



UNIVERSITY
of
OTAGO

Te Whare Wānanga o Otāgo
NEW ZEALAND

Faculty of Dentistry SJWRI Research Day 2022

Thursday 8 September
Programme and abstracts

Programme

9:00 am Welcome and introductions

IADR Distinguished Scientist Keynote

9.15 am Richard Cannon Oral fungal infections – the benefit of sticking around

Dentistry in life and death

9:45 am Carolina Loch Dental biorhythms and associations with adolescent growth and weight gain

10:00 am Angela Clark An anthropological perspective: Data sovereignty in forensic identification

Nicole Guise Expanding the dentist's toolkit: Reproducing complex forensic trauma in a 3D format

Jesse Matheson Tika or Tapu? The implementation and benefits of tikanga Māori and Te Ao Māori in forensic research hui

10:40 am Morning tea

New materials, technologies and therapeutics I

11:00 am Qing Sun Expression of proinflammatory cytokines in cultured keratinocytes from specimens of oral lichen planus

11:15 am Shelly Arora Evaluation of IL-23 inhibitor as a pulp immunomodulating agent: an *in vitro* and *in vivo* study

11:30 am Stephanie Toepfer Heterologous expression of *Candida auris* drug targets and efflux pumps in *Saccharomyces cerevisiae*

11:45 am Minati Choudhury Gold nanoparticles against oropharyngeal pathogens in cancer therapy

12:00 pm Dina Abdelmoneim *In vitro* and *in vivo* investigation of antibacterial scaffolds for bone tissue regeneration

12:15 pm Chitra Krishnan Evaluating the suitability of Electrolysed Oxidising Water as a denture disinfectant

12:30 pm Sunethra Tennekoon Analysis of changes in saliva composition in patients with oral cancer and oropharyngeal cancer using Fourier Transform Infrared Spectroscopy

12:45 pm Beatrice Ng Use and utility of teledentistry in aged residential care facilities in the Otago region of New Zealand

1:00 pm Lunch

Programme

Oral health in Aotearoa

2:00 pm	Deanna Beckett	Dental consequences of vitamin D deficiency during pregnancy and early infancy
2:15 pm	Farah Zainuddin	Measuring dry mouth in older people in residential care in Dunedin
2:30 pm	Lesieli Tomiki	The effect of complementary feeding patterns on the oral health status of infants aged 7-10 months, New Zealand

Evaluating our teaching, learning and practice

2:45 pm	Lee Adam	Linking theory to practice: co-teaching biochemistry in dental education
3:00 pm	Hanna Olson	Students' experiences with using e-learning tools in early learning in dentistry
3:15 pm	Zeina Al Naasan	Cultural safety in dental practice for former refugee patients

3:30 pm Afternoon tea

New materials, technologies and therapeutics II

3:45 pm	Nigel Tan	Knotless third molar wound closure
4:00 pm	Jesslyn Praganta	Effects of Advanced Platelet-Rich Fibrin (A-PRF) on short-term third molar surgery outcomes: a single-blinded randomised controlled trial
4:15 pm	Teddy Nguyen	Stereophotogrammetric analysis of lip changes induced by simulated incisor protraction
4:30 pm	Nick Pittar	Effect of passive clear aligners on masticatory muscle activity in adults with and without high oral parafunction
4:45 pm	Sherry Lee	Patients' experiences with orthodontic treatment through traditional fixed appliances, clear aligners and direct-to-consumer clear aligners: a qualitative study
5:00 pm	Carrol Jin	Clear aligners brands and marketing claims: an overview of available information on the web
5:15 pm	Nick Heng	The genetic basis of bacteriocin STH ₂ resistance in <i>Streptococcus mitis</i> I18

5.30 pm Awards and farewell

IADR Distinguished Scientist Keynote

9.15 am - 9.45 am

Session chair: A/Prof Dawn Coates

Oral fungal infections – the benefit of sticking around

Professor Richard Cannon

Sir John Walsh Research Institute, Faculty of Dentistry

2022 International Association for Dental Research Distinguished Scientist Award

Fungi are normal inhabitants of the oral cavity, albeit present in lower numbers than bacteria. They can, however, give rise to oral disease when host defences are impaired. There is a constant flow of saliva in the mouth, and in order to cause an infection fungi need to adhere to oral surfaces. These surfaces are coated with salivary pellicles. This presentation will examine research undertaken to investigate the role of saliva in the oral adhesion of the opportunistic fungal pathogen *Candida albicans*. It is evident that different saliva proteins mediate the adherence of *C. albicans* to different surfaces, and *C. albicans* binds to some saliva proteins only when the proteins are absorbed to surfaces, but can the oral adhesion of *C. albicans* be prevented?



Professor Richard Cannon gained a BA in Natural Sciences in 1983 followed by a PhD on the topic of yeast-mycelial dimorphism in *Candida albicans* in 1987 from the University of Cambridge. Professor Cannon emigrated to New Zealand in 1987 to take up a Postdoctoral position in the University of Otago Faculty of Dentistry Experimental Oral Biology Laboratory. Since then, Professor Cannon has contributed to teaching and research in the Faculty of Dentistry. He teaches oral microbiology to Dental, Oral Health and Dental Technology students.

Professor Cannon has undertaken research primarily on the molecular genetics of *C. albicans*, oral microbial adhesion mechanisms, antifungal drug discovery and antifungal drug resistance. Professor Cannon has published 149 journal articles, 11 book chapters and 2 patents. His work has been cited over 5,300 times. He has supervised, or co-supervised, 18 PhD students, 13 Doctoral of Clinical Dentistry students, one Masters student and 62 undergraduate research projects.

Professor Cannon was the Associate Dean (Research) for the Division of Health Sciences 2018-2020, Director of the Sir John Walsh Research Institute 2014-2021 and is currently Deputy Dean (Academic) for the Faculty of Dentistry. He was the 2022 recipient of the International Association for Dental Research (IADR) Distinguished Scientist Award for Research in Oral Biology.



Dentistry in life and death

9.45 am - 10.40 am

Session chair: Dr Carolina Loch

Dental biorhythms and associations with adolescent growth and weight gain

Dr Carolina Loch

Senior Lecturer, Department of Oral Sciences

Deputy Director, Sir John Walsh Research Institute

Programme leader, Biomaterials, Biomechanics and Oral Implantology

Carolina Loch¹, Sophie White¹, Patrick Mahoney², Gina McFarlane², Bruce Floyd³, Erin C. Dunn⁴, Rosie Pitfield², Alessia Nava², Debbie Guatelli-Steinberg⁵

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2. School of Anthropology and Conservation, University of Kent, Canterbury, UK

3. School of Social Sciences, University of Auckland

4. Department of Psychiatry, Harvard Medical School and the Massachusetts General Hospital, Boston, MA

5. Department of Anthropology, The Ohio State University, Columbus, Ohio, USA

Aims/Objectives: Evidence of a long-period biological rhythm present in the teeth and bone of mammals relates to the average body mass. Current studies have just begun to investigate the role of this biorhythm in human physiology. Here, we investigate whether the timing of this rhythm relates to longitudinal measurements of height and weight taken from 61 adolescents.

