



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

Research Report

2017-2018



1907

University of Otago School of Dentistry founded

The original School of Dentistry was housed at 80 Union Street, a category 1 registered heritage building now used as the University Staff Club.

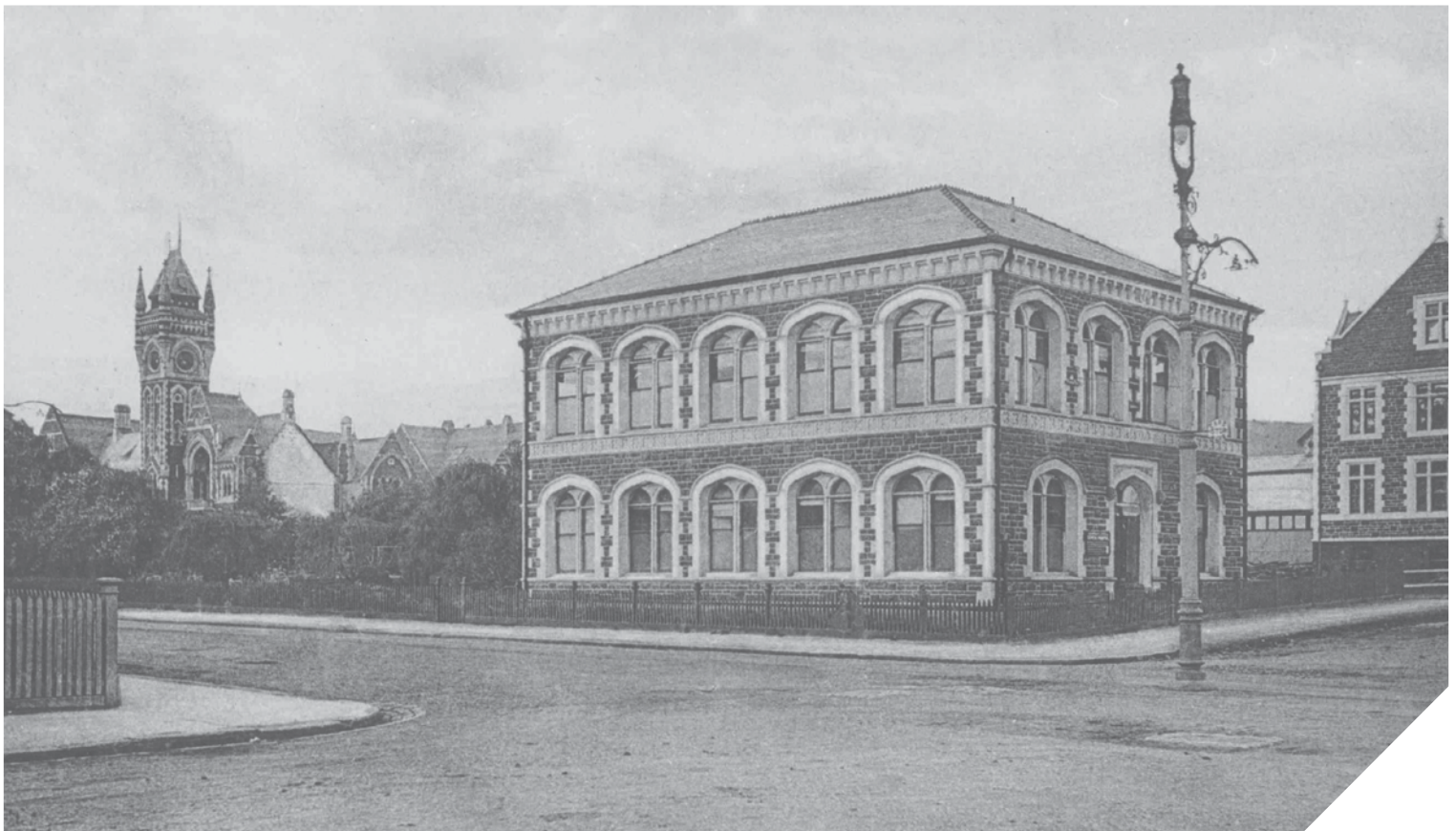


Table of contents

| | |
|---|-----|
| About the Sir John Walsh Research Institute | 3 |
| Introduction from our Director, Professor Richard Cannon | 4 |
| Who was Sir John Walsh? | 6 |
| Our highlights | |
| Publications and research funding summary | 8 |
| Dentistry redevelopment programme | 10 |
| New Auckland dental facility | 16 |
| Te Kāiika health hub opens | 18 |
| World ranking successes | 19 |
| Staff awards and achievements | 20 |
| SJWRI Research Day | 24 |
| SJWRI Awards | 30 |
| Research funding successes | 39 |
| Student awards and achievements | 44 |
| Conferences and outreach activities | 47 |
| Stories from our research | 52 |
| Our programmes | |
| Biomechanics and Oral Implantology | 60 |
| Clinical and Translational Research | 65 |
| Craniofacial Research | 70 |
| Dental Education Research | 75 |
| Dental Epidemiology and Public Health | 80 |
| Molecular Microbiology | 84 |
| Oral and Molecular Immunopathology | 89 |
| Our people | |
| Profiles of our academic and research staff | 96 |
| Our achievements | |
| Research funding secured | 147 |
| Research publications and outputs | 156 |
| Postgraduate research degree completions and thesis abstracts | 174 |
| Undergraduate research projects | 198 |
| Research seminars and Research Day presentations | 208 |

We hope you enjoy this Research Report of the Sir John Walsh Research Institute, a snapshot of research activities and achievements from New Zealand's National Centre for Dentistry for 2017-18. If you would like more information, further details on our research programmes, activities and achievements, our latest news and events, and profiles of researchers are available from our website www.otago.ac.nz/sjwri.

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This Research Report of the Sir John Walsh Research Institute 2017-18 was compiled by Dr James Smith, with thanks to Professor Richard Cannon and the staff and students of the Sir John Walsh Research Institute.

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Cover image: Artist's impression of the new University of Otago dental teaching facility and patient treatment clinic at the Counties Manukau DHB SuperClinic site in South Auckland, currently under construction. Image courtesy Jasmx.

Sir John Walsh Research Institute

The Sir John Walsh Research Institute (SJWRI) advances research and increases knowledge for the improvement of oral health in New Zealand, and provides a national focus for dental research.

The Institute's innovative, future-focused, interconnected research programmes cover the spectrum of oral health research, from the molecular, through biological systems to the health of populations.

The SJWRI is integral to New Zealand's only Faculty of Dentistry, ranked in the top 30 worldwide in 2017-18, and its members have well-established productive collaborations across the University and with other institutions in New Zealand and worldwide.

Our mission is to undertake research that underpins our teaching and clinical practice, and that translates discoveries into measurable health improvements for all New Zealanders.

The Institute is named after Sir John Walsh, Dean of Dentistry from 1946 to 1971, a strong advocate for research in dentistry and oral health.

Mission

- Advance research and increase knowledge for the improvement of oral health in New Zealand
- Support and represent the oral health research community in New Zealand
- Facilitate the communication and application of our research findings for the benefit of oral and general health worldwide

Values

- Research for Public Benefit - we are committed to carrying out research that leads to new methods for disease prevention, diagnosis, and treatment, in order to improve people's oral and general health
- Excellence - we are committed to the pursuit of excellence in research for the development of dental care to enhance the oral health of the public
- Integrity - we are committed to integrity, honesty and consistently high standards in research and in all our interactions, both internally and externally
- Accountability - we believe that we are accountable for our actions and we are prepared to submit ourselves to appropriate scrutiny
- Equity - we will ensure that our policies and practices do not discriminate unfairly or lead to other forms of unfair treatment

Introduction from our Director



The last two years at the Sir John Walsh Research Institute (SJWRI) have been a combination of stability and change. The SJWRI has continued to undertake cutting edge research within its seven research programmes: Biomechanics and Oral Implantology, Clinical and Translational Research, Craniofacial Research, Dental Education Research, Dental Epidemiology and Public Health Research, Molecular Microbiology Research, and Oral Molecular and Immunopathology Research. Details of the achievements within these programmes can be found in this research report. The Institute has also continued to run very successful annual Research Days that showcase our research and build collaborations across New Zealand and internationally.

We have continued to make significant contributions to the International Association for Dental Research (IADR) Australia New Zealand (ANZ) Division and IADR General Sessions. Professor Karl Lyons is currently the Vice-President of the ANZ Division, and Associate Professor Jonathan Broadbent is President of the New Zealand Section. The SJWRI has had booths promoting both our research and the Faculty of Dentistry at the IADR General Sessions in San Francisco in 2017 and London in 2018, which proved to be very popular. Dr Li Mei was awarded the ANZ IADR Oral Biology Award at the Divisional meeting in Adelaide in 2017. At the same meeting, Dr Kai Chun Li was awarded the ANZ IADR Joan Chong Award in Dental Materials, and Dr Carolina Loch was awarded the ANZ IADR Oral Biology Award in 2018. Professor Murray Thomson was awarded the IADR Robin Heath Award for the most downloaded paper in the journal *Gerodontology* during the previous five years, at the 96th General Session of the IADR in 2018.

The Institute has continued its outreach activities. As a result of our *Making a good impression: from fossils to false teeth* outreach programme in local primary and intermediate schools, Dr Loch was approached by Te Kura Kaupapa Māori o Ōtepoti for assistance to run a dental science programme in their Kura looking at the effect of sugar in the diet. A team from the SJWRI and the Department of Human Nutrition helped run monthly sessions where the students undertook experiments and activities investigating sugar and acids in their diet and the effect of these on their teeth and bodies.

The last two years have also been a period of change. The phrase “the only thing that is constant is change” may seem very topical, but it is attributed to Heraclitus of Ephesus who lived from 535 to 475 BCE, so change is nothing new. The rate of change at present, however, is rapid and the scope of the change is large. There are changes in the expectations of society, and funding agencies, on scientists in terms of outcomes and impact from research. Furthermore, funding for research is becoming increasingly difficult to secure.

The Institute has responded to these changes. We have established contestable PhD start up grants and Sir Thomas Sidey SJWRI PhD scholarships to support postgraduate research. The institute has recently awarded three research grants generously sponsored by Colgate Palmolive, and we hope to be able to repeat this annually. The SJWRI has worked with the New Zealand Dental Association (NZDA) to contribute a research session at the Annual NZDA conference designed at sharing our research results with the dental profession.

There are also changes afoot in the Faculty of Dentistry. We are in the middle of a building programme to replace the dental clinics, the research laboratories, and establish a dental facility in Auckland. This has involved decanting offices and laboratories from the Walsh building to various locations around the University of Otago campus. While these changes have caused some disruption to research there are also benefits – the fact that our laboratories have been decanted to the University of Otago Centre for Innovation and the Department of Biochemistry, is increasing our ‘outreach’ and may lead to new interdisciplinary collaborations. The Faculty of Dentistry is currently in the process of moving into a new state-of-the-art Clinical Services Building which will be able to support and extend our clinical research. There is no progress without change, and we are excited by the prospect of new facilities enabling the SJWRI to take its research to the next level.

Professor Richard Cannon

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With thanks to the staff and students of the Sir John Walsh Research Institute and Faculty of Dentistry, University of Otago.



Sir John Walsh
Research Institute
Research Day 2018



Auditorium



do not touch the artworks

Sir John Walsh KBE (1911-2003) made such a remarkable contribution to dentistry in New Zealand that Chapter 8 of Tom Brooking's *A History of Dentistry in New Zealand* is entitled 'The Walsh Era 1947-1972.'

After graduating with a first class honours degree in dentistry, followed by a medical degree, and then serving as a medical officer in the Royal Australian Air Force, this self-described 'brash Australian' was appointed as the third Dean of the School of Dentistry at the University of Otago in 1946, at just 34 years of age.

Walsh was a powerful advocate for research. Staff in the Faculty of Dentistry were encouraged to undertake PhD study. The School of Dentistry set out to grow its own researchers by introducing the highly successful Master of Dental Surgery graduate programme. Some fifty years later this degree was replaced by the Doctorate in Clinical Dentistry featuring a considerably expanded research component. This increased the research experience and clinical expertise of graduates in a world where biological knowledge, and its impact on clinical practice, are changing at an unprecedented rate. This initiative undoubtedly would have been endorsed by Walsh.

One of his most significant, but least well-known achievements, was developing a high-speed dental handpiece. Early electric drills were inefficient and caused considerable discomfort to patients. While testing the hearing of Australian airmen Walsh not only identified frequencies that caused pain, but also those that did not. This led to the hypothesis that the vibrational frequencies from sufficiently high speeds could minimise patient discomfort.

With the assistance of H.F. Simmons from the University of Otago Department of Physics, an existing air-powered low-speed drill was modified to operate initially above the 42,000 rpm vibrational threshold, and then at 60,000 rpm. In 1947, Walsh persuaded the Ministry of Science and Industry to underwrite the development of the air turbine handpiece at the Dominion Physics Laboratory in Lower Hutt.

By 1949, a prototype was made, Walsh then obtained the results that contributed to his DSc (Doctorate of Dental Science) from the University of Melbourne, and a New Zealand patent.

Although the prototype overcame the pain problem, its high-pitched noise, excessive exhaust of air into the patient's mouth, and the too-frequent seizure of its primitive bearings due to overheating, made it difficult to obtain further support from government or commercial sources. American and Swedish researchers had overcome the technical problems in the mid-1950s to produce the Borden Airtor.

Walsh expanded research activity within the Faculty by attracting research funding. He established the Biochemical Research Unit within the Dental School in 1960, now the Molecular Biosciences Laboratory, and supported an electron microscopy suite, now reflected in the Otago Centre for Electron Microscopy.

Walsh's appointment advanced dentistry at many levels. He served as a spokesperson for dentistry at the World Health Organisation. He led a campaign that overcame vociferous opposition to fluoridate water supplies. He was knighted in 1960 and awarded honorary life membership of the New Zealand Dental Association in 1971. After 10 years of struggle he succeeded in building the iconic, heritage-listed glass curtain building that houses the Faculty of Dentistry and bears his name.

Fittingly, the redeveloped Walsh Building is to be retained as the centrepiece of the new University of Otago Faculty of Dentistry precinct, to be opened in 2020.



Sir John Walsh at his desk in the Otago Dental School, 1940s. Hocken Collections, Uare Taoka o Hākena, University of Otago.

Our highlights

1926

Marples Building

To accommodate growth, the School of Dentistry relocates to a new purpose-built building at 360 Great King Street (now known as the Marples Building – Department of Zoology).



Publications and funding summary

Publications summary

| Category | 2017 | 2018 | Total |
|--|------------|------------|------------|
| Edited Book - Research | 1 | | 1 |
| Chapter in Book - Research | 9 | 2 | 11 |
| Chapter in Book - Other | 2 | | 2 |
| Journal - Research Article | 93 | 111 | 204 |
| Journal - Research Other | 14 | 20 | 34 |
| Journal - Professional & Other Non-Research Articles | 7 | 2 | 9 |
| Conference Contribution - Published proceedings: Full paper | | 2 | 2 |
| Conference Contribution - Published proceedings: Abstract | 75 | 37 | 112 |
| Conference Contribution - Poster Presentation (not in published proceedings) | 3 | 3 | 6 |
| Conference Contribution - Verbal presentation and other Conference outputs | 24 | 8 | 32 |
| Other Research Output | 1 | 5 | 6 |
| Awarded Doctoral Degree - Staff | 2 | 5 | 7 |
| Awarded Masters Degree - Staff | 1 | | 1 |
| Total, Sir John Walsh Research Institute/Faculty of Dentistry | 232 | 195 | 427 |

To avoid double counting, unique publication counts are used when a publication has authorship from more than one department; e.g. for a publication with authors from more than one department, each department's contribution is allocated proportionally. Publications data courtesy Dr Donna Hendry, Publications Office.

Postgraduate degree completions

| Degree | 2017 | 2018 | Total |
|--|-----------|-----------|-----------|
| Doctor of Philosophy (PhD) | 2 | 7 | 9 |
| Doctor of Clinical Dentistry (DClinDent) | 18 | 12 | 30 |
| Master of Community Dentistry (MComDent) | 4 | | 4 |
| Master of Dentistry (MDent) | 2 | 2 | 4 |
| Master of Dental Surgery (MDS) | | 1 | 1 |
| Master of Oral Health (MOH) | | 1 | 1 |
| Postgraduate Diploma in Clinical Dental Technology (PGDipCDTech) | 21 | 9 | 30 |
| Postgraduate Diploma in Clinical Dentistry (PGDipClinDent) | 3 | 5 | 8 |
| Postgraduate Diploma in Dental Therapy (PGDipDentTher) | 1 | | 1 |
| Total, Sir John Walsh Research Institute/Faculty of Dentistry | 51 | 37 | 88 |

Data are for all postgraduate degree completions between 1 Jan 2017 and 31 Dec 2018, for which the SJWRI or other departments within the Faculty of Dentistry were listed as host department.

Data courtesy Karen O'Neil, Faculty of Dentistry.

