to evaluate the intrinsic properties and surface residual stresses present in various pressable ceramics to zirconia resulting from cooling induced temperature gradients.

Methods

The study compared the X-ray diffraction response and the mechanical properties of four different pressed ceramics (Noritake CZR Press, Vita PM9, Wieland PressXzr and IPS e.max ZirPress) to Vita In-Ceram YZ zirconia substrate. The adhesion was determined using the interfacial strain energy release rate fracture mechanics approach and biaxial flexural strength values of each material was determined. Indentation fracture toughness test was used to evaluate the residual stress present in the ceramic system when subjected to different cooling regimen. The cooling responses were also evaluated by thermocouples embedded in the surface of the porcelains and at the porcelain–zirconia interface.

Results

X-ray diffraction analysis revealed that pressed ceramics compatible with zirconia tested were of two types; leucite containing and non-leucite containing essentially glass ceramics. The pressed ceramics with leucite have better adhesion and flexural strength than non-leucite ceramics to zirconia. The results from indentation test and the thermocouples confirmed the presence of surface residual compressive stress subjected to different cooling procedures. Slow cooling significantly reduced the formation of residual stress for all pressed ceramics compared to fast cooling.

Conclusion

Practitioners have choices of two types of ceramic materials when using pressing technique: Leucite containing and non-leucite glass ceramics. To reduce the development of residual stress within the ceramic system, practitioners are advised to slow cool the restoration on the last heat treatment cycle (e.g. glazing cycle).

The Faculty of Dentistry Sir John Walsh Research Institute
Research Day 2013 is proudly sponsored by

3M Unitek 3M ESPE