Methods: The biorhythm was observed via histological analyses and calculated from naturally exfoliated primary molars. Measures of the same individual's weight, height, lower leg length and body mass were collected over 14 months between September 2019 to October 2020. Univariate and multivariate statistical analyses were used to isolate and identify relationships with the biorhythm.

Results: Participants with a faster biorhythm typically weighed less each month and gained significantly less weight and mass over 14-months, relative to those with a slower biorhythm. The dental biorhythm related to sex differences in weight gained.

Conclusion: In this study we identified a previously unknown factor that associates with the rapid change in body size that accompanies human adolescence. Our findings provide a basis to explore novel relationships between dental biorhythms and potential weight-related health risks.



An anthropological perspective: data sovereignty in forensic identification

Dr Angela Clark

Lecturer, Sir John Walsh Research Institute

The science behind forensic identification aims to benefit society by improving justice outcomes. New digital technologies used by forensic experts may strengthen scientific evidence, yet impinge on cultural and ethical values held by members of some groups within our bicultural society.

Aim: The aim of this paper is to synthesise and identify gaps in the existing literature about the collection, retention, use, and sharing of forensic data, and this relevance to Aotearoa New Zealand.

Methods: This narrative review used a combination of methods, including search engines and tracing reference lists of seminal articles, to retrieve relevant forensic science research, and analyse the frequency of different key terms such as 'data sovereignty', 'Indigenous perspectives', and 'cultural values'.

Results: Globally, anthropologists are moving towards a shared access of skeletal and dental data. However, current discussions lack engagement with Indigenous communities, and considerations of data sovereignty within forensic identification practices is scarce. In Aotearoa New Zealand, research on Indigenous perspectives of forensic DNA analysis and genetic data offer a foundation for additional models and future investigations. Although limited, this review shows that decolonising forensic science and the criminal justice system begins with the treatment of data, and enhanced communication of scientific processes.

Conclusion: As Māori have the right as Te Tiriti o Waitangi partners and citizens of Aotearoa New Zealand to benefit equitably from an effective criminal justice system, it is essential that questions of Indigenous sovereignty are an integral part of how forensic experts envision and develop data practices with new digital technologies. To empower equitable data use partnerships and Indigenous data sovereignties, this review suggests that further research is needed, which embarks on critical conversations with stakeholder groups discussing the collection, retention, use, and sharing of forensic data in Aotearoa New Zealand, so that in its broadest sense, justice may prevail.



Expanding the dentist's toolkit: Reproducing complex forensic trauma in a 3D format

Nicole Guise

Assistant Research Fellow

Nicole Guise, Jonathan Broadbent, KC Li, Warwick Duncan, and Angela Clark

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

Specialists in forensic identification may be required to present evidence on complex skeletal trauma and explain intricate fracture biomechanics within a court of law. We hypothesize that scanning skeletal remains with a dental intraoral handheld scanner and then printing in 3D will provide sufficiently accurate replicas to meet this need.

Aim: To develop a methodology that accurately reproduces trauma in a 3D format.

Methods: 3D replicas of a human mandible [n=1] and fractured pig ribs [n=6] were scanned with the Trios 3scanner and printed using an Ultimaker 3 Extended 3D Printer. The 3D scans of both the original bone samples and the printed replicas were exported as a .stl mesh for digital comparison using the open-source 3D-point cloud and mesh processing software, CloudCompare®. Original bone samples were considered the 'reference model' and printed models considered the 'aligned model'. Statistical analyses of the relationship between the original samples and printed models were undertaken to determine trueness and precision of the methodology.

Results: Individual scans can take between 15 to 60 minutes to produce an accurate representative scan of a bone sample, with variation in timing depending on external factors, such as light exposure, surface reflections, and scanning approach. Our methodology evolved to account for these factors and resulted in 3D printed replicas with an average mean \pm standard deviation of 0.039mm \pm 0.19mm for the mandible, and 0.013mm \pm 0.031mm for the fractured ribs.

Conclusion: Experimental data using the Trios 3 demonstrates that accurate and precise 3D replicas can be reproduced in various 3D formats. We recommend that future research be conducted using these 3D printed replicas to assess their utility for presenting complex biomechanical evidence to lawyers, police, and jurors in the courtroom.



Tika or Tapu? The implementation and benefits of tikanga Māori and Te Ao Māori in forensic research hui

Jesse Matheson

Assistant Research Fellow

Jesse Matheson, Samuel Carrington and Angela Clark

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

The introduction of new technology that impacts forensic identification needs to be tika. Within Aotearoa New Zealand there is a complex history where Māori have not been consulted regarding new technology and systems, which ultimately have negative consequences for Māori.

Aim: For Māori voices to be heard, our aim was to develop a Kaupapa-Māori aligned methodology that applies Te Ao Māori principles in qualitative forensic research. This presentation introduces these principles and discusses the importance of incorporating these culturally appropriate concepts into sensitive research topics.

Methods: As discussions with Māori in uiuinga and hui-ā-rōpū potentially involve triggering and emotionally distressing topics, such as mate, grief, tangihanga and violent crime, it is crucial mana whenua discuss these important yet sensitive topics in an environment where principles of Te Ao Māori are acknowledged. Specifically, this includes whakawhanaungatanga, whanaungatanga, whakapapa, manaakitanga, and utu, and that aspects of tikanga Māori, such as karakia, kōrero, kai, and koha, are embodied within the kaupapa.

Results: “He aha te mea nui o te ao? He tangata! He tangata! He tangata! What is the most important thing in the world? It is people! It is people! It is people!”. Given the colonising histories, health and social inequities, and marginalisation that many Māori live with, it was crucial to implement a kaupapa Māori lens within this research. Results show how decolonising methodology incorporating tikanga Māori, creates a culturally safe and comfortable space for Māori participants to share their kōrero and whakaaro about tapu topics.

Conclusion: Using a culturally appropriate lens, this pilot study methodology enabled a supportive researcher-participant relationship to develop, which was paramount for exploring Māori perspectives of forensic technologies in Aotearoa New Zealand. This research highlights the inseparability of Indigenous experiences and their value in informing technological, ethical and justice-oriented considerations.



New materials, technologies & therapeutics I

11 am - 1 pm

Session chair: A/Prof Dawn Coates

Expression of proinflammatory cytokines in cultured keratinocytes from specimens of oral lichen planus

Qing Sun

Research Fellow

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

Aims/objectives: The aim of this study was to establish primary keratinocyte cultures from the buccal mucosal epithelium of patients with oral lichen planus (OLP) and from inflamed control oral mucosa and to assess the expression of proinflammatory cytokines in epithelial cells.