Research funding summary

| Funder/Contracting body | 2017 | 2018 | Total |
|--|--------------------|------------------|--------------------|
| Aroa Biosurgery Ltd | \$264,460 | | \$264,460 |
| Australian and New Zealand Association of Oral and Maxillofacial Surgeons (ANZAOMS) Research and Education Foundation Inc. | | \$2,725 | \$2,725 |
| Australasian Council of Dental Schools | | \$54,000 | \$54,000 |
| BLIS Technologies Limited | \$3,981 | \$5,000 | \$8,981 |
| Cure Kids | \$26,800 | \$49,458 | \$76,258 |
| Deer Industry New Zealand | \$150,000 | | \$150,000 |
| Dentalife Australia Pty Ltd | \$13,425 | | \$13,425 |
| Downie Stewart (Fuller Trust) | \$13,875 | \$33,000 | \$46,875 |
| Health Research Council of NZ (HRC) | \$198,588* | | \$198,588* |
| HiTem Co. Ltd | \$9,132 | | \$9,132 |
| ITI International Team for Implantology | | \$242,004 | \$242,004 |
| Kiwi Innovation Network Limited | | \$20,000 | \$20,000 |
| Maurice and Phyllis Paykel Trust | | \$10,000 | \$10,000 |
| MedTech CoRE | \$25,000 | \$91,887 | \$116,887 |
| Ministry of Health Oral Health Research Fund | \$9,970 | \$53,093 | \$63,063 |
| New Zealand Dental Association Central Districts Branch | \$3,000 | \$3,000 | \$6,000 |
| New Zealand Dental Research Foundation | \$106,068 | \$133,432 | \$239,500 |
| New Zealand Institute of Dental Technologists | \$4,668 | \$4,930 | \$9,598 |
| New Zealand Lottery Grants Board | \$166,482 | | \$166,482 |
| Otago Innovation Limited | \$149,997 | | \$149,997 |
| Otago Medical Research Foundation | \$15,000 | | \$15,000 |
| Otago Museum Trust Board | \$13,700 | | \$13,700 |
| Royal Society of New Zealand | | \$80,000 | \$80,000 |
| Silventum Limited | | \$17,489 | \$17,489 |
| University of Otago Research Grants | \$74,680 | \$191,589 | \$266,269 |
| University of Michigan | \$34,326 | | \$34,326 |
| Total | \$1,283,152 | \$991,607 | \$2,274,759 |

Figures are in New Zealand dollars and represent all external research funding contracts commencing between 1 Jan 2017 and 31 Dec 2018, led by Principal or First Named Investigators from the Sir John Walsh Research Institute and Faculty of Dentistry. This does not reflect contracts beginning in earlier years which ran through the 2017-18 period. *This grant was declined post-award due to the departure of the PI.

Research funding data courtesy Dr John Milnes and Lorraine Harris, Research and Enterprise Office.

A full listing of research publications, research funding and postgraduate degree completions from the SJWRI and Faculty of Dentistry for the 2017-18 period follows later in this Report in the section titled 'Our Achievements'.

Dentistry redevelopment project

Artist's impression of the exterior of the new School of Dentistry buildings. Courtesy Jasmx.



The Faculty of Dentistry and the Dental School Redevelopment Project Team wishes to thank everyone for their patience while New Zealand's only dental faculty is becoming the most technologically advanced in Australasia – providing Otago with world-class research and teaching facilities for its world-leading academics, and the best environment possible for students and patients.

The Faculty carries out about 76,000 treatments on the public from around the lower South Island annually, hosts the Sir John Walsh Research Institute, and caters for undergraduate and postgraduate programmes in dentistry, oral health and dental technology. The University has been home to New Zealand's only Faculty of Dentistry since 1907, but the faculty has been in its current building for 54 years so needed to move with the times. The redeveloped dental school precinct will herald a new era of development in dentistry, and will lead Australasia in patient management and technology.

Construction of the new 8,000m² Clinical Services Building commenced early in 2017 behind the Walsh Building in Great King Street. The CSB will house specialty and teaching clinics, the Primary Care Unit, radiography, and surgical suites. It will have 214 new dental chairs, 61 more than now – and patient records will be digital, and accessed on computers at the chairside, instead of using paper files.

After the Clinical Services Building is finished in mid-2019, the Walsh Building's remaining clinical areas will relocate to the new facility. Then, the 10,000m² Walsh Building, opened in 1961 and listed as a category 1 historic place, will be refurbished. Once completed in 2020, the refurbished Walsh building will house the Sir John Walsh Research Institute, administrative support for the faculty, the management team, academic and support staff, research and teaching laboratories.

The two buildings will be linked by an 1,800m² atrium, which will be the 'heart' of the facility, used by patients, students and staff.

The Faculty's \$130 million dollar extreme makeover also includes refurbishment of the Blue Lecture Theatre, adjoining the Walsh Building in Frederick Street. This part of the project was completed in early 2018.



CSB construction progress, November 2017.
Courtesy Fiona McDonald.

Moving on up: the Dental School decant

Redevelopment of the Walsh Building required the decanting of staff, students and clinical and research facilities to other locations across campus during 2017-18.

The first stage of the decant took place in 2015-16, in which the Walsh Building's former West Wing was evacuated ahead of its demolition in order to make space for the new CSB. About 40 staff and the Faculty's Simulation Laboratory – where students develop their skills on sophisticated artificial heads – moved from the Walsh Building to the Dunedin Hospital Children's Pavilion.

The second stage of the Dentistry decant – which took place between November 2017 and the end of 2018 - involved 16 individual moves, and moved almost 300 people and five laboratories to nine locations around the University of Otago's Dunedin campus. The decant was particularly complex because the campus is already packed tight with people and facilities; just finding spaces for everyone took about 18 months. The decant project involved construction of laboratories for histology, clinical technology, and biomaterials and forensic research in the Centre for Innovation (Cfi), on the University of Otago's main campus. These laboratories moved into their temporary premises in the Cfi at the end of November 2017, with staff and students moving into nearby office space in 533 Castle St.

Other facilities and staff also shifted from the Walsh Building in mid 2018 to various locations around campus, including the Childrens' Pavilion and the Jamieson Building (formerly home to the University's Human Resources Division). The Dental School Project Team moved from the Walsh Building to 71 Frederick St, formerly the base for the Sir John Walsh Research Institute which moved to the Jamieson Building. The Molecular Biosciences Laboratory moved into the ground floor of the Department of Biochemistry building on Cumberland Street, while Dental Technology teaching laboratories moved to a specialist laboratory portacom next to the Higher Education Development Centre (HEDC) in Union Street. All will return to the completed Walsh Building in 2020.



CSB construction, 2017-18

Left: Construction progress, Dec 2017.

Middle row, left: Progress, early 2018.

Middle row, right: Fitout inside the new CSB as of June 2018, where steel wall partitions had gone up and pipes, ducting and trays for electric cables had also been installed.

Bottom: By June 2018 the roof was finished on the new CSB – a milestone marked by a function for Faculty staff and project team members - and the floors had been poured on all four levels. A crane had started to fit glass in the windows on the south and western façades.

Photographs courtesy Fiona McDonald and Beth Chisholm, Building Project Team.



Scheduled to open in 2020, the completed Dental School Redevelopment will feature:

- New operating theatres and surgical suites that will cater for developments in surgical specialties
- 214 new high-specification dental chairs, 61 more than in the previous Dental School building
- Digital patient records that can be accessed on computers at the chairside instead of paper files
- Digital imaging that will reduce x-ray exposure and handling of potentially hazardous chemicals
- Digital imaging technologies that will improve support for researchers, particularly for investigations involving sleep apnoea and movement of the jaw
- Tutorial spaces linked to patient treatment areas, with integrated technology to enrich the learning experience
- Uniting the research laboratories of the SJWRI into one area within the redeveloped Walsh Building; currently, staff and students are divided among many small laboratories across campus
- Academic offices brought together on the floor below the laboratories, allowing ready access to clinics and research facilities.



Artist's impressions of the interior of the new Clinical Services Building and the Atrium linking it to the redeveloped Walsh Building.



Clinical Services Building completion, mid 2019

Below: External view of the new Clinical Services Building.

Opposite page, top row: installation of dental chairs in the clinic spaces on the second floor. Middle left: orthodontics clinics. Middle right: patient waiting room, first floor. Bottom row: view of the atrium space between the CSB and the Walsh Building, which is now being redeveloped.





New Auckland dental facility



Artist's impression of the new University of Otago dental teaching facility and patient treatment clinic in South Auckland, construction of which began in late 2018. Courtesy Jasmx.

Otago to build new dental facility in South Auckland

The University of Otago is building a dental teaching facility and patient treatment clinic in South Auckland to help meet high health needs, while providing students with wide-ranging learning opportunities in a diverse community.

The \$28.2 million, two-storey, 32-chair building will be built upon land owned by the Counties Manukau District Health Board at its Manukau Super Clinic on Great South Road.

Announced in August 2018, construction began in December 2018 and the project is on target for completion before the start of the academic year in 2020.

University of Otago Vice-Chancellor Professor Harlene Hayne says by making a real difference to people's lives and a community's health and well-being, the University will be living its strategic commitment to providing for the national good and improving lives.

The University is also committed to helping develop students into good citizens and this project will create a community-focused experience that involves thoughtful giving and service, Professor Hayne says.

Pro-Vice-Chancellor of the Division of Health Sciences and Dean of the Faculty of Dentistry from 2016 to 2018, Professor Paul Brunton, says the

project is a win-win situation for both the local community and the University.

"Patients are contributing to the education of the country's future dentists and, in exchange, they have access to high-quality dental care."

The Manukau dental teaching facility and patient treatment clinic will follow the long-standing social contract model operated successfully in Dunedin, where patients receive treatment provided by students under supervision at a highly accessible cost, Professor Brunton says.

Forty-eight final-year Bachelor of Dental Surgery students will be assigned to the Manukau facility at any one time.

Professor Brunton says treating people in Manukau is only possible because of a much-valued relationship with the CMDHB, which led to the two institutions signing a Memorandum of Understanding in November 2014 so they could work together to achieve mutual goals.



Businessman and philanthropist Graeme Hart receiving his Honorary Doctor of Commerce in December 2017 from John Ward, then University of Otago Chancellor.

The Counties Manukau District Health Board provides services to 11 per cent of New Zealand's population, including 12 per cent of New Zealand's Māori, 37 per cent of New Zealand's Pacific people, and 21 per cent of New Zealand's Asian people.

"The new facility will not only provide students with diverse practical learning opportunities but also increase their understanding of people from a wide range of backgrounds," Professor Brunton says.

The project will strengthen relationships and partnerships with Māori and Pacific communities as well, based on mutually beneficial goals incorporating patient care, research and education.

Not only will the Faculty of Dentistry regularly consult the community to find out what it needs from the clinics then work to deliver that, the Faculty will also provide a wide range of outreach activities.

Having an Auckland base in an area home to a large number of oral healthcare professionals will also make it easier for them to access continuing education opportunities.

The facility could help meet international demand for upskilling dentists as well, due to Auckland's accessibility.

History-making donation secures future of Auckland dental facility

The University of Otago is grateful to internationally renowned businessman and philanthropist Graeme Hart and his wife Robyn for their generous donation of \$10 million which will help develop a new dental teaching facility in South Auckland.

The donation is the most significant in the University's 150 year history, and University of Otago Foundation Trust Chair John Ward says the University is indebted to Mr and Mrs Hart.

"We are immensely grateful to Graeme and the Hart family for their generosity," Mr Ward says.

"This funding will make a significant contribution to the development of a new dental teaching facility which will not only provide students with diverse practical learning opportunities, but will also provide dental care for the local diverse communities at a highly accessible cost."

Mr Hart, who lives in Auckland, is considered one of the most successful and generous businessmen to operate both within New Zealand and on a global scale. Last December he was awarded an Honorary Doctor of Commerce degree by the University, in recognition of his contribution to the business sector and philanthropy by supporting education and children's health.

Mr Hart is pleased the donation will help support both the University and the South Auckland community. "We are delighted to be able to assist our University in providing a Dental School that will meet the needs of lower socio-economic groups. We are very pleased that the youth and young children of this region will benefit from this facility," Mr Hart says.

Mr Hart notes that he and family members are very thankful for having had the opportunity to study at the University of Otago, to have experienced life on the University of Otago campus, and to meet individuals there with global reach. He considers that undertaking a Master of Business Administration there was one of the most pivotal and influential experiences of his career.

University of Otago Chancellor, Dr Royden Somerville QC, says that Mr and Mrs Hart's extraordinarily generous gift is a major contribution to the provision of dental health care.

"Their significant philanthropic support of the University will sustain the excellence in research, teaching, and community outreach that the University of Otago is renowned for. Since the University of Otago was established in 1869, as New Zealand's first university, philanthropy has been essential to maintaining its world-class reputation."

Te Kāika health hub opens

The Faculty of Dentistry are proud to be part of a new iwi-driven health hub for Māori, Pasifika and low-income families in the Dunedin area, focusing on affordable, high quality health and social services, which officially opened its doors in February 2018.

Around 200 people attended the opening of Te Kāika, which aims to deliver a number of health and wellbeing services for Māori, Pasifika and low income families. It is situated in the former College Street School in Caversham, Dunedin.

The services at the former School buildings include a primary health care service (Te Mataora), which provides affordable GP and dental services, the latter provided by staff and students of the Faculty of Dentistry.

The University of Otago will also use the centre to train students from across Health Sciences, including dentistry, medicine, pharmacy and physiotherapy.

The initiative, which has been three years in the making, aims to inspire other areas to take up a hub-based model of health services.

Te Runanga o Otakou chair Donna Matahaere-Atariki, one of the founders of Te Kāika, emphasised Te Kāika would embody both health and wellbeing services.

“This is about being really pragmatic and saying people live complex lives, and we need to be able to respond to that complexity without freaking out about it,” Ms Matahaere-Atariki said.

“Given the group we were focused on were those historically underserved by those institutions, it wasn't about doing things for people – it was about creating an environment to help people make their own decisions.”

Among those at the opening was former Whanau Ora minister Dame Tariana Turia, who praised Te Kāika for being an inspirational model of collaboration.



Komene Cassidy from the Centre for Māori Development, University of Otago, addresses the crowd at the Te Kāika opening.

“In many ways what you're doing is reflecting on the foundational essence of your community, and identifying the diverse strains that make us this village, and that is something to be proud of,” Dame Turia told the crowd.

“Te Kāika is exactly what we intended for Whanau Ora.”

The University's Pro-Vice Chancellor (Health Sciences) Professor Peter Crampton told the crowd there were a number of key benefits for all parties.

“The University of Otago is very proud, and humbled, to be a partner in this initiative led by Ngāi Tahu,” Professor Crampton said.

“And let me remind everyone again why Te Kāika is important – because we aim to provide a range of high quality health and social services to support whanau, Pacific families and low income families in Dunedin in order for them to be in control of, and in charge of, their lives.”

Professor Crampton also paid tribute to Otākou Rūnanga chair Donna Matahaere-Atariki and Albie Laurence, who he described as the intellectual architects of Te Kāika.

Te Kāika is a partnership between Arai Te Uru Whare Hauora, Te Rūnanga o Ōtākou, and the University of Otago. It is run by Otakou Health Limited (OHL), a charity founded in 2015 aimed at bringing affordable health and wellbeing services to Dunedin.

Te Pūtahitanga o Te Waipounamu (the South Island Whānau Ora Commissioning Agency) has provided funding for start-up and infrastructural costs, while Te Rūnanga o Ngāi Tahu has also strongly supported the project.

Initially focused in the Dunedin south area, it is expected to attract families from across the city.

Left: Te Runanga o Ōtākou chair Donna Matahaere-Atariki and Ngai Tahu kaiwhakahaere Lisa Tumaha'i unveil the plaque outside Te Kāika.

World ranking success

Dentistry at Otago maintains top 30 world ranking in 2017-18

The University of Otago has maintained its ranking among the top 30 institutions in the world in the subject area of Dentistry, according to the QS World University Rankings by Subject for 2017 and 2018. This ranking places Dentistry at Otago second overall of all dental schools in the Oceania region, and in the top ten across Asia-Pacific.

Dentistry at Otago ranked equal 29th worldwide in 2017, and rose two places to equal 27th in 2018. Otago was ranked seventh overall in all dental schools in the Asia-Pacific region for 2017, and sixth in 2018.



The QS subject rankings are derived on the basis of a combination of factors including Academic Reputation (how academics from other universities rate a university in a particular subject area), Employer Reputation (how employers rate a university in a particular subject area), and citations (the extent to which the work of an academic in a subject area is quoted or referenced in the work of others).

Research performance, led by the achievements of the Sir John Walsh Research Institute, are critical to the Faculty's high ranking.

In 2017, the University of Otago ranked among the top 50 institutions in the world in five subject areas and among the top 100 in 12. Otago was judged to be among the world's top 10 universities for the study of Sport and sport-related disciplines, placing seventh internationally. This was the highest ranking achieved by any New Zealand university for any subject area in the 2017 rankings, an honour held by Dentistry at Otago in 2015. Aside from Dentistry, the University had three further subjects ranked inside the top 50, namely Anatomy and Physiology (24th in QS's inaugural Anatomy and Physiology measure), Archaeology (40th) and Development Studies (44th).

In the 2018 QS World University Rankings by subject, as well as maintaining five subjects in the top 50 worldwide (with three of those, including Dentistry, improving their position within the top 50), the numbers of Otago subjects ranked between 51st and 100th increased from eight to 10. Aside from Dentistry, the University's Physical Education, Archaeology, Anatomy and Physiology and Development Studies offerings also achieved top-50 rankings.

In the broader "faculty" categories assessed for the rankings, Otago's life sciences and medicine areas (including Dentistry) were ranked 64th in the world overall for 2018, compared to 66th in 2017. Otago also secured top 100 faculty rankings for social sciences and management and for arts and humanities.

As an institution, the University of Otago climbed 18 places in the 2018 QS World University rankings from 2017 to number 151, securing its place in the top echelons of universities worldwide. Within this ranking, Otago comes in at 28th in the International Faculty indicator, with aims to assess how successful a university has been in attracting academics from other nations.