Experimental Methods: Epithelial cells were isolated from patients with OLP and cultured *in vitro*. The expression of pan-cytokeratin and vimentin was determined by immunohistochemical assay. The concentration of interleukin (IL)-1 β , IL-6 and IL-23 in the supernatant from normal and OLP keratinocytes with or without stimulation with recombinant tumour necrosis factor (TNF)- α and TNF-related weak inducer of apoptosis (TWEAK) were measured by enzyme-linked immunosorbent assay (ELISA). Statistical analyses were performed using the Student's T-test.

Results: Characteristic pan-cytokeratin was expression in the control and OLP keratinocytes. Compared with normal oral epithelium, OLP epithelium demonstrated significantly higher level expression of inflammatory cytokines (IL-1 β , IL-6 and IL-23) under the stimulation of recombinant TNF- α and TWEAK.

Conclusions: We have successfully established an *in vitro* cell culture system of epithelium from OLP patients and established that the levels of proinflammatory cytokines (IL-1 β , IL-6 and IL-23) are higher in OLP epithelial cells than normal epithelial cells under the stimulation of recombinant TNF- α and TWEAK.

As IL-23 is an important pro-inflammatory cytokine that drives the differentiation and activation of T helper 17 (Th17) cells, the enhanced expression of IL-23 by epithelial cells may contribute to the perpetuation of inflammatory process in OLP. This observation paves the way for examination of the use of anti-IL23 agents as potential therapy for OLP.

The contribution of partial funding for this project from Sun Pharma, USA, is acknowledged with thanks.



Evaluation of IL-23 inhibitor as a pulp immunomodulating agent: an *in vitro* and *in vivo* study

Shelly Arora

PhD candidate

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

**School of Pharmacy, University of Otago*

Aims/objectives: This study aimed to assess the effects of IL-23 blockade as a pulp immune-modulating agent *in vitro* and *in vivo*.

Experimental methods: *In vitro*, human dental pulp cells (HDPCs) were isolated and cultured from both healthy and carious teeth (n = 5, each) using the explant technique. Vimentin, cell growth curve, colony forming unit and mineralization assays were evaluated in both healthy and carious HDPCs at passage 4. Gene expression of Toll-like receptors (TLR)-2,-4,-9, tumour necrosis factor (TNF)- α , interleukin (IL)-1 β , IL-6, IL-8, IL-17A, IL-17R, IL-23, nuclear factor- κ B (NF- κ B), mitogen activated protein kinase (MAPK1), dentin matrix protein (DMP)-1, dentin sialophosphoprotein (DSPP) and sex determining region Y-box 2 (SOX2) was determined using quantitative real-time reverse-transcription polymerase chain reaction. HDPCs were seeded in a range of concentrations of IL-23 inhibitor to evaluate cell viability using MTS assay. *In vivo*, a Wistar rat pulp exposure model was used (n = 12). Mechanically exposed pulps were capped with IL-23 antibody while controls received sterile saline. After 1-, 15- and 30-days mandibular jaws were obtained and prepared for histological analysis.

Results: Significantly higher levels of TLR-2, TLR-4, TLR-9, TNF- α , IL-6, IL-8, IL-17R, IL-23A, NF- κ B, MAPK1, DMP1, DSPP and SOX2 were detected in carious HDPC cultures compared with nCHDPCs (p<0.05). IL23 inhibitor (5 μ g/mL) treatment enhanced the proliferation of carious HDPCs (p<0.05). *In vivo*, histologically at day one both groups demonstrated inflammation and no mineralized tissue formation. On day 15, inflammation was present in both the groups but only the IL-23 inhibitor treatment group showed the presence of mineralized tissue. On day 30, the IL-23 inhibitor group demonstrated the presence of mineralized tissue within the viable pulp with no evidence of inflammation while the control group exhibited inflammatory reaction, and mineralized tissue.

Conclusion: IL-23 blockade induced the proliferation of carious HDPCs with an inflammatory phenotype, and in a rat pulp exposure model treatment promoted mineralization. Clinically, IL-23 inhibition has the potential to modulate inflammation and promote mineralization.



Heterologous expression of *Candida auris* drug targets and efflux pumps in *Saccharomyces cerevisiae*

Stephanie Toepfer

PhD candidate

Stephanie Toepfer, Mikhail Keniya, Michaela Lackner and Brian Monk*

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Objectives: The emerging fungal pathogen *Candida auris* causes severe infections that are difficult to eliminate because most clinical isolates are highly resistant to one or more of the current antifungal drugs. The Centers for Disease Control and Prevention (USA) has determined *C. auris* to be a global health threat because it is (1) difficult to identify with standard microbiological methods, (2) frequently highly resistant to commonly used antifungal drugs, and (3) causes outbreaks in health care settings. In the recent years several underlying resistance mechanisms have been identified in *C. auris*, but more research is needed to understand and overcome resistance pathways.

Aim: to increase understanding of established drug targets and resistance determinants by building a screening platform of *C. auris* recombinant proteins expressed in the baker's yeast *Saccharomyces cerevisiae*.

Methods: The genes for the Erg11 drug target, and the Mdr1 and Cdr1 efflux pumps were transformed into a *S. cerevisiae* host to enable heterologous functional expression. Genetic constructs were confirmed by DNA sequence analysis. The recombinant proteins were characterized biochemically using western blots, mass spectrometry and drug binding studies. Phenotypes were established using susceptibility tests with common azoles used for infection management.

Results: DNA sequencing, western blotting and mass spectrometry confirmed expression of the *C. auris* genes and their protein products in recombinant strains. Strains overexpressing recombinant Erg11 protein bound azole drugs and conferred increased azole resistance compared to the host strain ADDD. Overexpressed Mdr1 conferred resistance against short-tailed azoles (e.g., fluconazole) but not long-tailed azoles (e.g., posaconazole). Strains overexpressing Cdr1 protein were resistant to all tested azoles.

Conclusion: The *S. cerevisiae* platform expressing functional *C. auris* proteins is a promising tool to help establish new treatment approaches. The platform can be used to screen for new antifungal compounds affecting drug targets without using clinical isolates of *C. auris*.



Gold nanoparticles against oropharyngeal pathogens in cancer therapy

Minati Choudhury

PhD candidate

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4. Department of Microbiology and Immunology, University of Otago

Aims/objectives: Head and neck cancer therapy is associated with microbial dysbiosis resulting in innate immune response. In immunocompromised patients, these microbial cells, form biofilms with strong resistance to antibiotics and cause life-threatening infections. Gold nanoparticles (AuNPs) with documented immunomodulatory properties offer a potential therapeutic approach. However, their antimicrobial properties are not well established. The aim of this study was to evaluate the antimicrobial efficacy of AuNPs against oropharyngeal pathogens associated with cancer therapy, under both planktonic and biofilm growth conditions.