The 2018 QS rankings saw Massachusetts Institute of Technology (MIT) retain the top spot for the sixth consecutive year, followed by Stanford and Harvard. However, QS Research Director Ben Sowter says the continued dominance of the top US universities should not obscure a changing landscape elsewhere, with other US and UK institutions making way for the best of Australia, New Zealand, Russia, China and India – among others.

"New Zealand now boasts five universities among the Top 300, one more than last year and three are among the world's top 200 in our research indicator."

Mr Sowter says the international clout of the New Zealand higher education system is impressive, especially considering that it competes with far more populous and richer countries.

Staff awards and achievements

Associate Professor Jonathan Broadbent wins 2017 HRC Liley Medal

Associate Professor Jonathan Broadbent was awarded the Health Research Council of New Zealand's (HRC) Liley Medal for 2017 for a study showing a clear long-term association between a child's upbringing and the state of their teeth as a middle-aged adult.

Dr Broadbent, head of preventive and restorative dentistry at Otago, led the study to help explain how socioeconomic inequalities in dental health arise, using 40 years of data following participants from the world-renowned Dunedin Multidisciplinary Health and Development Study.

The main paper from the study, which was the most-read article in the *Journal of Dental Research* in 2016, showed that parents' socioeconomic status and beliefs about how to keep teeth healthy strongly influenced their children's beliefs and health behaviours growing up.

These factors were also associated with substantial differences in untreated tooth decay and tooth loss by the time their children reached their 30s.

HRC Chief Executive Professor Kath McPherson says the paper reveals just how critical childhood is for determining our future dental health, and that ongoing exposure to socioeconomic disadvantage increases our risk of worsening oral health as we age.

"Jonathan and his colleagues have been able to explore and model the pathways to poor oral health from birth to adulthood thanks to the invaluable and unique data accumulated through the Dunedin Study, which the HRC has supported for more than 40 years."

Dr Broadbent says the association between socioeconomic status and dental health is probably stronger in dentistry than any other area of health.

The research shows a striking inequality in dental treatment.

"Up to age 18, the study members that needed care mostly got it, but once access to state-funded dental care ended, the socioeconomic gap widened at an increasing rate as the study members aged," he says.

"In this paper, we traced the explanation back to their childhood. Those whose parents held inaccurate beliefs about what is good for the teeth grew up to also be less likely to believe in the importance of brushing, avoiding too much sugar, and visiting the dentist. They ended up with more teeth extracted or with untreated decay."



Dr Broadbent says he is fortunate to work with an excellent team of researchers using high-quality data.

"I'm extremely grateful to my colleagues and to the study participants. I hope that by being acknowledged with such a prestigious award the findings will get the attention of health policymakers. I'd like this paper to get people thinking about the way we provide dental health care, particularly to adults, for whom the social divide in dental care is greatest."

Dr Broadbent is an investigator on the HRC-funded Dunedin Study programme (\$5M) led by Professor Richie Poulton, within which he leads a project (\$1.2M) using the Dunedin Study data to investigate dental health changes from childhood to age 45 years, including the interrelationship between oral health and other aspects of health such as heart health and quality of life.

In early 2017, the Dunedin Study was awarded the Prime Minister's Science Prize and the University of Otago's Research Group Award for 2016.

Associate Professor Broadbent was among three University of Otago researchers whose outstanding achievements were recognised through the bestowing of prestigious national awards at the 2017 New Zealand Research Honours Dinner.

Professor Sally Brooker (Department of Chemistry) the Society's Hector Medal, while Department of Physics PhD student Mr Ryan Thomas won the Hatherston award.

Hosted by Royal Society Te Apārangi, the event was held on 10 October, 150 years to the day of the Royal Society's official enactment by Parliament on 10 October 1867, and was attended by their Patron, the Governor-General Dame Patsy Reddy.

Child poverty casts long shadow on oral health care

Child poverty and its detrimental impact on dental health care casts a long shadow and affects oral health into adulthood, University of Otago Associate Professor in the Faculty of Dentistry, Jonathan Broadbent says.

He welcomes the Child Poverty Action Group's report *Too soon for the tooth fairy*, released March 2018, which shines the spotlight on the implications of child poverty for oral health.

The report backs up Associate Professor Broadbent's concerns over inequality in dental health care in an opinion article published in the University of Otago Magazine 46.

His comments are based on analysis of dental data from the University of Otago's internationally recognised Dunedin Multidisciplinary Health and Development Study, tracking the lives of more than 1000 babies born in Dunedin between April 1972 and March 1973.

Now that the study members are adults, it is possible to investigate how their childhood influenced their adult dental health, and the Dunedin study is revealing.

Up to 18 years of age, more dental decay occurred among children from socio-economically disadvantaged families, but those who needed dental care mostly got it due to New Zealand's universal dental health care for children and adolescents, Associate Professor Broadbent explains.

However, this changed once access to state-funded dental care ended at age 18. By the time they were 26, the average number of teeth with untreated decay among young people from socio-economically disadvantaged families was five times greater than it had been at age 18.

"Publicly-funded dental care minimises inequality up to age 18, but then the bottom drops out," Associate Professor Broadbent says.

By age 38, the average number of teeth lost was six times greater among those who had been born into disadvantaged families than for those born into well-off families.

Socio-economic differences in tooth decay rates don't explain socio-economic inequality in dental health alone, because well-off people who eat too much sugar and have poor oral hygiene have a high rate of tooth decay too, Associate Professor Broadbent says.

"But, if you have a high rate of decay as a child and are born into a family with low-income parents, this will affect your risk of having poor dental health right through your life, not just during childhood."

In a recent research paper based on the Dunedin Study, Otago researchers investigated the pathway from childhood to having dental problems as an adult. Socio-economically disadvantaged parents were less likely to understand the dental problems caused by sugary foods or how to effectively care for teeth. Their beliefs rubbed off on their children who were more likely to hold similar unfavourable beliefs through their teens and into their 20s. They were less likely to regularly brush their teeth or go for regular dental checks.

Associate Professor Broadbent says dentists are often given a hard time by the media, portrayed by some commentators for being "too expensive", but most dental interventions are surgical and involve costly imported dental products, expensive equipment, compliance-related costs, salary for support staff – and a lot of time.

"Innovate public health interventions targeted to reduce inequalities – like a sugary drink tax – and expanded publicly-funded dental care (including preventive care for adults) deserve to be given a chance," Associate Professor Broadbent says.

www.otago.ac.nz/otagomagazine/issue46/opinion/

SJWRI Associate Investigator Dr Carla Meledandri wins 2017 Prime Minister's MacDiarmid Emerging Scientist Prize

Dr Meledandri, from the University of Otago's Department of Chemistry, was presented with her \$200,000 prize by Prime Minister Jacinta Ardern in Wellington on 13 February 2018.



NZ Prime Minister Jacinta Ardern (right) presents the 2017 Prime Minister's MacDiarmid Emerging Scientist Prize to Dr Carla Meledandri, 13 February 2018.



Dr Carla Meledandri and Dr Don Schwass with Dr Alexandra Tickle of Otago Innovation Limited.

A long-time collaborator and Associate Investigator of the Sir John Walsh Research Institute, Dr Meledandri is exploring ways to solve problems using ultra-small materials that look, act, and react differently when they are reduced to the nano-scale.

Early applications of her award-winning science include silver nanoparticles to treat and prevent dental disease, and finding ways to store and use clean energy technologies that have the potential to replace fossil fuels.

Silver nanoparticles developed in her lab are being incorporated into a range of breakthrough products designed to fight tooth decay and infection, through a start-up company she co-founded with Dr Don Schwass from the SJWRI and Faculty of Dentistry, Silventum Limited, and a technology licensing deal with a multinational dental company.

"In all cases with dental decay, the source of the problems is bacteria," she says.

"Our technology treats the bacterial source of the disease, without staining teeth. It's particularly exciting because of the growing problems with resistance to antibiotics, which are the usual treatment for bacterial infections."

"Our nanoparticles have a completely different mechanism that doesn't allow them to become resistant."

She says tooth decay is one of the most prevalent chronic diseases in the world and the products being created through her science offer a new solution. In addition, they have the potential to make dental care more affordable, through the availability of reliable treatments that don't require repeated trips to the dentist.

Also at the cutting edge is the current focus of her fundamental science research, in which she is developing nanomaterials for use in industrial applications such as gas capture and storage, which can potentially assist to mitigate global warming.

Dr Meledandri's entrepreneurial eye and her commitment to partnering fundamental science with applications that solve problems were highlighted by the prize judges as standout strengths.

A meeting with Dr Don Schwass at a speed collaboration session for academics led to a long-time partnership that Dr Meledandri says is pivotal to the success of the dental technologies they have developed.

“Don had run his own practice for 20 years so he was all too familiar with dental diseases and the fact that most current treatments deal with the symptoms not the cause. It was having his practical knowledge feed into the research that has been critical to its success.

“Knowledge of the underlying fundamental science enables us to create things on the applied side and the applied science reveals problems that the fundamental science can solve.

Dr Meledandri, who is also a Principal Investigator for the MacDiarmid Institute for Advanced Materials and Nanotechnology, was joint winner of the Norman F.B. Barry Foundation Emerging Innovator award in 2016.

She credits the spirit of collaboration amongst New Zealanders as central to her success.

“It doesn't exist other places in the same way - the connections, the opportunities to engage with other scientists and being able to establish a start-up company in a supported environment.

“I feel very privileged to be able to work in New Zealand and to have my research group's work recognised in this way.”

The 2017 Prime Minister's Science Prizes, administered by the Royal Society of New Zealand, were presented to winners on 13 February 2018 at the Banquet Hall, Parliament Buildings, Wellington.



Dr Carla Meledandri and Dr Don Schwass gave a joint keynote presentation on their research into dental applications of silver nanoparticles at SJWRI Research Day, September 2014.

More honours and awards for our staff in 2017-18

Dr Dawn Coates was promoted to Research Associate Professor by the University of Otago in December 2017. Following a post-doctoral research position at the University of Cambridge and leading the Bioactive Discovery research group at AgResearch Invermay for a number of years, Dr Coates joined the University of Otago's Faculty of Dentistry as a Senior Research Fellow in 2006. A highly productive researcher and very well regarded supervisor of postgraduate students, Dr Coates' research interests are in stem cell biology and angiogenesis (blood vessel formation) in oral health and disease, with a particular interest in finding treatments for medication-related osteonecrosis of the jaw (MRONJ). Dr Coates was the winner of the SJWRI's premier commendation, the Sir John Walsh Award for Research Excellence, in 2016.

Dr Li Mei was awarded the ANZ IADR Oral Biology Award at the International Association for Dental Research Australia/NZ Divisional meeting in Adelaide, September 2017. At the same meeting, **Dr Kai Chun Li was awarded the ANZ IADR Joan Chong Award in Dental Materials.**

Professor Murray Thomson was awarded the International Association for Dental Research's Robin Heath Award for the most downloaded paper in the journal *Gerodontology* during the previous five years. This award was presented at the 96th General Session of the IADR in London, July 2018.

Dr Carolina Loch was awarded the ANZ IADR Oral Biology Award at the International Association for Dental Research Australia/NZ Divisional meeting in Perth, September 2018.

Dr Gemma Cotton was awarded with the Kiwinet Emerging Innovator award in 2018 to develop her innovations around novel antimicrobial regenerative membranes for dental applications.

SJWRI Research Day 2017



The 2017 SJWRI Research Day, highlighting the research achievements of the University of Otago's Sir John Walsh Research Institute and Faculty of Dentistry, was held on Tuesday 5 September at the Dunedin Public Art Gallery.

In its eleventh year, the Institute's annual celebration of research excellence returned to its traditional single-day duration while retaining the specialised concurrent sessions focusing on each of our SJWRI research programmes, meaning more of our staff and students could present their work to peers, fellow researchers from across the University, industry professionals and dental practitioners.

The meeting opened with keynote presentations from invited speakers Professor Peter Hunter (Auckland Bioengineering Institute and Medical Technologies CoRE, University of Auckland, *pictured left*) and Professor Alan Brook (University of Adelaide and Queen Mary University of London, *facing page*).

Other invited speakers included Professor Stephen Robertson of the Department of Womens' and Childrens' Health and A/Prof Roslyn Kemp of the Department of Microbiology and Immunology.



Keynote speaker Prof Peter Hunter, University of Auckland.

Concurrent sessions in the areas of oral molecular and immunopathology, clinical and translational research, biomaterials, molecular microbiology and craniofacial research highlighted the research of our staff and students.

The meeting closed with a presentation from sponsor representative Stephen Langdon of 3M Oral Care, and a reflective keynote address from Professor Mike Morgan, Head of the Melbourne Dental School, and an Otago Dentistry graduate

Research Day 2017 concluded with presentation of the SJWRI Awards for 2017, and farewell drinks in the ODT Gallery.



DClinDent candidates Frances Ruddiman (left) and Philippa Greer.



Keynote speaker Prof Alan Brook, University of Adelaide and Queen Mary University of London.

2017 Research Day presentation awards

Awards were presented to the best student oral presenter in each of the five session blocks, as well as the best student and staff poster competition entries. Congratulations to the following presentation award winners:

Oral presentation awards

Biomaterials/Molecular Microbiology (combined): Lisa Falland, PhD candidate

Anatomical skin/skull/brain model to measure impact force transfer and displacement upon blunt force impact (L Falland-Cheung, JN Waddell, KC Li, DC Tong, PA Brunton)

Clinical and Translational Research: Assil Russell, DClinDent candidate (Endodontics)

The Butterfly Effect: An investigation of sealer penetration and adaptation in root canals (AA Russell, NP Chandler, LT Friedlander)

Craniofacial Research: Fiona Firth, DClinDent candidate (Orthodontics)

A human periodontal ligament cell mechanical strain culture model for the study of endoplasmic reticulum stress (F Firth, T Milne, B Seo, M Farella)

Dental Epidemiology & Public Health/Paediatric Dentistry (combined): Nina Scott, DClinDent candidate (Endodontics)

Dental trauma in New Zealand adults: a secondary analysis of national survey and ACC data (N Scott, WM Thomson, P Cathro)

Oral Molecular and Immunopathology: Nawal Abdul Rahman, DClinDent candidate (Oral Pathology)

Expression of the Lysyl Oxidase family in odontogenic lesions (NA Rahman, B Seo, H Hussaini, AM Rich)

Poster presentation awards

Student: Ashley The, BOH student, NZDA R.C Tonkin Summer Scholarship recipient

Impacts of space disruptions on a Dental School learning environment (A The, L Adam (presenter), A Meldrum, P Brunton)

Staff: Dr Joanne Jung Eun Choi, Lecturer

Bond strength between modern denture base acrylics and relene materials (J Choi, TE Ng, CK Leong, HS Kim, P Li, W Jansen van Vuuren, N Waddell)



Winners of SJWRI Awards and Research Day Presentation Awards for 2017. Left to right: (back row) Dr KC Li (Staff Research Publication Award), Professor Richard Cannon (SJWRI Director), Prof Warwick Duncan (Sir John Walsh Award), Lisa Falland (Oral Presentation Award/Postgraduate Research Publication Award), Fiona Firth (Oral Presentation Award); (front row) Nawal Abdul Rahman (Oral Presentation Award), Dr Joanne Choi (Undergraduate Research Supervisor Award/Staff Poster Award), Dr Carolina Loch (Strategic Research Prize), Assil Russell (Oral Presentation Award)

SJWRI Research Day 2018

SJWRI Research Day 2018, highlighting the research achievements of the University of Otago's Sir John Walsh Research Institute and Faculty of Dentistry, was held on Thursday 30 August at the Dunedin Public Art Gallery.

In its twelfth year, the Institute's annual celebration of research excellence was structured around the emergent themes of Understanding the Oral Health of New Zealanders, New Technologies and Therapeutics, and Evaluating our Teaching, Learning and Practice.

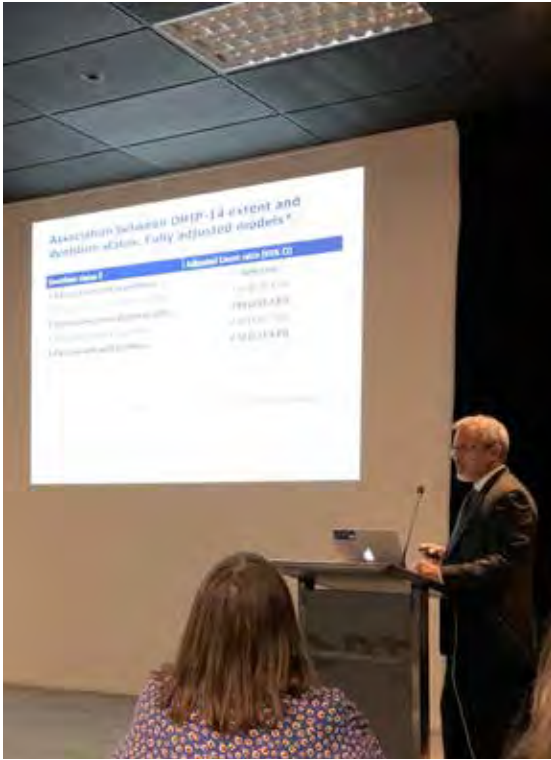
As in previous years, the opening session of Research Day spotlighted one of our areas of research strength as our featured research programme; this year, within the opening theme of Understanding the Oral Health of New Zealanders, our featured programme was Dental Epidemiology and Public Health, led by Professor Murray Thomson.

Our opening keynote was given by invited speaker Professor Marco Peres, Director of ARCPOH (the Australian Research Centre for Population Oral Health) at the Adelaide Dental School, who provided an overview of population-based oral health-related studies conducted in Australia and their relevance for surveillance and hypothesis-driven research.

Our New Technologies and Therapeutics theme was headlined by a keynote presentation from invited speaker Professor Paul Cooper of the University of Birmingham, who is currently a Sir Thomas Sidey Visiting Professor at the Faculty of Dentistry. Professor Cooper's presentation explored his research interests in dental tissue regeneration, identifying modifying factors involved in the ability of the dentine-pulp complex to heal itself and developing novel treatment approaches to facilitate these innate regenerative abilities.

The programme for the day also featured a presentation from Dr Young-Chul Kwon, Asia-Pacific Scientific Affairs & Education Manager for 3M Oral Care, providing an update on dental composites with a focus on clinical relevance. The day concluded with presentation of the SJWRI Awards for 2018, and farewell drinks in the ODT Gallery.





Above: Keynote speaker Prof Marco Peres, University of Adelaide.
 Right: Keynote speaker Prof Paul Cooper, University of Birmingham.
 Below: Poppy Horne (DCLinDent candidate), winner of the best student oral presentation at SJWRI Research Day 2018.



2018 Research Day presentation awards

Presentation awards were made to the best student oral presentations across the day, as well as the best student and staff poster competition entries. Congratulations to:

Student oral presentation awards

First prize: Poppy Horne, DClinDent candidate (Periodontics)

Psychosocial aspects of periodontal disease diagnosis and treatment (PE Horne, LA Foster Page, JW Leichter, WM Thomson, ET Knight)

Second prize: Chuen Lin Hong, PGDipComDent candidate

Personality, dental neglect, and oral health: a longitudinal study (CL Hong, WM Thomson, JM Broadbent)

Third prize: Divya Ramanan, DClinDent candidate (Orthodontics)

Jaw muscle overload as a possible cause of orofacial pain (D Ramanan, S Palla, A Polonowita, M Farella)

Poster presentation awards

Student: Hafizi Mohd Ali, DClinDent candidate

Quality evaluation of dental records and patient satisfaction following periodontal surgery (HM Ali, A Tawse-Smith, J Broadbent, W Duncan)

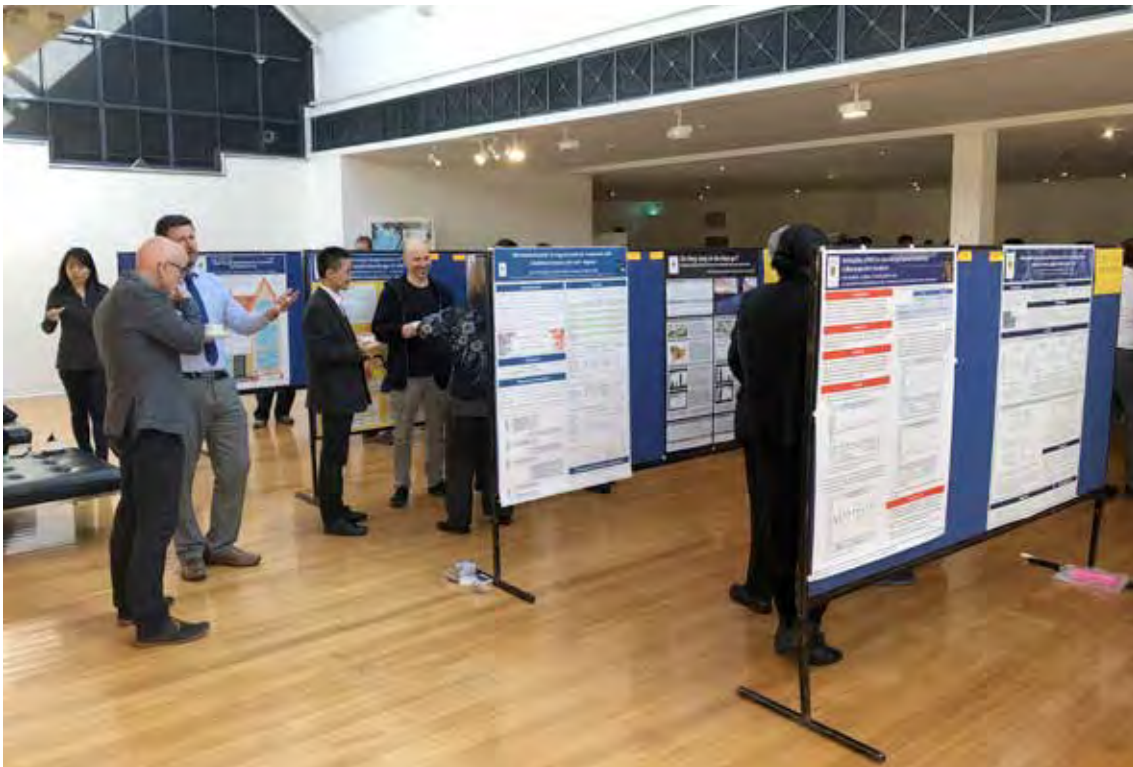
Staff (two awards):

Christina Gee, Assistant Research Fellow

Antimicrobial and cytotoxicity effects of silver nanoparticles on primary human gingival fibroblasts in vitro (C Gee, G Cotton, W Duncan, A Jude, D Abdelmoneim, D Coates)

Dr Jithendra Ratnayake, Assistant Research Fellow

Structural and biological characterization of a xenograft material developed from bovine cancellous bone (J Ratnayake, M Gould, M Mucalo, G Dias)



SJWRI Awards for 2017 and 2018

Congratulations to the recipients of Sir John Walsh Research Institute Awards for 2017 and 2018, which are announced and awarded at the conclusion of SJWRI Research Day each year. These Awards celebrate the research achievements of academic staff and postgraduate students, as well as commending the contribution of general staff to the research successes of the SJWRI and Faculty of Dentistry.

Sir John Walsh Award for Research Excellence

The Sir John Walsh Award, our premier research award, acknowledges excellence in research over an extended period of time by a member of staff of the Faculty of Dentistry. The recipient of our premier research award receives \$5,000 towards professional development.

2017 Sir John Walsh Award winner: Professor Warwick Duncan

Professor Warwick Duncan is the director of the Clinical and Translational Research programme within the SJWRI, as well as leading Implantology research within the Biomechanics and Oral Implantology research programme. Within the Faculty of Dentistry he is Head of Discipline of Periodontology, and in 2015 became the first Otago-qualified periodontist to be promoted to Professor at the University of Otago.



Professor Duncan's primary research interests are in periodontics (the treatment of gum diseases) and implantology (the replacement of missing teeth with dental implants). This work has extended from preliminary trials in animal disease models, to validation

in human clinical trials, and have included the development of new bone replacement grafting materials, new metals and surfaces for osseointegration of oral implants, stem-cell therapy for bone regeneration, novel approaches to the treatment of periodontal and peri-implant diseases, and new technologies for diagnostic imaging of gum and bone around teeth and implants.

Professor Duncan has demonstrated sustained research productivity extending over many years, having published over 40 journal articles over the past five years. He has supervised 40 PhD, DClinDent and Masters research theses, 24 as primary supervisor. He has been principal or named co-researcher on 75 successful grant applications since 1995 with a total value to date of \$4.78 Million, including two recent MBIE grants for >NZ1.0M each. He is a co-applicant on one provisional patent application. He has extensive international research collaborations, and is regularly invited to speak at international conferences.

2018 Sir John Walsh Award winner: Dr Erwin Lamping

Dr Erwin Lamping is a Senior Research Fellow within the Molecular Microbiology research programme of the SJWRI, whose research focuses on the structure and function of eukaryotic membrane proteins, especially integral membrane proteins associated with multidrug resistance of fungal pathogens and human cancer cells. His internationally recognised research sheds light on the evolution of resistance in fungal species and sets to aid researchers in designing new treatment strategies to overcome drug resistance.

Dr Lamping produces high quality research that is reflected in his sustained high impact factor research outputs (in journals such as Antimicrobial Agents and Chemotherapy, Molecular Microbiology and Genetics), invited collaborations and presentations, his status as an expert reviewer in numerous journals, and requested science expertise in media outlets such as The Scientist. In particular, his 2017 publication in Genetics received international attention, and was highlighted by the Genetics Society for America, for discovering valuable new clues in the fight against multi-drug

resistance. His work may aid researchers in designing new ways to overcome drug resistance and may help understand why cancer cells become resistant to multiple drugs, why people react differently to drugs and why some drugs do not work for some people.

As a co- or principal investigator, Dr Lamping has attracted nearly a million dollars in funding, including as co-PI on a major Marsden Fund grant, and as an associative investigator has received \$1,812,600. He has extensive international collaborations facilitated by Dr Lamping's co-inventorship on a patented yeast membrane protein expression system that is used worldwide by over 50 research teams.



Valuable new clues in fight against multi-drug resistance

Research into yeast, the single-celled organism behind a range of human infections, has led to SJWRI researchers identifying a previously unknown piece of genetic sleight-of-hand which may enable multi-drug resistance, a major emerging global health problem.

The research, led by Dr Erwin Lamping and supported by funding from the Royal Society Te Apārangi Marsden Fund, investigated how yeast becomes drug resistant. Through coming to an unexpected understanding of the resistance process, researchers may now be able to design ways to overcome drug resistance in humans.

To explain what they found, Dr Lamping starts with the basic process of gene mutation that organisms use to adapt.

“When a gene mutates and has another function, the original gene function is lost. However, another way organisms adapt is by gene duplication, where they make a second copy of the gene. This has the advantage that if one copy mutates and changes its function, the organism still has the original gene with its original function. This allows organisms to adapt by using almost identical genes to develop a range of different functions or abilities.”

While studying how the yeast behind human infections such as oral and vaginal thrush becomes drug resistant, Dr Lamping and his team found the organism makes a protein which pumps the drug out of the yeast cell.

“We also found, by chance, that there was a very similar gene next door - an example of gene duplication. What we discovered, which has not been found before, was that while large parts of the adjacent genes were identical, six short regions were different and had remained different for over 130 million years. The reason why they had remained different is because they were the regions that allowed the two pumps to pump different drugs.”

“We carefully studied genes from seven yeast strains originating from different parts of the world and found 30 copies of the pump gene, all with the same pattern: they had large regions that were exactly the same and small regions that differed. This shows that this mechanism of evolution is widespread - in the entire yeast population studied,” he says.

“This repetition of almost identical genes, but with different functions, may have gone unnoticed in other organisms including humans.”

This may help understand why cancer cells become resistant to multiple drugs, why people react differently to drugs and why some drugs do not work for some people.

The findings have been published in the journal *Genetics* and was highlighted by the Genetics Society of America in their popular science blog ‘Genes to Genomes’.

genestogenomes.org/the-push-and-pull-evolution-of-tandem-duplicated-drug-resistance-genes/

Research Supervisor Award

Introduced in 2016, this award is to celebrate outstanding research supervisors of postgraduate and undergraduate students within the Faculty of Dentistry. Nominations are made via a survey process, whereby students are asked to anonymously nominate outstanding supervisors, with reasons for their nominations. Attributes such as being supportive, available, interested and enthusiastic, knowledgeable and an expert in their field, a good communicator, and taking prompt, decisive action to resolve issues were listed as being important for excellent supervision.

In both 2017 and 2018, as a result of a very strong field of nominees, the award was split into undergraduate and postgraduate research supervisor awards. The winners of each award received \$1,000 towards professional development.

2017 Postgraduate Research Supervisor Award: Professor Murray Thomson

Professor Murray Thomson is the Head of Department of Oral Sciences and leads the Dental Epidemiology and Public Health Research Programme within the SJWRI. His research interests are in the areas of life-course epidemiology and longitudinal research, periodontal epidemiology and risk factors, gerodontology research, and dental public health and health services research. He is a highly productive researcher, having published 283 papers in the peer-reviewed international scientific literature to date.

Throughout his career, he has supervised to completion 64 postgraduate students, including 10 PhDs, 18 DClindents and 36 Masters graduates, more than half of which have been Masters of Community Dentistry graduates. He has another thirteen current supervisions, including two PhDs, eight DClindents, one MComDent and one Masters of Public Health. Nearly half of Professor Thomson's published output (137 peer-reviewed papers) has been co-authored with his students.

Here are a selection of comments from student nominations:

"extremely helpful and supportive throughout my research journey. He provides the right amount of guidance but lets me problem-solve and take initiative."

"Even though he has so many other responsibilities, he has always made time for me."

"an inspiring supervisor... not only have I benefited from his considerable knowledge; his organisation and timely feedback meant I was able to proceed smoothly with my research."



2017 Undergraduate Research Supervisor Award: Dr Joanne Choi

Dr Choi was recently appointed as a Lecturer within the Department of Oral Rehabilitation, having completed a PhD within the SJWRI under the supervision of A/Prof Neil Waddell, Prof Mauro Farella, Prof Karl Lyons and the late Prof Jules Kieser. Her research interests are in dental materials, craniofacial biology and clinical oral physiology, carrying out qualitative and quantitative analysis of the mechanical properties and failure mechanisms of restorative dental systems. She also has research interests in investigating the physiology of the oral environment using portable measurement systems; for her PhD, Joanne developed and validated a wired sensor system to monitor intraoral pH and temperature for long-term periods, the results of which can be used in identifying and evaluating causal factors involved with dental wear.

Dr Choi supervises undergraduate student research in the Dental Technology programme, primarily dental technology final year students within the biomaterials research paper DTEC301. She typically serves as primary supervisor for a group of 4 students as the primary supervisor every year, as well as acting as co-supervisor or advisor for other student groups. She is also involved in supervising BDS honours and elective projects.

Here are a selection of comments from student nominations:

"Joanne carries a truly genuine desire to see her students excel. She is not only passionate about research but most importantly in providing students with the most encouraging environment that builds students' interest in the topic. I particularly felt extremely encouraged to further my develop in research [from] Joanne's supervision."

"the most supportive, kind and helpful supervisor. Joanne has made me interested in research through her teaching. She gave me enough freedom to do my own research while still helping where appropriate."



Dr Joanne Choi (left), with A/Prof Neil Waddell and 2018 summer student Helene Chua.

2018 Postgraduate Research Supervisor Award: Dr Lara Friedlander

Dr Lara Friedlander, a Senior Lecturer in the Department of Oral Rehabilitation, is a specialist endodontist with research in the areas of pulp development and disease, practice-based research, dental education and immunopathology. She is Deputy Director of the Oral Molecular and Immunopathology research programme of the Sir John Walsh Research Institute.

Dr Friedlander has developed research themes in pulpal biology, regeneration and angiogenesis; and separate from this is also active in research related to Endodontic curriculum development and teaching. Results of her PhD research around pulp biology and angiogenesis associated with immature permanent teeth have been presented at international conferences and published in internationally peer-reviewed journals. This work has influenced clinical practice by providing further knowledge about pulp cell behaviour and healing following dental trauma.

Dr Friedlander is a co-supervisor of doctoral (DClinDent and PhD) students, and has had substantial competitive grant applications associated with these. Lara assists in advising on projects and funding applications including PhD pulp research which has evolved from her own research theme. She enjoys engaging with general dentists in practice-based research and is a member of the New Zealand Dental Research Foundation Board.



Dr Lara Friedlander (left) with student Payman Hamadani (DClinDent candidate in Endodontics).

Here are a selection of comments from postgraduate student nominations:

"Lara has organised our research team and worked tirelessly in getting us organised... I am very fortunate to have a supervisor with her knowledge and expertise. She is extremely well organised and sets the bar high with her leadership."

"Lara always has time to discuss my thesis. We have multiple dentists involved in collecting data and she is very helpful in following up the progress of the practitioners with me."

"She is very supportive of me and believes always I can do the work. She encourages me and teaches me the correct way in everything."

2018 Undergraduate Research Supervisor Award: Dr Sunyoung Ma

Dr Sunyoung Ma is a Senior Lecturer in the Department of Rehabilitation, specialising in prosthodontics. After completing her Doctor of Clinical Dentistry thesis titled 'Marginal bone loss around two implants supporting mandibular overdentures', Dr Ma continues to work with the Oral Implantology Research Group collecting the long-term prospective data.

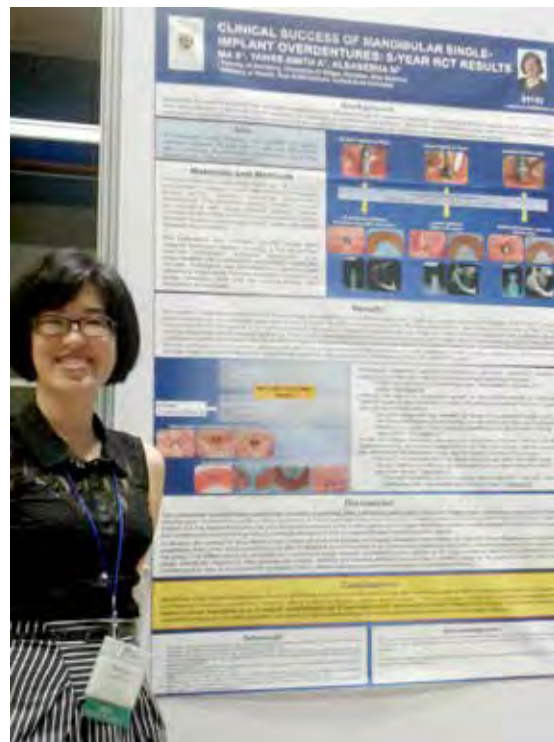
Her main focus of research lies on alveolar ridge resorption associated with implant prostheses, long-term implant success and prosthodontic maintenance issues. Dr Ma supervises undergraduate student research projects within the final-year BDS and BDS Honours programmes.