Experimental method: Various capped AuNPs of ranging in size, were purchased, and dimensions confirmed by transmission electron microscopy. Cytotoxicity was assessed using cultured human oral epithelial cells. Antimicrobial and antibiofilm efficacy were tested against the predominant oral opportunistic micro-organisms: *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, and *Candida albicans*.

Results: At concentrations above 1 mg/ml, all nanoparticles were stable and well-dispersed at pH 7.0. Epithelial cells remained viable (>80%) following exposure to 50 µg AuNP/ml. AuNPs exhibited no antimicrobial activity against tested species (MIC >100 µg/ml), but inhibited biofilm formation in a concentration- and size-dependent manner. AuNP (< 10 nm) at 25 µg/ml reduced bacterial biofilm formation by more than 80%. The < 10 nm AuNPs were also effective (>80%) against *Candida* biofilms at 6.25 µg/ml, while AuNPs > 10 nm in diameter were ineffective.

Conclusion: Ultrasmall AuNPs (< 10 nm) with low cytotoxicity against mammalian cells and negligible anti-microbial activity, but potent biofilm inhibitory effects could have therapeutic potential in sepsis.



***In vitro* and *in vivo* investigation of antibacterial bone regenerative scaffolds**

Dina Abdelmoneim

PhD candidate

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

**CReaTE Group, Department of Orthopaedic Surgery, University of Otago Christchurch*

Infection is a frequent complication of bone-grafted sites. Increasing bacterial resistance to antibiotics is a challenge associated with the prevention or treatment of such infections. Silver nanoparticles (AgNPs) are a potent alternative to antibiotics.

Aim: This study aimed to develop two antibacterial bone regenerative scaffolds by integrating AgNPs.

Methods: AgNPs were incorporated with both bovine bone particles (BBX) treated with temperatures between 100 °C to 220 °C (Product 1), and three light cross-linked hydrogel GelMA consistencies (Product 2). The samples were characterised using scanning electron microscopy and atomic force microscopy, thermogravimetric analysis, Fourier-transform infrared spectroscopy, X-ray diffraction, and compression testing. We further studied the biological response in terms of cellular attachment, proliferation, and differentiation. Disc diffusion assay was conducted to test the antibacterial properties. The regenerative capacity of the optimised AgNPs functionalised BBX and GelMA were tested in a rabbit cranial model.

Results: Increasing the BBX treatment temperature was associated with decreased protein levels and compressive strength and increasing surface irregularities and crystallinity. Higher osteoblast proliferation and differentiation were obtained from treatments lower than 190°C. Stiff hydrogel constructs showed superior AgNPs retention, however high stiffness negatively impacted both handling properties and AgNPs diffusion within the constructs. We also found that AgNPs can be used at a 100 µg/ml dose that inhibits bacteria, with minimal adverse effects. Our rabbit model showed that both the optimised BBX at 160°C and 5%wt GelMA hydrogels were biocompatible and had similar regenerative capacity compared to a commercially available product - BioOss®.

Conclusions: Increasing the processing temperature correlates with significant changes in the characteristics of the BBX. The distribution, retention and release profile of AgNPs from 5%wt GelMA was superior for the intended application. Grafts functionalised with AgNPs can provide antibacterial protection and simultaneously act as a scaffold for attachment of bone cells.



Evaluating the suitability of Electrolysed Oxidising Water as a denture disinfectant

Chitra Krishnan

PhD candidate

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

Background: Acrylic dentures can become colonised by *Candida albicans* which can cause oral candidosis. Neutral-pH electrolysed oxidizing water (EOW) generated by passing an electric current through brine, is a hypochlorous acid (HOCl)-based promising “green” disinfectant, however its suitability as a denture disinfectant is unknown.

Objectives: This study evaluated EOW (ANK Neutral Anolyte, Enviolyte, Nw) for its storage stability, anticandidal activity and long-term effects on denture resins.

Methods: Physico-chemical properties of EOW samples stored at 4°C, room temperature (RT) and 37°C were measured over a 28-day period. Minimum growth inhibitory concentrations (MIC90s) of EOW were determined for seven *C. albicans* strains. Cell viability after 5 minutes EOW treatment of *C. albicans* ATCC10231 biofilms formed on 3D-printed denture resin discs, was measured by the XTT metabolic assay, and compared with that of Polident 3-Minute™ denture cleaning product. Denture resin samples prepared by 3D-printing, CAD/CAM milling or heat polymerisation were custom-cycled in EOW, Polident, or tap-water to simulate three years of a 5-minute daily disinfection and evaluated for changes to colour (ΔE_{00}), surface roughness, surface hardness and flexural strength. Data were analysed by ANOVA and post-hoc multiple comparisons.

Results: The mean available chlorine content in EOW decreased by 10B, 15B, and 39B, and the mean xHOCl₂ decreased by 3B, 8B, and 18B, for the 4°C, RT, and 37°C samples, respectively. Mean MIC90(HOCl) following a 5-minute EOW treatment was 54µM. After 5-minute treatment, EOW and Polident reduced mean biofilm metabolic activity by 86B and 43B, respectively. EOW and Polident affected surface roughness, hardness, and flexural strength of denture resins similarly. Polident-treated CAD/CAM resin showed a higher mean ΔE_{00} (1.77) than EOW-treated samples (0.95) (ΔE_{00} perceptibility threshold = 1.3).

Conclusions: Neutral-pH EOW remained relatively stable at RT over 28 days, showed effective anti-candidal activity and caused less colour change to denture resins than did Polident.



Analysis of changes in saliva composition in patients with oral and oropharyngeal cancer using Fourier Transform Infrared Spectroscopy

Sunethra Tennekoon

DClinDent candidate, Special Needs Dentistry

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**Southern Blood and Cancer Service, Dunedin Public Hospital and Otago Medical School, University of Otago*

Aim: To show if Attenuated total reflection Fourier Transform Infrared (ATR-FTIR) spectroscopy, when applied to saliva samples, may be used as a sensitive, non-invasive, low-cost technique to screen for and diagnose oral cancer (OC) and oropharyngeal cancer (OPC), as well as observe the changes in saliva composition for cancer samples before and after cancer treatment.