Here are a selection of comments from student nominations:

"Dr Sunyoung Ma is an absolutely fantastic supervisor and I cannot recommend her enough for this award. She is always available to her students whether it be 4.45pm on a weekday or even in a research emergency on a weekend... Her expectations of me as a research student are always clear and this can be attributed to her excellent communication skills... Dr Ma has stimulated my interest in dental research and also prosthodontics and I am both a better clinician and researcher all for her teaching. I consider myself privileged to have had the honour to work under Dr Sunyoung Ma."

"Very flexible and understanding and expresses a genuine interest in the research. Always puts the time and effort into helping and supporting us."

"Dr Ma is not only a fantastic supervisor but also a caring and supportive mentor. She constantly encourages her students to do their best and looks for opportunities to help them shine."



Dr Sunyoung Ma presenting her research at the 94th IADR General Session in Seoul, South Korea, June 2016.

Strategic Research Prize

This award is to acknowledge and promote new research within the Faculty of Dentistry, by supporting a research development initiative by a member of staff or postgraduate student that could make a contribution to the strategic direction of research within the Institute. The recipient is awarded \$5,000 in seed funding to support their proposed research project.

2017 Strategic Research Prize recipient: Dr Carolina Loch

Dr Loch was awarded the 2017 Strategic Research Prize for her project 'Reading between the lines: on the biorhythms of enamel deposition'. Tooth enamel covers mammalian tooth crowns and is the hardest and most durable substance in the body. Enamel neither remodels nor repairs, and its microstructure preserves vital information on how we develop and grow. When enamel is analysed through light microscopy, cross-striations and lines are evident. These lines, called Retzius lines, relate to growth rhythms in the secretory activity of ameloblasts and reflect biorhythms in the human body. Biorhythms are cyclic changes in an organism's growth or function that are driven by an internal biological 'clock' and synchronized through environmental cues. The periodicity of Retzius lines (RP) varies amongst human populations and between mammalian species. It has been hypothesized that the biorhythm underlying RP regulates the rate of bone growth and adult body mass via metabolism. The causes of this large variation in RP may relate to metabolic rates, growth rates or differences in body size; larger mammalian species tend to have slower RPs, slower metabolisms and extended growth periods relative to smaller bodied species. New Zealand has a demographically diverse population of European, Māori, Asian and Pasifika ancestry, with marked differences in growth rates, dental development and body mass, diet, health status and risk factors. Dr Loch's Strategic Research Prize research investigates whether the periodicity of Retzius lines in teeth is associated with height, weight, sex and self-reported ethnicity. This approach will provide a novel comparative framework for palaeontologists and anthropologists as they search for the origins of mammal growth trajectories in the fossil record. This study will be of wide interest to researchers in human biology, forensics and palaeoanthropology.



Dr Carolina Loch.



A/Prof Dawn Coates (left) with collaborators Prof Warwick Duncan and Dr Trudy Milne.

2018 Strategic Research Prize recipient: Associate Professor Dawn Coates

This project aims to establish a new strategic direction for research within the Sir John Walsh Research Institute through collaboration with A/Prof Tim Woodfield's Christchurch Regenerative Medicine and Tissue Engineering (CReaTE) Group within the Centre for Bioengineering & Nanomedicine at the University of Otago, Christchurch. This initiative develops and merges two current key competencies - our significant existing experience in the isolation and clinical application of dental pulp stem cells, and the development of 3D bio-printing for tissue engineering, which is an established strength of the CReaTE Group. They have a strong research program utilising 3D bio-printing and their considerable expertise

in the handling and crosslinking of hydrogels, suitable for in vivo application, is invaluable. By tailoring the components of the gels, crosslinking, gel density and cell seeding density we aim to generate in vivo degradable scaffolds, containing dental stem cells. These scaffolds/stem cells can then be placed into tooth models of regeneration and repair, as well as being used to form bone in conjunction with dental implants.

A/Prof Coates' Strategic Research Prize will support a two-way information exchange through travel for students and staff between Christchurch and Dunedin to consolidate this collaboration and to transfer skills in the optimisation of the complex delivery systems and share our expertise in stem cell growth and differentiation.

Research Publication Award

This award is to recognise excellence in research by acknowledging the research calibre and effort required to publish in high impact journals in science and dentistry. To be eligible, the manuscript must have been accepted for publication between 1 January and 31 December of the preceding year. The recipient receives \$1,000 towards professional development.

2017 winner: Dr Kai Chun Li

Dr KC Li is a Lecturer in Biomaterials Science in the Department of Oral Rehabilitation. His paper, "Porcelain bonding to novel Co-Cr alloys: Influence of interfacial reactions on phase stability, plasticity and adhesion" was published in the December 2016 edition of *Dental Materials*.

The objective of the study was to determine the hardness and adhesion strength at the porcelain to alloy interface of novel cobalt-chromium (Co-Cr) dental alloy restorations.

The adhesion of the alloy to porcelain was found to be inversely related to the hardness of the interfacial layer at the alloy surface. Lower interfacial hardness was found to be accompanied with higher adhesion energy due to the additional plastic energy consumed during crack propagation along the more ductile interface region of the alloy.

Dr Li was a major contributor in all aspects of the study ranging from manufacturing, testing and data analysis of the specimens to writing the publication as the corresponding and first author.

The study was submitted to *Dental Materials* on the 26th November 2015 and accepted on the 3rd September 2016. *Dental Materials* is a renowned journal in dental materials research, has a 5-year Impact Factor of 5.155 and is in the top 3 journals within its discipline.

Li, K. C., Tran, L. Y., Prior, D. J., Waddell, J. N., & Swain, M. V. (2016). Porcelain bonding to novel Co-Cr alloys: Influence of interfacial reactions on phase stability, plasticity and adhesion. *Dental Materials*, 32(12), 1504-1512. doi: 10.1016/j.dental.2016.09.008

2018 winner: Dr Susan Moffat

Dr Susan Moffat (below) is a Senior Lecturer in the Department of Oral Sciences, Susan Moffat's field of research includes dental public health, dental therapy history, and the dental therapy and oral health workforce.

Dental therapy is an academic discipline which has until recently had little research tradition of its own, having relied traditionally on work undertaken in the disciplines of paediatric dentistry and dental public health. In that respect, Susan is one of the pioneers in dental therapy research, with her work laying some of the groundwork for an ongoing research foundation for the discipline.



Susan's award-winning publication, in *Frontiers in Public Health*, explores the history and impact on oral health inequalities of New Zealand's School Dental Service, through its establishment, expansion, decline and eventual replacement by the Community Oral Health Service in 2006.

Moffat SM, Foster Page LA, Thomson WM. New Zealand's School Dental Service over the decades: Its response to social, political, and economic change, and the effect on oral health inequalities. *Frontiers in Public Health* 5:177 (2017)

Postgraduate Research Publication Award

This award is to recognise excellence in postgraduate student research by acknowledging the research calibre and effort required to publish in high impact journals in science and dentistry. The publication must have been accepted between 1 January and 31 December 2016, and have been written by a Masters or Doctoral research student. The recipient receives \$500.

2017 winner: Lisa Falland

SJWRI PhD graduate Lisa Falland undertook her PhD research within the Biomechanics and Oral Implantology research programme of the SJWRI under the supervision of Professor Paul Brunton, A/Prof Neil Waddell and Prof Darryl Tong.

Her paper, titled "Investigation of the elastic modulus, tensile and flexural strength of five skull simulant materials for impact testing of a forensic skin/skull/brain model", investigated different simulant materials (agar/glycerol and agar/glycerol/water) for use as a translucent brain simulant for ballistic testing.

This is of interest as access to human and animal brain tissue to model ballistic or head impact experiments is problematic, imaging of cavity formation and internal wounding mechanisms in ballistic studies is difficult due to the opacity of brain tissue, and existing simulants are of limited suitability as a brain simulant for ballistic studies.

Lisa's study looked at agar/glycerol and agar/glycerol water under a variety of conditions in comparison to fresh deer brain. Of the simulants tested, agar/glycerol/water was determined to be the most suitable brain simulant.

This is the first time that a suitable translucent brain simulant with brain-like properties has been developed and is a significant contribution to the study of ballistic injury and blood/tissue back spatter using high speed imaging. In addition, this simulant brain material can be used for physical modelling impact studies.

As lead investigator and primary author, Lisa prepared the specimens, carried out the experiments, analysed the data and wrote the manuscript, with the assistance of her co-authors.

This study was accepted for publication in September 2016 in the *Journal of Mechanical Behavior of Biomedical Materials*, which has an Impact Factor of 3.110 (5-year impact factor of 3.544) and is ranked as the #20/77 in the category Engineering, Biomedical Journals.

Falland-Cheung, L., Waddell, J. N., Li, K. C., Tong, D., & Brunton, P. (2017). Investigation of the elastic modulus, tensile and flexural strength of five skull simulant materials for impact testing of a forensic skin/skull/brain model. *Journal of the Mechanical Behavior of Biomedical Materials*, 68, 303-307. doi: 10.1016/j.jmbbm.2017.02.023.



2018 winner: Azza Al-Ani

The 2018 winner of our Postgraduate Research Publication Award, DClintDent graduate Azza Al-Ani, conducted her DClintDent research within the Craniofacial Research programme of the SJWRI, which is led by Professor Mauro Farella.

Her published study showed for the very first time an association between maternal smoking and offspring with hypodontia (congenitally missing teeth). When odds ratios were adjusted for possible confounders, if the mother smoked ten or more cigarettes each day during pregnancy, there was more than four times the risk (odds) that the child would have hypodontia.

The article has already had great impact, reported by media around the world. The *Journal of Dental Research* is considered the premier dental journal, with a 2017 Impact Factor of 5.380 (JCR). The journal is ranked second out of 90 journals in Dentistry, Oral Surgery & Medicine.

Al-Ani AH, Antoun JS, Thomson WM, Merriman TR, Farella M. Maternal smoking during pregnancy is associated with offspring hypodontia. *Journal of Dental Research* 96:1014-1019 (2017).



Dr Azza Al-Ani (second from left) with study co-authors Dr Joseph Antoun, Prof Mauro Farella and Prof Murray Thomson.

Mothers who smoke more likely to have babies with teeth abnormalities

Women who smoke more than 10 cigarettes a day during pregnancy are much more likely to give birth to babies who will fail to grow all their teeth, new SJWRI research has found.

The condition, known as hypodontia, commonly involves children failing to develop up to six permanent teeth, which are usually lateral incisors and premolars.

The Otago study, published in the *Journal of Dental Research*, investigated 83 children with the condition and compared them with 253 children without hypodontia.

Their mothers were asked to report active and passive smoking exposure, as well as alcohol and caffeine consumption during pregnancy.

Study lead author Professor Mauro Farella of the Faculty of Dentistry says that the research team controlled for other factors such as the mother's age when the child was born, its sex, whether there was a full-term delivery or not, and socio-economic status.

"We found no significant associations between drinking alcohol or caffeinated drinks and hypodontia, but there was a suggestion of a 'biological gradient' effect with tobacco - the more cigarettes a mother reported smoking during pregnancy, the greater the likelihood was of her child having hypodontia."

"Though more research is needed to confirm the association we found between maternal smoking and the condition, a plausible explanation is that smoking causes direct damage to neural crest cells in developing embryos," Professor Farella says.

Professor Farella says a large body of evidence exists regarding the many damaging effects that smoking has during pregnancy. These include other dentofacial defects, such as cleft lip and cleft palate.

"This latest research further reinforces the importance of women seeking support to quit smoking when they are pregnant."

The work was supported by grants from the Health Research Council of New Zealand and the New Zealand Dental Research Foundation, as well as a Fuller Scholarship grant from the SJWRI.

Research funding successes

SJWRI oral health research supported by the NZ Dental Association and Ministry of Health

The New Zealand Dental Association and Ministry of Health (MoH) are key supporters of our cutting-edge dental and oral health research, through the NZ Dental Research Foundation (NZDRF) and MoH Oral Health Research Fund grant rounds. Funding from these grants supports the research of our academic and research staff as well as training of our postgraduate students.

In 2017-18, a total of \$239,500 in funding was awarded from the NZ Dental Research Foundation for projects led by our staff, PhD and DClinDent students. SJWRI researchers were also principal or key named investigators on projects awarded \$164,439 in targeted Ministry of Health Oral Health Research funding. As always, we thank the NZ Dental Association and the Ministry of Health for their continued support of our research.

New Zealand Dental Research Foundation

Established in 1964, the NZ Dental Research Foundation awards grants for research projects related to dentistry. Its overall purpose is to “promote, foster and extend the study and practice of the art and science of dentistry in New Zealand”. Since its inception, the Foundation has provided financial support for decades of dental and oral health research projects within the Dental School and the SJWRI, to help extend the boundaries of dental knowledge and to promote the fostering and extension of the study and practice of the art and science of dentistry in New Zealand. The Research Foundation is funded by donations from dental practitioners, the dental supply industry and other businesses, as well as profits from the annual NZDA Conference and other fundraising activities. The SJWRI and the Faculty are hugely grateful for the role and contribution of the in supporting our research over the past five decades, in the process helping many of our Masters, PhD and specialising dental postgraduate students complete their studies.

In the 2017 NZDRF grant round, SJWRI researchers led projects awarded a total of \$106,068 in funding, including \$4,100 from the International College of Dentists and \$9,700 from the Continuing Dental Education Trust of Auckland.

| Lead investigator | Other named investigators | Project title | Awarded |
|-------------------|---|---|----------------|
| Dr Joseph Antoun | Ana Low, Dr Li (Peter) Mei, A/Prof Geoffrey Tompkins, Prof Mauro Farella | Effects of different adhesive removal methods on bacterial colonization on in vivo orthodontic bracket model | \$11,965 |
| Deepak Chellappa | Dr Peter Cathro, A/Prof Geoffrey Tompkins | Comparing the antimicrobial efficacy of contemporary irrigation techniques in curved root canals | \$3,500 |
| Harsha De Silva | Dr Haizal Hussaini, Prof Alison Rich | Role of <i>Candida albicans</i> in oral carcinogenesis | \$9,589 |
| Philippa Greer | Dr Dawn Coates, Dr Benedict Seo, Dr Haizal Hussaini, Prof Alison Rich | The regulation of galectin-1 and implications for epithelial-mesenchymal transitioning in oral squamous cell carcinoma | \$14,584 |
| Poppy Horne | A/Prof Lyndie L Foster Page, Prof Jonathan Leichter, Prof Murray Thomson, Dr Ellie Knight | Psychosocial aspects of periodontal disease diagnosis and treatment | \$4,100 (ICD) |
| Dr Erwin Lamping | Prof Richard Cannon | NanoBRET - a novel and versatile protein reporter technology for oral health research | \$5,696 |
| Adelyn Lau | Prof Darryl Tong, Prof Murray Thomson, A/Prof Rohana De Silva, Harsha De Silva | The use of dexamethasone in the reduction of post-operative outcomes after wisdom teeth surgery. A comparison of two routes of administration | \$9,700 (CDET) |
| Dr Li (Peter) Mei | Prof Richard Cannon, Prof Mauro Farella | Management of biofilm formation with Air-Flow in patients with fixed orthodontic appliances | \$5,512 |

| Lead investigator | Other named investigators | Project title | Awarded |
|---------------------------|---|---|----------|
| <i>Sabarinath Prasad</i> | Prof Mauro Farella, A/Prof Michael Paulin (UO Zoology), Prof Sandro Palla (U Zurich) | Validation of a wireless device to access EMG activity in freely moving subjects | \$5,380 |
| <i>Amira Salem</i> | A/Prof Geoffrey Tompkins, Dr Peter Cathro | Novel therapeutic targets for endodontic infections | \$14,900 |
| <i>Oripa Waqa</i> | Dr Benedict Seo, Dr Haizal Hussaini, A/Prof Rohana De Silva, Prof Darryl Tong, Prof Alison Rich | BRAF mutations in ameloblastoma: Correlation with clinical and histopathological features and behaviour | \$7,600 |
| <i>Elizabeth Williams</i> | Dr Dawn Coates, Dr Benedict Seo, Dr Haizal Hussaini, Prof Alison Rich | Human papillomavirus in oral verrucal-papillary lesions: detection by polymerase chain reaction | \$13,542 |

Named investigators are from the SJWRI/Faculty of Dentistry, University of Otago unless otherwise noted.

Italicized names are doctoral research (PhD/DClinDent) candidates.

ICD: International College of Dentists Award.

CDET: Continuing Dental Education Trust (Auckland) Award.

In the 2018 NZDRF grant round, projects led by SJWRI researchers were awarded a total of \$133,432 in funding, including \$4,100 from the International College of Dentists and \$11,654 from the Continuing Dental Education Trust of Auckland.

| Lead investigator | Other named investigators | Project title | Awarded |
|------------------------------|--|--|--------------------------------|
| <i>Mohammad Arshad Aziz</i> | Dr Benedict Seo, Dr Haizal Hussaini, A/Prof Marilyn Hibma (UO Pathology), Prof Alison Rich | Analysing heat shock proteins and mRNA of specific oncogenes within exosomes derived from oral cancers | \$15,000 |
| Dr Manikandan Ekambaram | Prof Cynthia KY Yiu (UHongKong), A/Prof Neil Waddell, Dr Kai Chun Li, Sam Lowrey (UO Physics), Dorothy Boyd, Yu-Lynn Lee | Bonding universal dental adhesive resin to developmentally hypomineralized enamel | \$14,970 (\$4,100 from ICD) |
| <i>Rachel Farrar</i> | Prof Mauro Farella, Prof Warwick Duncan, Dr Joseph Antoun, Prof Birte Melsen (UAarhus) | Development of an ovine model for investigating effects of orthodontic tooth movement | \$15,000 |
| Dr Lara Friedlander | <i>Shaikha Al Samahi</i> , Dr Trudy Milne, Dr Haizal Hussaini, Prof Alison Rich | Type 2 diabetes - how do human dental pulp cells respond to glucose and lipopolysaccharides? | \$14,890 |
| <i>Danielle Hodgkinson</i> | Prof Mauro Farella, Dr Joseph Antoun, Dr Li Mei, Dr Austin Kang | Do orthodontic extractions ruin faces? | \$11,654 (CDET) |
| Dr Haizal Hussaini | Dr Harsha de Silva, <i>Sajith Edirisinghe</i> , Dr Trudy Milne, Prof Alison Rich | Expression of vascular endothelial growth factor and associated pathways in oral squamous cell carcinoma | \$14,496 |
| Ludwig Jansen van Vuuren | Prof Warwick Duncan, A/Prof Neil Waddell, A/Prof Jonathan Broadbent | Development of a simulant model for clinically relevant testing of implant- and natural tooth-supported all-ceramic restorations [Phase Two] | \$10,000 |
| Dr Hee Ji Lee | Prof Richard Cannon, A/Prof Brian Monk | Automated pipetting system for oral health and dental research | \$15,000 |
| <i>Saeideh Nobakht</i> | A/Prof Dawn Coates, Prof Warwick Duncan, Dr Trudy Milne | Pleiotrophin family gene and protein expression in a sheep tooth socket model of bone healing | \$14,255 |
| <i>Nurul Izyan Zainuddin</i> | Dr Haizal Hussaini, Dr Benedict Seo, Prof Alison Rich | Neuropilin-1 expression in the tumour microenvironment of oral squamous cell carcinoma | \$8,167 |



Prof Warwick Duncan, Prof Mauro Farella, Dr Joseph Antoun and Rachel Farrar.



Sajith Edirisinghe and Dr Haizal Hussaini.

Ministry of Health Oral Health Research Grants

In 2007, the NZ Ministry of Health established a funding programme for oral health research, managed by the NZDA and its Research Foundation, to fund research targeted towards the oral health priorities of the Ministry. Priority is given to oral health research that targets children and adolescents; people of all ages with physical, intellectual, behavioural, or cognitive disabilities, or who are medically compromised; people experiencing inequalities of outcome (e.g. Maori, Pacific and low-income populations); maternal oral health; older adults; and research focusing on promoting oral health, building links with primary care and building the oral health workforce.

In the 2017 MoH Oral Health Research round, SJWRI researchers were named investigators on awards totalling \$68,697.

| Lead investigator | Other named investigators | Project title | Awarded |
|---|---|--|----------|
| A/Prof Sheila Skeaff (UO Human Nutrition) | Prof Bernadette Drummond | To determine the actual fluoride intakes of New Zealand children living in fluoridated and non-fluoridated areas of the lower South Island | \$14,698 |
| Dr Moira Smith (UOW Public Health) | Prof Murray Thomson | Public-sector oral health service provision for high needs and vulnerable New Zealanders | \$44,029 |
| Nurulhuda Thiyahuddin | Prof Richard Cannon, Dr Erwin Lamping, Prof Alison Rich | Candida species and strains in the oral cavity of the elderly: a comparison between people in home-based care and in an aged care facility | \$9,970 |

In the 2018 MoH Oral Health Research round, SJWRI researchers were named investigators on awards totalling \$95,742. Of this, \$53,093 was awarded to projects led by SJWRI investigators.

| Lead investigator | Other named investigators | Project title | Awarded |
|------------------------------------|--|--|----------|
| Dr Lara Friedlander | Payman Hamadani, Prof Nick Chandler, A/Prof Ben Daniel (HEDC) | Managing elderly patients requiring endodontic treatment - a New Zealand practice based research study | \$9,463 |
| Dr Lee Smith | Prof Murray Thomson, Dr Moira Smith (UOW Public Health) | The barriers to, and facilitators for, maintaining oral health and hygiene amongst a cohort of 40 dentate older home-based residing people who require additional living support | \$43,630 |
| Dr Moira Smith (UOW Public Health) | William Leung (UOW Public Health), Prof Murray Thomson, Dr Graeme Ting | Estimating unmet dental need and associated resource utilisation costs, and exploring treatment funding options, for dependent older New Zealanders | \$42,649 |

Lottery Health Research grants support SJWRI research projects and equipment purchases

Congratulations to Professor Paul Brunton and Dr Joanne Choi, who each led successful funding applications to the Lottery Health Research grant round awarded in March 2018.

Prof Brunton's funding is for a new research project involving a novel approach to treating root caries in the elderly using chlorhexidine-modified glass ionomer cements. The proposal, also involving Prof Karl Lyons, Dr Carolina Loch, Dr Nick Heng, Prof Richard Cannon, Dr Jithendra Ratnayake and Hassan Mohammed Ahmed, was awarded \$46,482. Here is a summary of their research project:

We want to investigate the clinical effectiveness of a new treatment for root caries in elderly patients using a noninvasive technique (atraumatic restorative technique, or ART). We will recruit 34 patients from the Faculty of Dentistry clinics. Root surface caries lesions will be restored with conventional glass ionomer cement (GIC) and modified GIC with chlorhexidine. Microbial analysis will be undertaken on samples of whole unstimulated saliva and dental plaque from the supragingival margins and interproximal region of the carious teeth connected prior to the ART application and after one-, three- and six-months. Microbial analysis will evaluate whether modified GIC with chlorhexidine would significantly increase the antimicrobial properties in comparison to conventional GIC during the investigated time period.

Dr Choi's funding (\$120,000) will support the purchase of a Neoplus UFW200 Universal multi-function wear test system to carry out novel, in-depth research on dental wear. The equipment will also support multi-disciplinary projects in the SJWRI and across the University of Otago. Named investigators include Dr Loch, A/Prof Neil Waddell and Prof Warwick Duncan.

Like all our other body parts, our teeth are exposed to a complex, changing environment. They are constantly exposed to forces (chewing food and clenching/grinding of teeth), temperature (hot/cold drinks) and pH (acidic soft drinks), leading to tooth wear. As dental wear affects the aesthetics, function and longevity of our teeth, particularly given our ageing population, this issue is of great importance to New Zealand health. To understand complex dental wear mechanisms such as attrition, abrasion and erosion, a modern wear-testing system is needed. We are applying for an equipment grant to purchase a universal, multi-purpose wear-testing system to conduct novel, in-depth research on dental wear. This equipment will be invaluable for dental research and will be shared with other research groups conducting multidisciplinary projects in anatomy, material science, geology and engineering.

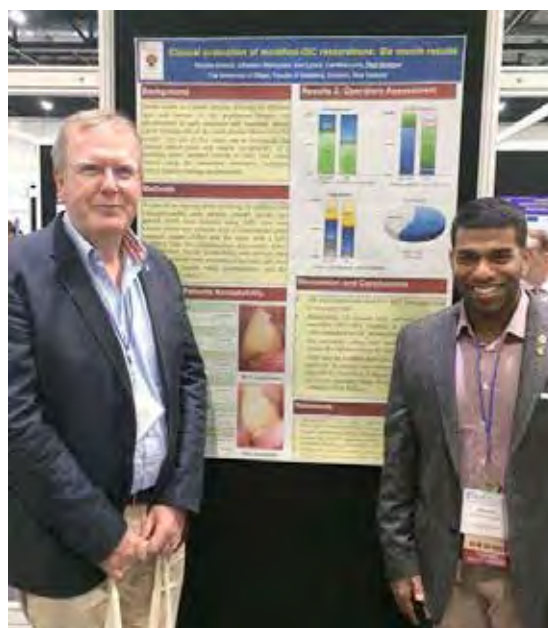
Dentistry Dean appointed PVC of Health Sciences

Dean of the Faculty of Dentistry, Professor Paul Brunton, was appointed Pro-Vice-Chancellor of the Division of Health Sciences in June 2018.

He replaced Professor Peter Crampton, who stepped after 7½ years as PVC Health Sciences and Dean of the Medical School.

Prof Brunton became Dean of Dentistry in 2015. Since arriving from the UK, he has overseen the rebuilding of the dental school facilities.

"I relish a new challenge and it is a privilege to lead the division through what I believe is going to be a period of unprecedented change with significant infrastructure projects being developed alongside a new hospital planned for Dunedin," Prof Brunton said on his appointment.



Prof Paul Brunton and co-investigator Dr Jithendra Ratnayake at the 96th IADR General Session in London, July 2018.

International Team for Implantology supports new implant research at SJWRI



Our congratulations to the SJWRI's Dr Momen Atieh, who in December 2017 was awarded AUD \$220,000 from the International Team for Implantology for his project "Titanium-zirconium narrow (3.3 mm) versus standard (4.1 mm) diameter dental implants for replacing single posterior missing teeth: a randomized controlled trial".

Numerous clinical studies have previously reported high success rates of narrow-diameter implants, but with limited data on patient outcomes and the need for additional bone augmentation. The use of narrow-diameter implants can minimise the need for bone regenerative procedures, promote early bone formation, and improve the primary stability of the implant. This will provide a cost-effective treatment approach that will likely limit unnecessary discomfort, cost, clinical time, and increase both the patients' and clinicians' acceptance.

The aim of Dr Atieh's research is to evaluate the clinical outcomes and success rates of narrow- versus standard-diameter single implants placed and loaded to replace single missing teeth at sites with limited availability of bone volume.

The ITI is a global association of professionals in implant dentistry, headquartered in Switzerland. The objectives of the ITI are the promotion and dissemination of knowledge about implant dentistry and related fields, and to support and facilitate cutting edge research in this field. Dr Atieh's award was the first time an Otago researcher had been funded by ITI.

In May 2018, the ITI approved the Fellowship nomination of Dr Momen Atieh. Fellows are regarded as the 'leaders' of the ITI and attend the Annual General Meetings, which are exclusive to Fellows. They also contribute to discussions on matters that affect the ITI and have the right to vote on decisions of the organisation.

Unprecedented success for our early-career staff in University of Otago Research Grant rounds

Academic staff from the SJWRI and Faculty of Dentistry achieved unprecedented success in the University of Otago Research Grant (UORG) rounds run in 2017 and 2018.

In the most recent round, awarded October 2018 for grants beginning in 2019, UORG applications from the SJWRI were funded at an unprecedented 85% success rate, with the majority of awards made to new and early-career academic staff.

2019 University of Otago Research Grants awarded to SJWRI/Dentistry staff, Oct 2018

Dr Kai Chun (KC) Li was awarded \$57,000 for his grant proposal *Development of 3D-printed crowns to enable non-invasive treatment of dental caries in primary teeth*.

Dr Joanne Choi was awarded \$44,900 for *Investigation of pressure distribution in edentulous patients: Development and validation of simulation systems*.

Dr Graeme Ting was awarded \$44,208 for *Oral health knowledge and attitudes of carers of home-based dependent older people*.

Dr Carolina Loch was awarded \$25,931 for *Dolphin teeth as a biomonitoring tool of heavy metal exposure*.

Dr Peter Cathro was awarded \$11,490 for *Development of a novel bone graft material from waste bovine teeth for dental surgery applications*.

Dr Manikandan (Mani) Ekambaram was awarded \$8,060 for *Family functioning and oral-health-related quality of life among children following dental treatment under general anaesthesia*.

2018 University of Otago Research Grants awarded to SJWRI/Dentistry staff, Oct 2017

Prof Murray Thomson was awarded \$15,000 for *Public-sector oral health service provision for high needs and vulnerable New Zealanders*.

Dr Kai Chun (KC) Li was awarded \$36,680 for *Developing a simulant skull model with accurate mechanical properties using 3D-printed polymers*.

Dr Joanne Choi was awarded \$23,000 for *Development of tooth-coloured shell crowns to treat dental caries in children*.

Student awards and achievements

Postgraduate research students shine in SJWRI and Otago Three Minute Thesis competitions

The 2017 edition of SJWRI 3MT, our three-minute thesis competition for postgraduate research students, was held on 28 June in the Hunter Centre.

SJWRI 3MT challenges our students to present their research in an engaging manner, able to be understood by a general audience with no background in the research area. This competition develops our postgraduate students' research communication skills, as well as giving them the chance to tell us a little more about their project.

As in previous years, SJWRI 3MT entrants were required to present for no longer than three minutes on the topic of their thesis, describing the research, and communicating the significance of the work.

Presentations were judged on the following criteria:

1. Communication style

Was the thesis topic and its significance communicated in language appropriate to an intelligent but non-specialist audience?

2. Comprehension

Did the presentation help the audience understand the research?

3. Engagement

Did the oration make the audience want to know more?

This year's competition saw a broad range of presentations from PhD, DClindent and Masters students on topics ranging right across the spectrum of SJWRI research, from public health to molecular microbiology. All presentations were of an excellent standard and communicated their subject matter well.

This year's winner of first prize was first-year PhD student Sabarinath Prasad, of the Craniofacial Research programme, for his presentation 'The S.M.A.R.T. Study'. Sabarinath's project involves developing wireless devices to measure muscle activity in real time via surface electromyography.

The runner up was Yasmeen Ruma, who had recently commenced her PhD in the Molecular Microbiology research programme, with her presentation 'Structure-directed antifungal drug discovery'.

Congratulations to our winners, and to all who entered. Our thanks to 3MT judges Claire Gallop, Dr Diana Rothstein and Prof Richard Cannon.



2017 SJWRI 3MT winner Sabarinath Prasad with SJWRI Director Professor Richard Cannon.



2017 SJWRI 3MT runner-up Yasmeen Ruma receiving feedback from judge Claire Gallop.

Sabarinath went on to represent the SJWRI and Faculty of Dentistry in the University of Otago 3MT, along with Faculty of Dentistry lecturer Deanna Beckett who competed in the Masters section of the competition.

The Otago 3MT is a competition in which the SJWRI has a very strong history; in 2015, SJWRI PhD graduate Jenny McDowell won the Otago 3MT overall, and went on to perform strongly in the Trans-Tasman final.

On 20 July, Sabarinath Prasad and Deanna Beckett won the Doctoral and Masters heats of the Divisional round of the Otago 3MT, defeating very strong fields of postgraduate students from across the Dunedin-based Division of Health Sciences departments and schools.

The University-wide Grand Final of the Otago 3MT was held on 4 August, with eleven doctoral and masters students facing off. Deanna won the Masters category of the event, with her presentation on oral health, quality of life, and economic evaluation.



Dentistry's Deanna Beckett presenting in the SJWRI 3MT competition.

In her winning presentation, Deanna discussed the way her research aims to provide evidence to the government that oral health is important and affects a person's quality of life, and that there should be funding for treatment. She says she was thrilled to win.

"It was very exciting. There were lots of amazing students doing amazing things, and I felt very privileged to have made it as far as the finals. I also feel very happy to be able to represent both the Department of Preventive and Social Medicine, and the Faculty of Dentistry, as my supervisors were from both disciplines, and they are equally important to me."

"To start with it was incredibly daunting, particularly as I needed to be able to simplify what I considered a complex topic enough to make it understandable and interesting to a lay audience," Ms Beckett says. "It was a very worthwhile exercise however, and it really helped me to learn to be concise, and get to the point."



2017 Otago 3MT finalists. Back row (from left): Alex Wilson, Adam Denny, Andrew Mills, Adeel Akmal and Rafaela Costa Camoes Rabello. Middle row (from left): Ellie-May Jarvis, Sabarinath Prasad, Josie Cairns and Chidimma Aham-Chiabuotu. Front: Nicola Beatson (PhD winner). Absent: Masters winner Deanna Beckett. Photo: Sharron Bennett.

Nicola Beatson, Teaching Fellow and PhD candidate of the Department of Accountancy and Finance won the PhD category of the 2017 3MT for her research on the role of self-efficacy in accounting education, and whether confidence and self-belief matter when learning accounting. She had previously won the Masters category of the 3MT in 2015.

Deanna went on to represent Otago at the Masters 3MT Inter-University Challenge at Victoria University of Wellington on 24 August 2017, where her presentation won the 'People's Choice' award.

Inaugural SJWRI PhD Scholarships awarded

The SJWRI PhD Scholarship, introduced in 2018, is a prestigious award to support doctoral research in the Sir John Walsh Research Institute. In its inaugural year, the Scholarship consisted of a NZ\$20,000 stipend per annum for three years, plus domestic tuition fees for 36 months. The Scholar also received a NZ\$3,000 project seeding grant to cover initial research expenses, in the name of their primary research supervisor.

The 2018 recipient of the SJWRI PhD Scholarship was Parham Hossaini (lead supervisor Prof Brian Monk). A one-year scholarship was awarded to third year PhD student Amira Salem (lead supervisor A/Prof Geoff Tompkins) to support her through her final year of PhD candidature.

Our congratulations to both recipients, and to their supervisors.

IADR New Zealand Section Colgate student poster competitions

2017 competition

The New Zealand Section 2017 Colgate Poster Competition was held in three sessions between 11 and 18 May 2017. There was a record 14 entries: 6 in the Senior Category and 8 in the Junior Category including one Bachelor of Oral Health student.