Methods: Unstimulated whole saliva samples were collected from 8 individuals with OPC or OC and 8 healthy individual controls. The prepared samples were used to generate ATR-FTIR spectra within the wavenumber range of 400 cm^{-1} to 4000 cm^{-1} . Infrared spectra of whole saliva for the healthy individuals (HI) and the cancer samples, before treatment (B-OC) and after treatment (A-OC), were compared for significant difference. Analysis was conducted for original average spectra data and Fourier deconvoluted average spectra data. Second derivative analysis was also used to identify peaks of interest and curve-fitting analysis was carried out on the deconvoluted spectral data in order to identify differences between the intensities of the deconvoluted peaks and to identify differences between areas under the peaks of interest for the three groups.

Results: No significant differences were detected between HI and B-OC groups for any of the analysis methods, however for the deconvoluted spectral data of the B-OC and A-OC groups, a significant difference ($p < 0.005$) was noted for the wavenumber 524 cm^{-1} when area under peaks and intensity of wave peaks were studied.

Conclusion: There was no identifiable difference in the HI and OC/OPC groups prior to oncology treatment thus suggesting that ATR-FTIR spectroscopy was not able to discriminate between these two groups. A significant difference noted in the saliva of OC/OPC participants was after the cancer group received surgery or chemotherapy and radiotherapy, confirming the significant impact that cancer therapy has on saliva.



Use and utility of teledentistry in aged residential care (ARC) facilities in the Otago region of New Zealand

Beatrice Ng

DClinDent candidate, Special Needs Dentistry

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3. Biostatistics Centre, Division of Health Sciences, University of Otago

Aims: This study aimed to explore ARC residents' and staff perceptions of benefits and comfort with using teledentistry, and to identify the factors associated with the feasibility of using teledentistry in ARCs.

Methods: This study used a cross-sectional design. Rest-home level residents and care staff in ARCs in the Otago region of NZ, located within a 100km radius from Central Dunedin, were surveyed using structured questionnaires to answer the research questions. Data were analysed using Stata SE 17.0 statistical software.

Results: In total, 100 residents and 77 care staff from 14 facilities participated. The response rates were 82.6% and 71.3% in each participant group, respectively. Resident participants were receptive to teledentistry use in ARCs. Three-quarters (76.0%) of resident participants thought that teledentistry might be of benefit to them; perceived benefits included convenience, the potential to improve their general wellbeing and to meet their oral health needs. Three in five (68.0%) were comfortable trying teledentistry if available. Those with higher oral health awareness, perceived dental needs, and perceived difficulty with access to oral care services were more likely to perceive the benefits and comfort with teledentistry use.

Similarly, staff participants were receptive to teledentistry use for residents in ARCs and comfortable supporting and assisting (68.8%) with teledentistry consultations if available. No staff participants denied the potential benefits of teledentistry use; perceived benefits included benefits for residents and staff with regard to reduced patient transfer time, minimised distress for resident and staff, and improved staff oral health awareness, understanding and skills in oral hygiene delivery, and the recognition of an effective health care delivery.

Conclusion: Teledentistry would likely be feasible and acceptable in ARCs in NZ and contribute to improved access to oral health care for ARC residents. There is an urgent need for further evidence to inform guidelines and policies for teledentistry practice in ARCs.



Oral health in Aotearoa

2 pm - 2.45 pm

Session chair: Dr Carolina Loch

Dental consequences of vitamin D deficiency during pregnancy and early infancy

Deanna Beckett

PhD candidate

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Background: Vitamin D (25OHD) is important for mineral balance in early childhood, optimizing the absorption of essential minerals such as calcium and phosphorus from the gut. 25OHD deficiency during pregnancy is relatively common in New Zealand and closely correlated with foetal and new-born 25OHD. The third trimester of pregnancy and birth are critical periods for dental development, as primary teeth and some permanent teeth are undergoing mineralization. Severe vitamin D deficiency commonly results in developmental defects in bone as well as defects in tooth mineralisation. The effects of milder vitamin D deficiency on foetal and neonatal oral health outcomes are still unclear.

Aim: To investigate dental consequences of vitamin D deficiency during pregnancy and infancy.

Methods: Dental examinations with radiographs were conducted, and exfoliated primary incisor teeth analysed for mineral and protein content using Micro-Computed Tomography (Micro-CT), Energy Dispersive X-ray analysis (EDX) and Raman spectroscopy. Pregnancy and birth data, including 25OHD status, were available for participants and their mothers were available through a previous study. Enamel mineral and protein content, dental caries and developmental enamel defect prevalence, and associations with 25OHD were investigated.

Results: 81 participants participated in this study, and 64 provided an exfoliated primary tooth for analysis. The mean age was 6.6 years, 52% were male, and 80% resided in areas of low or medium deprivation. Two thirds of participants had at least one tooth affected by an enamel defect, and approximately half had experienced dental caries. Vitamin D insufficiency (25OHD<50nmol/L) at all timepoints was not associated with enamel defect prevalence, but during third trimester pregnancy was associated with an increased caries risk IRR of 3.55 (CI1.15-10.92) by age 6. EDX and Micro CT analysis did not identify any differences in mineral or protein content by 25OHD status, however, Raman spectroscopic data revealed subtle structural differences between those with sufficient, insufficient, and deficient levels of 25OHD.

Conclusions: In general, the prevalence of enamel defects and dental caries in this sample of children was high relative to national and international data. Maternal 25OHD insufficiency during the third trimester of pregnancy was associated with greater caries experience in primary dentition. No association was found between early life 25OHD and enamel defect prevalence or severity. Subtle differences in enamel quality according to 25OHD categorisation were identified.



Measuring dry mouth in older people in residential care in Dunedin

Farah Zahiah Ahmad Zainuddin

DClinDent candidate, Special Needs Dentistry

Farah Zainuddin, Graeme Ting, Murray Thomson and Simon Guan

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

Aims: To investigate the association between salivary gland hypofunction, xerostomia, and oral clinical dryness symptoms in older people living in residential care facilities in Dunedin.

Methods: Clinical examination survey and saliva sampling involving 50 older people (80% females) living in residential care in Dunedin. Medications were recorded and analysed. Extra-oral and intraoral examinations were performed using a modified WHO clinical examination protocol. The five-item Summated Xerostomia Inventory (SXI) was used to assess xerostomia in the participants. The unstimulated flow rate was measured. The Challacombe scale was used to measure the clinical manifestations of oral dryness.

Results: Participants ranged in age from 65 to 99 years (mean age = 83.0; SD 9.1). The prevalence of xerostomia was 34.8%; for salivary gland hypofunction (SGH), it was 26.1%. Only 13.0% had both conditions, and 52.2% had neither. The SXI score and salivary flow rate were only weakly and negatively correlated ($r=-0.2$), but a moderate positive correlation ($r = 0.55$) between the Challacombe scale and the SXI. There was a moderate negative correlation between the Challacombe scale and the flow rate ($r = -0.47$).

Conclusion: Dry mouth is common among older people in residential care, and the relationship between the signs and symptoms of oral dryness is complex and not as clear-cut as may be assumed.



The effect of complementary feeding patterns on the oral health status of infants aged 7-10 months, New Zealand

Lesieli Tomiki

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

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In New Zealand very little information is known about what and how infants are being fed with during their complementary feeding periods. Complementary food describes by the World Health Organizations Ending Childhood Dental Caries Manual 2019 it is any food that should be added to a child's diet when breast milk is no longer enough to meet the child's nutritional needs. The transition from exclusive breastfeeding to family foods, referred to as complimentary feeding, typically covers the period from six months to 18-24 months. Two particular feeding methods have gained popularity amongst parents and caregivers as they transitioned their baby's diet from an exclusive milk diet to family food. These two feeding methods are the use of baby food pouches and baby-led weaning.

The objective of this study is to assess the association between dental health status and the eating and drinks frequency and also the use of baby food pouches and baby-led weaning by infants aged 7-10months in New Zealand. Description of the age of when the first tooth erupts, teeth cleaning habits, demographics and ethnicity will also be described.

A multi-centered observational study with a total of 625 aged seven to ten months infants participated from Auckland and Dunedin, New Zealand met the inclusion criteria. Data were collected from a questionnaire and intra-oral clinical photographs were taken of the participants.

A total of 624 participants from the 625 participants enrolled completed the questionnaires and one participant did not complete the questionnaire and was excluded from the analysis. Mean age for the participants was 8.4 months, 289 were female and 335 were male. From all of the participants 38.6% started solid foods by six months of age. Feeding methods when starting solid foods were traditional spoon feeding (84.6%), partial baby-led weaning (3.7) and baby-led weaning (11.7%). Initial analysis of the photographs revealed difference in the normal eruption sequence patterns with a small proportion having dental defects.

In NZ, there is currently no published data on the prevalence of ECC and DDE in infants. This data will provide additional information to knowledge on the Oral health status of New Zealanders, it will also help the Ministry of Health, dental professionals, and policymakers to make evidence-based recommendations to New Zealand parents on how to introduce solid foods to their babies safely. Our preliminary analysis of the photographs confirmed here was good intra-examiner reliability. The photographs enabled remote scoring and archiving.



Evaluating our teaching, learning & practice

2.45 pm - 3.30 pm

Session chair: Dr Carolina Loch

Linking theory to practice: co-teaching biochemistry in dental education

Lee Adam

Senior Lecturer in Education, Department of Oral Sciences

Programme leader, Dental Education Research

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

**Otago Medical School, University of Otago*

Aims: Basic knowledge of biochemistry underpins oral and dental care within the context of human health and disease. Previous research at the University of Otago Faculty of Dentistry found that students lack appreciation of biochemistry's relevance to clinical practice. To address this issue, a co-teaching approach was introduced in which two lecturers, with complementary expertise, concurrently presented information. Students' experiences, perceptions and engagement were evaluated following co-teaching into biochemistry and clinical dental sciences.

Methods: Two successive BDS2 cohorts were co-taught the metabolism section of the biochemistry module. Content was co-delivered by a biochemist and an oral biologist, either online (during the 2020 COVID lockdown) or in-person (2021). Each cohort was surveyed using an online questionnaire at the end of the teaching module. The questionnaire contained both interval scale and free-text questions.

Results: Respondents numbered 39 (42%) and 64 (85%) in 2020 and 2021, respectively. Students from both cohorts preferred a co-teaching approach with a mean of 8.74 (SD1.35) for the combined cohorts on a 10-point interval scale. In total, 77% and 82% of participants in 2020 and 2021, respectively, preferred biochemistry and dental science lectures to be delivered together, by two teachers with specialized knowledge. Thematic analysis of free-text responses revealed that students experienced enhanced engagement when co-taught and they attributed this to integration making the underlying biochemistry more relevant to clinical dentistry, providing inherently more stimulating lectures.

Conclusions: Students preferred a co-teaching approach rather than subjects taught in isolation. Co-teaching establishes the relevance of theoretical biochemistry to clinical dental science resulting in an enhanced learning experience.



Students' experiences with using e-learning tools in early learning in dentistry

Hanna Olson

Lecturer, Department of Oral Sciences

Hanna Olson, Sam Carrington, Andrew Tawse-Smith, Lee Adam

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

Aims/objectives: This study investigates to what extent online learning in pre-clinical simulation-based teaching can be implemented and taught for early learning in dentistry and oral health. Possibilities to merge e-learning material across the Bachelor of Dental Surgery and Bachelor of Oral Health programmes are explored to ultimately deliver a blended-learning approach for simulated teaching and learning.

Methods: Teaching and learning practices in the curricula were scrutinised for simulated education. This stock-take informed opportunities to change the way students experience learning, such as moving some aspects online. A preliminary e-learning module was developed and piloted with a small number of senior students. These students then participated in focus group discussions (FGDs) to discuss their experiences, including possible enablers and barriers to using e-learning tools.

Results: Preliminary findings from the FGDs indicate successful experiences with the e-learning material. Students advised that this kind of educational teaching and learning activity would be a suitable compliment to current teaching practices, prior to students' first patient contact. One important aspect the students raised was the need to clarify the roles of each of the two dental professions early on in their respective programmes. A suitable way of doing this would be through interprofessional education (IPE) early in the programmes, during simulation experience, before entering patient clinics.

Conclusion: Pre-clinical simulation-based teaching for dental and oral health students has the potential to be successfully delivered in a blended-learning approach. If carefully planned, through curriculum development and a genuine input from students' experience with using e-learning tools, some simulation-taught practices are well-suited to online delivery. Students believed that IPE would be an appropriate way forward as they preferred learning about each other's profession in their early years of study.



Cultural safety in dental practice for former refugee patients

Zeina Al Naasan

Lecturer, Department of Oral Sciences

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

**Department of Public Health, University of Otago Wellington*

Objective: Based on former refugees' experiences, the lack of cultural safety in healthcare provision is one of the major barriers to accessing oral health care services. This adds an extra burden to their already high oral health needs; accordingly, this research investigated dental students' cultural competency/safety knowledge and tested a cultural safety module in dental practice with an emphasis on former refugee patients.

Methods: A mixed methods' approach was applied. All 4th and 5th year BDS students were invited to participate in an electronic survey including a validated cultural competency scale and open-ended questions about former refugee oral health related issues. Syrian former refugees who had resettled in Dunedin, New Zealand, participated in focus group meetings seeking their input on a cultural safety module for dental students.

Results: A total of 85 students and 14 former refugees participated. Most student participants were in their 4th year of study (64%) and female (63%), with a mean age was 22.4 years. Student participants "somewhat agreed" that they were able to describe Māori (60%), Pākehā (37%) and Pasifika culture (35%). The majority of student participants believed in equitable healthcare for all patients. Student participants were able to identify the main barriers to meeting the oral health needs of former refugees; however, many failed to identify their own lack of cultural safety as a barrier. The thematic analysis of the former refugee focus groups identified both good and bad experiences depending on the cultural safety of providers. Refugee participants wished their dentists asked about their cultural background, expectations, and treatment options.