The Senior Category winner was Soo-Wee Ong, DCLinDent candidate in Oral Surgery, for his presentation *Third molar surgery outcomes: a comparison between intravenous sedation and general anaesthetic*. Runner-up was Fiona Firth, DCLinDent candidate in Orthodontics, with *The effect of mechanical strain on periodontal ligament cells in a three-dimensional culture*.

The Junior Category winner was Danni Chen who presented a poster titled *Identifying contact points for the development of next-generation antifungals*, while the runner-up was Michelle Chew with her presentation *One abutment, one time*.

Danni and Michelle were awarded ANZ Division Travel Grants, and Soo-Wee and Fiona awarded NZ Section Travel Grants to present their research at the 57th Annual Scientific Meeting of the IADR ANZ Division in Adelaide, South Australia, in September 2017.

The NZ Section would like to thank the 2017 competition judges, Associate Professor Jonathan Broadbent, Professor Nick Chandler and Dr Nick Heng.

2018 competition

The New Zealand Section 2018 Colgate Poster Competition was held in June 2018. There were 8 entries: 2 in the Senior Category and 6 in the Junior Category.

The Senior Category winner was Maggie Hsiao-Mei Chen, DCLinDent candidate in Prosthodontics, with her presentation *Reliability of RFA in Assessing Implant Stability: A Retrospective Analysis*.

The winner in the Junior Category was fourth year BDS student Anne Jude with *Cytotoxicity of nanosilver on primary human gingival fibroblasts in vitro*. Runners-up were final-year BOH student Lauren Allen with a poster titled *Comparison of F_1F_0 -ATPase amino acid sequences between oral streptococci* and final-year BDS student Manish Kumar with *Confirmation of three predicted disulphide bonds in *Candida albicans* Cdr1*.

Maggie, Anne, Lauren and Manish were awarded travel grants from the IADR NZ Section and Colgate to present their research at the 58th Annual Scientific Meeting of the IADR ANZ Division in Perth, Western Australia, in September 2018.

Manish Kumar went on to finish as runner-up in the Junior Category of the Colgate IADR ANZ Poster competition at the 58th Annual Scientific Meeting of the IADR ANZ Division, and will be supported by the ANZ Division to attend the 97th IADR General Session in Vancouver, Canada in June 2019.

Winning posters from the 2018 IADR NZ Colgate competition were part of a display of SJWRI research posters that featured on the Faculty's exhibitor booth at the NZ Dental Association Annual Conference at SkyCity Auckland, August 2018.

The NZ Section thanks the 2018 competition judges, Associate Professor Jonathan Broadbent, Dr Nick Heng, and Dave Purton.



Professor Nick Chandler stood down as President of the New Zealand Section of the IADR at the beginning of 2018. The NZ Section expresses its gratitude to Nick for his sterling service over an extended period (2006-2017) and in particular, for his efforts in organising the annual Colgate student poster competition. An election for President of the Section took place in April 2018, with **Associate Professor Jonathan Broadbent** elected as the new President.

Outreach activities

During 2017-18, the SJWRI represented the Faculty of Dentistry and University of Otago at a number of national and international meetings. These included the 94th General Session of the International Association for Dental Research in San Francisco in March 2017, the 95th General Session of the IADR in London in June 2018, and the NZ Dental Association Annual Conference in Auckland, August 2018.

95th General Session of the IADR

Moscone West Convention Center, San Francisco, California
22-25 March, 2017

Below: Images from the exhibitor booth and poster session.

Right: SJWRI Administrator Nicole Summerfield and Faculty of Dentistry Academic Administration Manager Claire Gallop, who organised and staffed our SJWRI and Faculty of Dentistry booth at the 95th IADR General Session in San Francisco.





University of Otago Postgraduate Open Day 2017

SJWRI Administrator Nicole Summerfield on the Faculty booth with an unidentified colleague, possibly from the Department of Marine Science, but definitely not Faculty of Dentistry Marketing & Communications Coordinator Dr Fiona McDonald.

96th General Session of the IADR

ExCeL London, 25-28 July 2018



Above: Images from the exhibitor booth and poster session, IADR 2018.

Top left: Dr Carolina Loch presented as part of a symposium on Dental Education Outreach, hosted by Prof Paul Brunton and Prof Richard Cannon from the SJWRI and Faculty of Dentistry.

Top right: SJWRI Administrator Nicole Summerfield and Faculty of Dentistry Administrator Sarah Shepherd, who staffed our booth at IADR 2018.

NZ Dental Association Annual Conference

SkyCity Convention Centre, Auckland

15-18 August 2018



Top row: The SJWRI was invited to present a symposium on the Thursday afternoon of the conference on cutting-edge dental and oral health research at the University of Otago. Top left: Speakers were (L-R) Dr Graeme Ting, Dr Lara Friedlander, Dr Joanne Choi, Dr Carolina Loch, Dr Manikandan Ekambaram and Professor Richard Cannon, who opened the symposium and gave an overview of our research (top right).

Bottom row: The SJWRI hosted an exhibitor booth on behalf of the Faculty of Dentistry and University of Otago, featuring a display of recent research posters from staff and students, with an associated CPD activity. Much of the research presented was funded by the NZ Dental Association through NZ Dental Research Foundation annual grants and NZDA Summer Studentships.

Outreach project educates children about “hidden sugars”

An outreach project led by the Faculty of Dentistry is helping to educate primary school aged children about healthy food choices and good oral hygiene.

Sugary foods and fizzy drinks have become common dietary choices for children. The consequences of this are increases in the prevalence of diabetes, obesity and dental caries in New Zealand people, particularly so for Māori. But are children and their whānau aware of how much sugar there is in snacks and fizzy drinks? Are they aware of the hidden sugar content in processed foods? Do they know the effects of sugar on teeth and on our general health?

The project, *Sugar in your diet – kino te pail*, has seen staff and postgraduate students from both Dentistry and Human Nutrition work with Dunedin’s Te Kura Kaupapa Māori o Ōtepoti staff, pupils and their whānau to investigate the hidden sugar content in their diet and how pupils can improve their oral health.

Each month the team visits with a science experiment to help the pupils discover the effects of sugar on teeth and their general health, and in parallel, a tooth brushing and oral hygiene intervention has also been implemented – with the children brushing their teeth every day at school.

The project enables children to examine their diets and report their findings to their whānau and wider community. The project is coordinated by Dr Carolina Loch from the Department of Oral Sciences, in collaboration with A/Prof Lyndie Foster Page, Prof Richard Cannon and Deanna Beckett from the Faculty of Dentistry’s Sir John Walsh Research Institute, and Dr Lisa Te Morenga of the Department of Human Nutrition. The project is supported by the Otago Participatory Science Platform, administered by the Otago Museum, and by the MBIE Curious Minds fund.

Dr Carolina Loch says the small school, located in the Dunedin suburb of Fairfield, has a predominantly Māori student base, making it an excellent school to work with on this project.

“In New Zealand in general, Māori children have less opportunity to engage with science and technology, have higher rates of obesity and diabetes, have poorer oral health and are more likely than other people to have tooth fillings or extractions due to poor oral hygiene. Our project is a good way to tackle some of these issues,” she says.



Pupils enjoyed the science experiments teaching them more about the effects of sugar on their teeth.



Faculty of Dentistry
Te Kaupeka Pūniho
New Zealand's National Centre for Dentistry



Sugar in your diet: kino te pai!

A University of Otago and Te Kura Kaupapa Maori o Otepoti joint project on the importance of healthy food choices and good oral hygiene



Funding from MBIE Curious Minds supported the production of an educational leaflet from the project, which can be found on the Otago Participatory Science Programme website <http://scienceintoaction.nz>.

Through the project children have learned about the nutritional information labels and how to read the amount of sugar contained in a certain product.

"Physically weighing the sugar content and placing it in plastic bags was an eye opener for the kids," Dr Loch says. "They were also surprised on the amount of physical activity required to "burn" the calories contained in certain foods. For example, they had to run around the school grounds for 10min to use the energy content of only one apple. Kids were also impressed with the sugar content of "so-thought" healthy products such as fruit juices, smoothies and sports drinks."

Experiments on the acidic nature of certain drinks were also interesting to the pupils, she says.

"If you chose a sugar-free or diet version of a fizzy drink, for example, it is still acidic and this can cause all sorts of dental problems."

The team expects this initiative will result in an increase in science engagement, better oral health and improved nutritional choices for the pupils, whānau and the broader community.



Outreach activities at NZ International Science Festival, Dunedin 2018.

Stories from our research

“Giant” problem looms for oral health of ageing New Zealanders

Urgent attention needs to be paid to frail older New Zealanders’ oral health, a University of Otago study has highlighted.

In a world-first, Otago researchers surveyed the oral health of 987 people living in aged residential care and found those with dementia, and older men in general, have dirtier and more decayed teeth.

Otago Head of Department of Oral Sciences and lead author, Professor Murray Thomson (*right*) describes poor oral health as one of the “geriatric giants” with the situation a “major clinical and public health problem which is going to get worse”.

Older people have higher rates of cognitive and physical impairments that can adversely affect their oral self-care and complicate the provision of oral care, he says.

“Neither the aged care sector nor the dental profession, in most countries, is prepared. Not only do we have more and more older people every year, but more and more people are entering old age with their own teeth, rather than full dentures, as was the situation just a couple of decades ago.

“In some ways, dentistry has been a victim of its success – we have long emphasised the idea of ‘teeth for life’ without much thought to what happens towards the end of life.

“We also now know that half of those in old age will end up in residential aged care, and that more and more of those will have some form of dementia.”

Professor Thomson believed that “slow progress” was being made in the area.

“It’s a very complex situation involving a lot of players – the aged care sector, the Ministry of Health, the dental profession, and the public. An encouraging sign is the inclusion of oral health in New Zealand’s Healthy Ageing Strategy. That’s a starting point, but there is a lot of work to be done,” he says.

Of those examined in the study (representative of the more than 14,000 New Zealanders living in aged care), recently published in the journal *Gerodontology*, about half had severely impaired cognitive function, and more than a third required fillings or extractions.

Those with severely impaired cognitive function had greater numbers of teeth with decay. They also had higher oral debris scores, reflecting poorer daily oral hygiene care.



Professor Thomson says greater rates of tooth decay can result in dental and facial infections, poorer quality of life, malnutrition and difficulties in communication.

The researchers also found that even the most cognitively impaired participants were able to be examined fairly easily, meaning that regular, routine removal of oral debris by carers should not be difficult.

“The issue that we currently face is that much of that debris removal is not being done, and this, along with frequent exposure to sugary, over-processed meals and snacks, and poor salivary function, is enabling plaque and dental caries to flourish in aged residential care populations.”

For those wanting to improve or maintain their oral health, Professor Thomson has some simple advice: brush twice daily with fluoride toothpaste; clean carefully between the teeth at least two to three times per week; avoid having sweet drinks or snacks between meals (and that includes sugar in tea or coffee – it takes only a couple of days to get used to not having it); and avoid smoking.

“For people who have poor oral health in middle age, it is not going to be any better in old age, and an honest, open conversation with a dentist about the options, which may include complete extraction, may be a very good idea.”

High unmet need for dental care among Syrian refugees

High unmet need for dental care is causing pain, embarrassment, worry and reducing quality of life among Syrian refugees, new University of Otago research shows.

The research, based on a survey of 62 adult Syrian refugees resettled in Dunedin over the past few years, found a very high level of unmet oral health need, while financial issues are perceived as a barrier to them receiving oral health care.

Lead researcher Associate Professor Jonathan Broadbent from the Faculty of Dentistry, says little is known about oral health among Syrian refugees.

While the research did not investigate whether similar refugees in other parts of the country are experiencing the same problems, he expects the situation to be similar nationally.

As a result of the evidence collected, he is now calling for a national protocol to standardise what dental care services are available and funded and how they should be accessed.

“Access to post-settlement oral health care for refugees is currently unsatisfactory, and dental clinicians and refugees are both placed into a different situation when pathways are unclear,” Associate Professor Broadbent says in the research paper recently published in the *NZ Dental Journal*.

“Oral health care should be accessible to refugees and other at-risk population groups to ensure they enjoy good oral health and overall well-being, and that their human rights are being realised,” he says.

“It is concerning that more than 70 per cent of former refugees reported current dental pain and fewer than 40 per cent had a dental check-up within the 18 months since their arrival.”

The majority perceived their oral health as “poor” or “very poor”. Many made additional comments about their dental problems. One participant stated: “I am very tired from all the dental problems I have, no one contacted me for dental treatment, please help me.” Another stated: “I want treatment because I feel self-conscious and have no confidence to smile. I feel like I have a bad smell all the time from my mouth.”

In New Zealand, newly-arrived refugees spend six weeks on an orientation programme at the Mangere Refugee Settlement Centre in Auckland. Their orientation includes an oral health screening and treatment for emergency dental problems.

Almost all refugees qualify for limited financial assistance for dental care in New Zealand. However, nearly half reported they had not received assistance and many were not aware of the options available to them.

This research did not involve collection of clinical examination data, which Associate Professor Broadbent says should be done in future research to better quantify dental care need requirements nationally among Syrian refugees.

However, this lack of clinical data should not stand in the way of efforts to improve care, he says. As a practising dentist who has treated some of these patients, he characterises their dental health needs as very high.

Local dentists pick up the pieces when ‘dental tourism’ goes bad

New Zealand dentists are increasingly having to provide remedial treatment where things have gone wrong for “dental tourists” who travel abroad for dental work.

Overseas travel for dental treatment is said to be the most prevalent form of medical tourism internationally with people from high-income countries seeking treatment in low-income countries. Each year about 40,000 to 50,000 patients from the UK seek dental care abroad and increasingly, it is becoming a phenomenon in New Zealand too.

Researchers at the University of Otago have found that typically New Zealanders seek dental treatment abroad because it is cheaper and they can also holiday in destinations such as Asia.

However, while for some the treatment is successful and is combined with a satisfying tourist experience, for others the treatment fails and the tourists seek remedial work once back in New Zealand.

The University of Otago survey of 337 New Zealand dentists in 2016 showed most (96 per cent) had encountered dental tourists at least once or twice a year, usually because they required remedial treatment.

Published recently in the *Journal of Tourism Management*, the research was carried out by Associate Professor Brent Lovelock from the Department of Tourism, Senior Research Fellow Dr Kirsten Lovelock from the Department of Public Health, and Faculty of Dentistry Professor Karl Lyons.



Left: University of Otago research has found that New Zealand dentists are fixing increasing numbers of 'unsuccessful dentist treatments due to 'medical tourism.' Image: Creative Commons.



Right: Professor Karl Lyons, a co-author of the study.

Dentists identified a range of issues arising from their patients receiving treatment abroad. The most important issue was a lack of follow-up maintenance and a lack of availability post-treatment. About half of the respondents identified lack of treatment planning and lack of treatment records to be issues.

One dentist explained they saw a patient in pain who had a full mouth of crowns and bridges.

"I wasn't prepared to treat the patient as the quality of work was absolutely appalling. The dentition had been absolutely wrecked and I wanted nothing to do with it," the dentist said.

Many dentists were concerned that patients are unaware of the poor quality of work often being carried out.

"Patients are unaware of the poor quality of the work they receive and the difference in standard of care compared to New Zealand dentistry. Patients are often over-treated and inappropriately treated with irreversible damage to their teeth and no apparent discussion or awareness of treatment options," another dentist said.

Thailand was the most commonly noted country of treatment, with nearly 90 per cent of dental patients having been treated there, followed by India and Indonesia.

While about half of the dentists acknowledged dental tourism provides access to affordable dental treatment, very few (6 per cent) felt it enhances dental health outcomes for their patients and even fewer (1.9 per cent) would recommend it to their patients. A considerable number (21.8 per cent) agreed that dental tourism should be discouraged due to its negative impact upon New Zealand's dental healthcare system.

When asked to rate the impact on dental care provision in New Zealand of providing remedial dental treatment for returned tourists, just over 60 per cent considered this to be more than at least "moderately significant".

The most common type of treatment sought abroad was crowns, while implants and bridges were other commonly observed treatments.

The Otago researchers acknowledge the perceived issue of "professional protectionism" with their study, in that dentists may consider the impact upon their practices by the provision of care abroad. So, they specifically asked dentists about the perceived impacts of dental tourism on their practice's income.

While a number of respondents (about 15 per cent) considered dental tourism would impact negatively on their practice incomes, a small number (6 per cent) felt it would actually increase their practice's income due to the increased demand for remedial treatment.

New Zealand Dental Association Chief Executive Officer Dr David Crum says dental tourism exists and will appeal to a small sector of New Zealanders.

"It comes with risks most often related to quick care supplied over a very short duration by a practitioner unknown to the patient."

Most often the dental care required is at the advanced, and more expensive, end of the spectrum, and often not discovered to be poorly implemented until months later after the patient has returned home, Dr Crum says.

The New Zealand Dental Association continues to believe patients are best served by establishing a long-term care relationship with a dentist who meets mandatory New Zealand standards in their own community.

'Killer' toothaches likely cause misery for captive orca

An international research team including Dr Carolina Loch of the SJWRI has undertaken the first in-depth investigation of the teeth of captive orca (killer whales) and have found them a sorry state, which raises serious concerns for these majestic mammals' overall health and welfare.



Anyone with a toothache knows how painful and distracting that can be - in orca which have around 48 large teeth, a sore tooth is likely no less painful or debilitating than for a person. Now, a new international study published in the journal *Archives of Oral Biology*, found that every individual examined had damaged teeth.