Conclusions: When treating former refugees/culturally diverse patients, both the healthcare system and providers need to place the patient at the centre of treatment, consider their expectations and try to shift the power balance towards them to move towards equitable health outcomes.



New materials, technologies & therapeutics II

3.45 pm - 5.30 pm

Session chair: A/Prof Nick Heng

Knotless third molar wound closure

Nigel Tan

DClinDent candidate, Oral Surgery

*Nigel Tan, Rohana De Silva, Harsha De Silva, Murray Thomson and Darryl Tong
Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago*

Aims/objectives: The aim was to compare the performance of knotless sutures (3-0 V-loc™ 90) against conventional suture closure (3-0 Vicryl Rapide™) in the surgical removal of bilateral similarly impacted mandibular third molars. Specific objectives were to determine advantages in wound closure speed, postoperative pain, irritation and swelling.

Methods: The study was a single-blind randomised controlled clinical trial using a split-mouth design. 70 participants were recruited from a source population of patients referred to the oral surgery service at the Dunedin School of Dentistry, University of Otago or to Southland Hospital Dental Unit, Te Whatu Ora Southern (formerly SDHB) by their primary care provider. The left or right mandibular third molars were randomly allocated to the proposed intervention (knotless sutures) and the control (conventional suture) to the other. A symptom diary was provided to record pain and irritation scores on each side using a 100mm visual analogue scale. Six pairs of scores were recorded over the first 48 hours by participants. Three facial measurements were taken to determine postoperative swelling: between the tip of the tragus and soft tissue pogonion (A); tragus and lateral corner of the mouth (B); lateral corner of the eye and the angle of the mandible (C). Changes between successive measurements of $[(A + B + C)/3]$, were expressed as a percentage (%). These were taken at baseline (Day 0), day 2 and day 7 postoperatively.

Results: The mean closure time for knotless sutures was 1 minute 23 seconds faster than for conventional sutures [$F(1, 62) = 262.8, p < .001$], and the study average was 3 minutes. There were no statistically significant findings for postoperative pain, irritation and swelling.

Conclusion: Knotless sutures confer some performance benefits, but this needs to be weighed against the increased material cost. It is a promising approach to intraoral wound closure, due to its superior intraoperative handling and comparable postoperative performance.



Effects of Advanced Platelet-Rich Fibrin (A-PRF) on short-term third molar surgery outcomes: a single-blinded randomised controlled trial

Jesslyn Praganta

DClinDent candidate, Oral Surgery

*Jesslyn Praganta, Harsha De Silva, Murray Thomson, Rohana De Silva and Darryl Tong
Sir John Walsh Research Institute, Faculty of Dentistry, University of Otago*

Objectives: This prospective, single-blind, split-mouth study aimed to investigate the clinical effects of advanced platelet-rich fibrin (A-PRF) on the postoperative pain, swelling and incidence of dry socket following third molar surgery

Methods: 70 participants with symmetrical mandibular third molar impactions were randomly assigned an ID number, determining each participant's intervention and control side. The surgeries were carried out under IV sedation and local anaesthesia, and premedication consisting of parecoxib, dexamethasone and fentanyl was administered to each participant. Following the third molar removal, the intervention socket was dressed with an A-PRF plug and Surgispon™, while the control socket only received Surgispon™. The blinded participants completed a 7-day diary to record their postoperative pain on a visual analogue scale (VAS) and their facial swelling on a 5-point ordinal scale. They were assessed clinically for postoperative complications on days 2 and 7 and had 3D stereophotography images taken using the 3dMDtrio™ system. Comparisons were made against baseline measurements taken preoperatively on surgery day to calculate the volumetric changes.

Results: There were no differences in the mean VAS scores and facial volumes between the two sides across the seven days. Participants from both sides did not develop any dry sockets; thus, there was no difference in the incidence between the A-PRF and control sides. Qualitative data analysis showed a higher proportion of the A-PRF side being 'pain-free' and 'swelling-free' on day 2 than the control side, but the results were not statistically significant.

Conclusions: The use of A-PRF in third molar sockets does not appear to confer an additional reduction in postoperative pain and swelling when other preventive strategies like pre-emptive analgesia and corticosteroid administration have been employed. Improvements shown through qualitative data merit further research to explore its potential benefits in compromised healing environments.



Stereophotogrammetric analysis of lip changes induced by the simulated incisor protraction

Teddy Nguyen

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

Introduction: Incisor protraction can cause lip changes in three-dimensional planes. Biomechanical properties of the lips may affect these changes.

Aims: (1) To investigate the upper lip changes induced by the simulated incisor protraction; (2) To assess the influence of biomechanical properties of the lips on the induced lip changes.

Methods: Thirty-four participants were recruited at the Faculty of Dentistry, University of Otago. Incisor protraction was simulated by placing a stent covering the maxillary incisors (4 mm thickness) and gingiva (2 mm thickness). Lip changes in 3D were measured with stereophotogrammetry utilising 3dMD scanning technology. Biomechanical properties of the lips, including muscle tone, stiffness, and elasticity, were measured by myotonometry, using a non-invasive digital palpation device (Myoton AS, Estonia).

Results: An average of 2mm displacement was observed in the upper lip with 4mm simulated protraction in the sagittal plane. A large inter-individual variation of displacement of lip were observed. Participants of some ethnicity demonstrated less displacement of the upper lip, after adjusting for body mass index. High lip tone and low elasticity were associated with greater displacement of the upper lip in the sagittal direction.

Conclusions: Lip changes induced by the simulated incisor protraction differed among the participants with different BMI, ethnicity, and lip biomechanical properties (tone and elasticity).



The effect of clear aligners on masticatory muscle activity in adults with and without high oral parafunction

Nicholas Pittar

DClinDent candidate, Orthodontics

Nicholas Pittar, Mauro Farella and Fiona Firth

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

Aim: To determine the short-term effect of passive clear aligners (PCAs) on masticatory muscle activity (MMA), occlusal discomfort (OD), and temporomandibular disorder (TMD) symptoms in adults with high or low levels of self-reported oral parafunction.

Methods: University students were screened for oral parafunctional behaviours using the oral behavioural checklist. Respondents in ≥ 85 th and ≤ 15 th percentiles were invited to participate. The final sample consisted of 31 individuals: 15 with high parafunction (HPF) and 16 with low parafunction (LPF). Selected participants underwent evaluation of their temporomandibular joints, vertical facial proportions, and hypervigilance. Digital intraoral scans were used to fabricate PCAs. MMA was assessed three times over nine days using a portable electromyography device connected wirelessly to a smartphone. A control recording without PCAs in situ was followed by recordings on Day 1 and Day 8 of PCA wear. Participants' OD, freeway space (FWS), stress, and TMD symptoms were monitored. Results were analysed using descriptive statistics and linear mixed modelling.

Results: PCAs were associated with a significant decrease in mean contraction episode amplitude in both groups ($p = 0.003$). No significant changes in mean contraction episode duration or frequency were observed between the two groups over time. OD increased in all participants on insertion of the PCAs ($p < 0.001$), with a significant interaction between 'group' and 'time' ($p = 0.048$). Significant differences were observed between the two groups for TMD symptoms at baseline ($p = 0.003$), somatisation questionnaire scores ($p = 0.006$), and lower anterior facial height percentage ($p = 0.015$). No significant changes in FWS, stress, or TMD symptoms were identified during the study period.

Conclusions: PCAs were associated with a decrease in MMA in all participants. People with high self-reported oral parafunction are more hypervigilant and reported greater discomfort when wearing PCAs than those with low self-reported oral parafunction.



Patients' experiences with orthodontic treatment through traditional fixed appliances, clear aligners and direct-to-consumer clear aligners: a qualitative study

Sherry Lee

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

**Higher Education Development Centre, University of Otago*

Aim: Traditional fixed appliances have long been the modality of choice for orthodontic treatment. However, there is a steady increase in the use of clear aligners and direct-to-consumer clear aligners. There is a need to turn to patients to learn about their experiences with orthodontic treatment. The overarching aim of this study was to explore the experiences of patients who have undergone orthodontic treatment with traditional fixed appliances, clear aligners or direct-to-consumer clear aligners.

Methods: Thirty New Zealand based adults were recruited for an exploratory case study using a purposeful sampling technique. Semi-structured interviews exploring themes relating to the study objectives were conducted. The interview transcripts were transcribed verbatim and analysed with NVivo software, using inductive thematic analysis.

Results: Individuals sought orthodontic treatment due to self-consciousness, aesthetics, familial influence and relief of previous financial constraints. The rationale behind participants seeking treatment with a specific treatment modality included recommendation by their orthodontist, cost, aesthetics and marketing. There was a range in the quality and quantity of information provided to each participant prior to treatment. The majority of patients' experiences were positive, with participants expressing satisfaction with their treatment outcome. Coronavirus disease of 2019 (COVID-19) and pain were common challenges. Other reported problems included broken brackets, appointment availability, pain, poor post-treatment occlusion and the lack of communication from certain direct-to-consumer clear aligner companies.

Conclusion: The patient experience with orthodontic treatment in New Zealand was generally positive. Self-consciousness, aesthetics and previous financial constraints were the main reasons participants sought treatment. Cost was the most influential factor when selecting a specific treatment modality. The information provided to each participant was not equal. Challenges faced by participants included broken brackets, appointment availabilities, pain, a lack of communication from direct-to-consumer clear aligner companies as well as COVID-19.



Clear aligners brands and marketing claims: an overview of available information on the web

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Objectives: To investigate the current commercially-available clear aligners related to brands, companies, Google trends, and marketing claims presented on their official websites.

Materials and Methods: A search was conducted in October 2020 to identify the relevant web-based information, using three languages (English, Chinese, and Korean) and search terms “clear aligner”, “隐形牙套”, “隱形牙套” and “투명교정장치” in four search engines (Google, Bing, Baidu, and Naver) to identify current clear aligner companies. Each company website was reviewed and assessed for its marketing claims.

Results: A total of 75 clear aligner brands were identified and included in the study, and 280 claims from their official websites were analysed. Most (70.7%) of the companies made claims regarding “aesthetics”, 66.7% made claims regarding “increased comfort”, 58.7% made claims regarding “shorter treatment time”, and 56.0% of the companies made claims regarding “superior material”. Other claims were made regarding their “novel technology”, “superior hygiene”, “tracking Apps”, “remote monitoring”, and “reduced in-office visits”. Of these marketing claims, only 4.5% cited references supporting the company’s website claims; however, the references were mainly derived from internal company research.

Conclusions: Using three languages (English, Chinese, and Korean), 75 different brands of clear aligners were currently found online. Most of the marketing claims from the clear aligner companies’ official websites were not referenced to quality scientific studies. Clinicians and patients should critically appraise the content of company claims and advertisements.



The genetic basis of bacteriocin STH₂ resistance in *Streptococcus mitis* I18

Nick Heng

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Nick Heng, Jo-Ann Stanton and Geoffrey Tompkins*

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

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Background: Members of the genus *Streptococcus* inhabit a variety of sites in the oral cavity and many species produce proteinaceous antibiotics (bacteriocins). Whilst much is known about bacteriocins and their genetic determinants, much less has been reported on bacteriocin resistance and its mechanisms. Streptocin STH₂, produced by *Streptococcus gordonii*, is a competence-induced, narrow-spectrum bacteriocin that selectively targets closely-related organisms including strains of *Streptococcus mitis* and *Streptococcus oralis*.

Objective: The primary objective of this study was to determine the genetic basis of resistance development using whole-genome comparisons of wild-type *S. mitis* I18 and two independently-generated STH₂-resistant I18 derivatives (strains I18^{**}-1 and I18^{**}-2).

Methods: Total genomic DNA from strains *S. mitis* I18, I18^{**}-1 and I18^{**}-2 was purified and sequenced using a hybrid sequencing strategy, specifically combining the ultra-long-read nanopore (Oxford Nanopore MinION) and short-read semiconductor (Ion Torrent PGM) sequencing platforms. Sequence datasets were assembled using SPAdes version 3.15.4 and the draft genome sequences were annotated by the Rapid Annotations using Subsystem Technology (RAST) version 2.0 server. The three genome sequences were compared directly using the Clustal Omega multiple sequence alignment algorithm. Results: The genomes of *S. mitis* I18 and its STH₂-resistant derivatives each comprise a single chromosome (2,021,458 to 2,039,748 bp) and a cryptic 4,043-bp plasmid (pSmil18). Interestingly, the genome of strain I18^{**}-1 is approximately 17.6 kbp smaller due to the excision of transposon Tn916, which encodes tetracycline resistance. Tn916 remained in the same position in the wild-type I18 and I18^{**}-2 genomes. Identified differences between the three genomes are ascribed to mutations in seemingly inconsequential loci.

Conclusion: Thus far, bacteriocin resistance has not been ascribed to a specific genetic variation. Deeper analysis may reveal more compelling STH₂-related resistance factors, particularly in genes encoding cell surface proteins and regulators of gene expression.



Sir John Walsh Research Institute

The Sir John Walsh Research Institute (SJWRI), a Research Centre of the University of Otago, 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.

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