Study lead author Professor John Jett of Florida's Stetson University, an ex-orca trainer, says the team investigated 29 orca owned by one company and held in the USA and Spain.

"Every whale had some form of damage to its teeth. We found that the more than 65 per cent possessed moderate to extreme tooth wear in their lower jaws, mostly as a result of chewing concrete and steel tank surfaces."

Additionally, the researchers found that more than 61 per cent of the orca they studied have "been to the dentist" to have their teeth drilled. Officially termed a "modified pulpotomy", a hole is drilled into the tooth to extract the soft pulpy tissue inside.

Study co-author Dr Carolina Loch specializes in the dentition of whales and dolphins, and says that unlike

Captive orca have terrible teeth, mostly caused by chewing concrete and steel tank surfaces, according to research that photographed the mouths of 29 orca kept in captivity. Image: Ingrid Visser.

us, the resultant hole is not filled or capped, but rather is left open for the rest of the animal's life, requiring daily flushing with chemicals to keep the teeth empty of food and bacteria in an attempt to manage resulting infection.

"Once the tooth gets worn to the point where the pulp is exposed this opens up a channel for disease and infection, so the staff then drill the teeth," Dr Loch says.

Dr Jeff Ventre, another of the study authors, also an ex-orca trainer and now a medical doctor, says that he had drilled orca teeth in his former work.

"Teeth damage is the most tragic consequence of captivity, as it not only causes morbidity and mortality in captive orcas, but often leads to chronic antibiotic therapy compromising the whale's immune system, as we saw recently with the orca known as Kasatka," Dr Ventre says.

Dr Loch added that a drilled tooth is severely weakened and if any other trauma occurs, fractures will happen.

"We have documented more than 60 per cent of the second and third teeth of the lower jaws were broken and this high number is likely linked to the drilling."

During his time as a trainer, Dr Ventre says that he had witnessed "whales breaking their teeth on steel gates while jaw popping. Small tooth fragments were then collected below the gate while diving the pool".

Jordan Waltz, an investigative researcher and co-author noted that "the damage to the teeth of these animals is so severe that most individuals can be identified by the specific fractures and tooth wear alone, much like forensic pathologists use for identification of humans post-mortem."

Dr Ventre also noted that "the obligatory daily teeth irrigations render the compromised orcas poor candidates for full release", should companies ever make the transition to look at rehabilitation for their captives.

Co-author Dr Ingrid Visser, a New Zealand-based scientist who has studied orca in the wild for more than three decades, has long been advocating for an end to orca captivity.

"We know that confining them in tanks is bad for the animals and this research now gives us some hard numbers to illustrate just how their health and welfare is compromised.

"Given how big the root of an orca's tooth is and that orca have a nervous system similar to ours, these injuries must be extremely painful.

"Compared to free-ranging orca, the teeth of captive orca are incredibly compromised and you just don't see this type or level of damage in the wild," says Dr Visser.

Dr Loch points out that "dentists have long said that oral health is a measure of general health as our mouths are the gateway to our body," and she believes that this is likely the same for orca.

Professor Jett concludes: "We have documented that tooth damage starts at a very early age in captivity and that all the orca in the study have issues with their teeth. Teeth are incredibly important to the overall health of an animal, and the results of our study should raise serious concerns for the health and welfare of captive orca."

Key findings

- Using high-resolution photographs, individual teeth in the mandible and maxilla of captive orca were scored for coronal wear, wear at or below the gum line, fractures, bore holes and absence.
- Dental damage was commonly observed across all captive whale cohorts, with damage beginning early in a whale's captive life.
- Forty five percent of whales exhibited "moderate" mean mandibular coronal wear, and an additional 24 per cent exhibited "major" to "extreme" wear.
- More than 61 per cent of mandibular teeth 2 and 3, and 47 per cent of mandibular tooth 4, exhibited evidence of having undergone the 'modified pulpotomy' procedure.
- Aggression amongst the whales and repetitive oral stereotypies such as biting on hard tank surfaces likely contributed to the tooth pathology observed.

John Jett, Ingrid N. Visser, Jeffrey Ventre, Jordan Waltz, Carolina Loch, Tooth Damage in Captive Orcas (*Orcinus orca*), *Archives of Oral Biology* Volume 84, December 2017, Pages 151-160

doi.org/10.1016/j.archoralbio.2017.09.031

SJWRI forensic scientists have challenging but rewarding role in repatriation mission

The remains of 27 New Zealand Defence Force (NZDF) personnel and one child have been reunited with their families, thanks to a team which included University of Otago archaeologists, bioarchaeologists and forensic odontologists.

The group is part of project Te Auraki ("The Return") under which NZDF personnel buried overseas after 1 January 1955 are being brought home to New Zealand, following a change in Government policy.

The NZDF deployed an expert disinterment team to carry out the repatriation and identification process. The team was headed by Disinterment Team Leader Lieutenant Colonel Charmaine Tate, and worked alongside the Malaysian Armed Forces who provided logistic and forensic support.

"There was an overwhelming feeling of working together for a common goal that transcended personal agendas and career ambitions which can plague academic projects."

Professor Hallie Buckley of Anatomy was the lead forensic anthropologist for the disinterment team and described her involvement as "humbling, exhausting, and rewarding".

The remains, returned at a ramp ceremony at Auckland International Airport yesterday, belonged to NZ Army soldiers who were serving in Malaysia, Thailand, and Vietnam when they died. The child was the son of a member of the NZ Army.

Along with Professor Buckley, seven other Otago scientists made up part of the disinterment team. They included Professor Warwick Duncan, Professor Darryl Tong and Dr Angela Clark of the Sir John Walsh Research Institute and Faculty of Dentistry, along with Dr Peter Petchey of Anthropology and Archaeology, and Drs Rachel Scott, Rebecca Kinaston and Anne Marie Sohler-Snoddy of Anatomy.

"All of the team is highly skilled and each played an integral part in getting the job done," Professor Buckley says.

In order to ensure positive identification of the personnel, the bioarchaeologists and archaeologists were tasked with excavating and analysing the skeletal remains, while the forensic odontologists carried out detailed examinations, comparing remains with original dental records provided by NZDF.

The biggest challenge they faced was carrying out gruelling physical work in very hot and humid conditions.



University of Otago scientists joined NZDF personnel at a blessing ceremony at Terendak Military Cemetery before beginning the disinterment work. Photo: NZDF.

One of the highlights, however, was the Otago contingent working with the NZDF and Malaysian medical and forensic team on such a positive task.

"There was an overwhelming feeling of working together for a common goal that transcended personal agendas and career ambitions which can plague academic projects. It was an enormously gratifying and liberating experience for me," Professor Buckley says.

The project was especially poignant for Professors Duncan and Tong as the forensic odontologists are also both senior Reserve Force officers in the NZDF.

"This project is about making sure the inequalities and inconsistencies of the past are put right and everyone is treated the same, regardless of wealth, rank or cause of death."

"The purpose of this operation was to return the remains of those who have served New Zealand abroad, to their relatives and descendants. We get a great deal of job satisfaction in achieving this and hopefully bringing some closure to these families," Professor Duncan says.

"Both Darryl and I were grateful to be invited by the NZDF for this historic and unique operation. We both feel that our knowledge of forensic dentistry and our ability to contribute to disaster victims' identification in New Zealand and abroad, has been considerably enhanced by the knowledge we gained during Operation Te Auraki."

Royal New Zealand Air Force Group Captain Carl Nixon says it is important to return the fallen personnel in a dignified manner in accordance with NZDF's contemporary cultural, religious and military protocols.

"Today we honour the memory of a child, and the sacrifice of 27 soldiers who died serving their country overseas. We're bringing them home to their families who have waited more than 60 years for this moment," Group Captain Nixon says.

"This project is about making sure the inequalities and inconsistencies of the past are put right and everyone is treated the same, regardless of wealth, rank or cause of death."

The first portion of Te Auraki was completed in May, with the remains of three personnel repatriated from Fiji and American Samoa.



Planning is underway for the next two portions of the project, which will see two personnel repatriated from England in September, and two from the Republic of Korea in October.

Dentistry staff make a major contribution to *Periodontology 2000* special issue

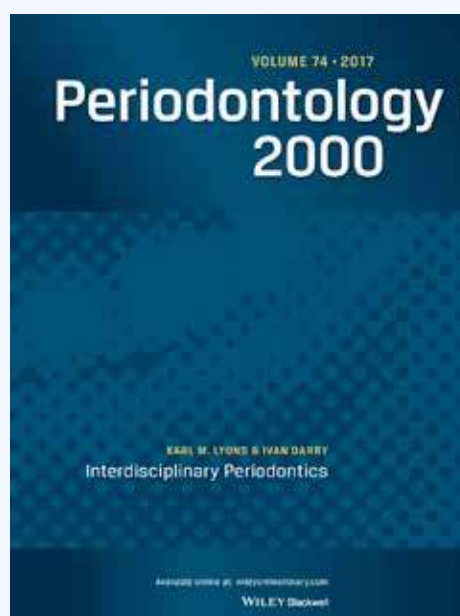
Staff from the Faculty of Dentistry's Sir John Walsh Research Institute made a major contribution to the May 2017 volume of *Periodontology 2000*, the top ranked journal for dentistry.

The focus of the volume is interdisciplinary periodontics, and the articles included discuss the interactions and the interrelationship between periodontal tissues/periodontal diseases and endodontics, fixed prosthodontics, implant dentistry, aesthetics, gerodontology, radiology, orthodontics, pediatric dentistry, oral and maxillofacial surgery, oral pathology, special needs dentistry and general medicine.

Of the 13 articles in the volume, 7 have been authored by Otago academics, with contributions from 13 current staff and 3 recent staff.

A recent description of the volume was "No other journal has ever done such a comprehensive job of delineating Interdisciplinary Periodontics".

The volume is available online at onlinelibrary.wiley.com/doi/10.1111/prd.2017.74.issue-1/issuetoc.



Our programmes

1957

Construction of the Walsh Building

Construction of the existing Faculty of Dentistry (the Walsh Building) begins. The building is designed in the 'Modernist' style and includes an early example of glass curtain walling.



Biomechanics & Oral Implantology

Programme leaders

Associate Professor Neil Waddell (Biomechanics and Biomaterials)

Professor Warwick Duncan (Oral Implantology)

Programme overview

Within the area of biomechanics and biomaterials, we conduct experimental and observational research in:

- Dental materials - development of new dental restorative materials for dental CAD/CAM systems.
- The use of 3D printing in the fabrication of dental appliances and prostheses.
- Cranio-facial biomechanics - prosthodontic failure mechanisms and adhesion of dental restorations and materials.
- Sub-concussive brain injury research - *in vitro* modelling of the effects of blunt force trauma to the head on accumulative damage to the brain.
- Dental hard tissues and evolutionary oral biology research - characterising animal teeth and other biological materials to elucidate the biology, evolution and interactions with the environment of fossil and recent species.
- Forensic biology - *in vitro* modelling of blunt force trauma, forensic odontology, wounding and ballistic blood splatter analysis, development of simulant materials for forensic modelling.

Within the area of oral implantology, our research focuses on:

- Grafting and regenerative therapies.
- Surface treatments of implant fixtures for enhanced osseointegration.
- The effects of implant fixture corrosion products on periodontal structures.
- Developing ultrasonic diagnostic devices for dentistry.
- Silver and gold nanomaterial technology group - developing nanoparticles for use in a range of therapeutic technologies.
- *In vitro* modelling of masticatory forces on implant overdentures, their supporting sub-structures and surrounding bone.

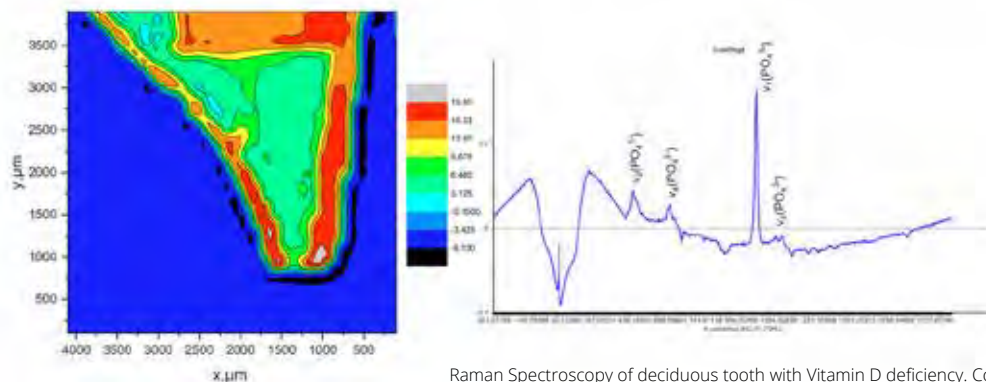
KEY PERSONNEL

Staff

Prof Warwick Duncan
Prof Karl Lyons
Prof Paul Brunton
Prof Darryl Tong
Assoc Prof J Neil Waddell
Assoc Prof John Broadbent
Assoc Prof Andrew Tawse-Smith
Assoc Prof Dawn Coates
Dr Peter Cathro
Dr Don Schwass
Dr Sunyoung Ma
Dr Carolina Loch
Dr Kai Chun Li
Dr Joanne Choi
Dr Gemma Cotton
Dr Tanmoy Bhattacharjee
Ludwig Jansen van Vuuren
Wendy Jansen van Vuuren

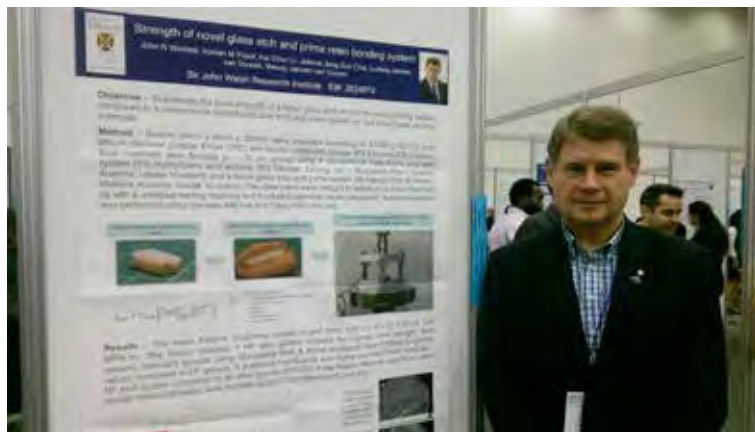
Postgraduate students

Christina Gee
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Janine Tiu
Andrew Tawse-Smith
Donald Schwass
Sunyoung Ma
Ludwig Jansen van Vuuren
Veivakatorocaketaki Masi Ovin



Raman Spectroscopy of deciduous tooth with Vitamin D deficiency. Courtesy Dr C Loch.

Right: Assoc Prof Neil Waddell presents dental biomaterials research during a poster session at the 95th IADR General Session in San Francisco, March 2017.



Collaborations

University of Otago

Department of Geology
 Department of Chemistry
 Department of Anatomy
 Department of Zoology
 Department of Marine Sciences

National

Department of Mechanical Engineering, University of Canterbury

Van Der Veer Institute, University of Canterbury

Department of Engineering Sciences, University of Auckland

Department of Mechanical Engineering, University of Auckland

Forensic Science, Department of Environmental Science and Research

South Island Brain Injury Research Group (SIBIRG)

International

School of Dentistry, University of Adelaide

Impact and Armour Group, Cranfield University

Defence Academy of the United Kingdom, Shrivenham

University of the Witwatersrand, Johannesburg

South African Nuclear Energy Corporation in Palindaba

Tokyo University of Agriculture and Technology, Tokyo

Facharzt für Rechtsmedizin, Institut für Rechtsmedizin, Leipzig, Germany

University of Kent, Canterbury
 Université Bordeaux

Hampden-Sydney College USA

South Australian Museum, Adelaide

CENPAT Puerto Madryn, Argentina

Universidade Federal de Santa Catarina, Brazil

Current research

Activity 1. Dental Materials.

Description: Evaluating specific issues associated with the range of dental materials from composite resin systems to advanced ceramics. One of the groups has a focus on mechanical properties of dental ceramics and their reasons for failure, with a particular interest in fractography and analysis of failure in brittle materials. A more recent novel area is the silver and gold nanomaterial technology group, which is developing nanoparticles for use in a range of therapeutic technologies.

Aim: Provide basic information about these materials that enables a better basis for understanding their usage in clinical settings and the development of new treatment technologies and materials.

Source(s) of funding: Neurological Foundation Research Grant, Maurice and Phyllis Paykel Trust, ANZAOMS Research and Education Trust, New Zealand Dental Research Foundation, Fuller Scholarship for Dentistry, Otago Innovation, University of Otago Research Grant, Sir John Walsh Research Institute and proprietary funding.

Activity 2. Sub-concussive Brain Injury.

Description: Concussive and subconcussive injury is a global phenomenon, which has been likened to a silent epidemic due to the large numbers of young people who sustain head injuries in sports and military activities. The objective of this research is to quantify the impact forces transmitted through the various levels of scalp, skull and brain at values below what is predictive of concussion. Once this data is obtained, clinical evaluations of neurologic function using established methodology can be used to correlate the effects of these impact forces for further research, but the main objective for this research study is the quantification of these forces.

Aim: Can the impact forces involved with subconcussive head injury be quantified in order to determine a threshold or range of impact forces that may be predictive of sub-concussion?

Source(s) of funding: Neurological Foundation Research Grant, Maurice and Phyllis Paykel Trust, University of Otago Research Grant. Division of Health Sciences Sandpit Funding. ANZAOMS Research and Education Trust.

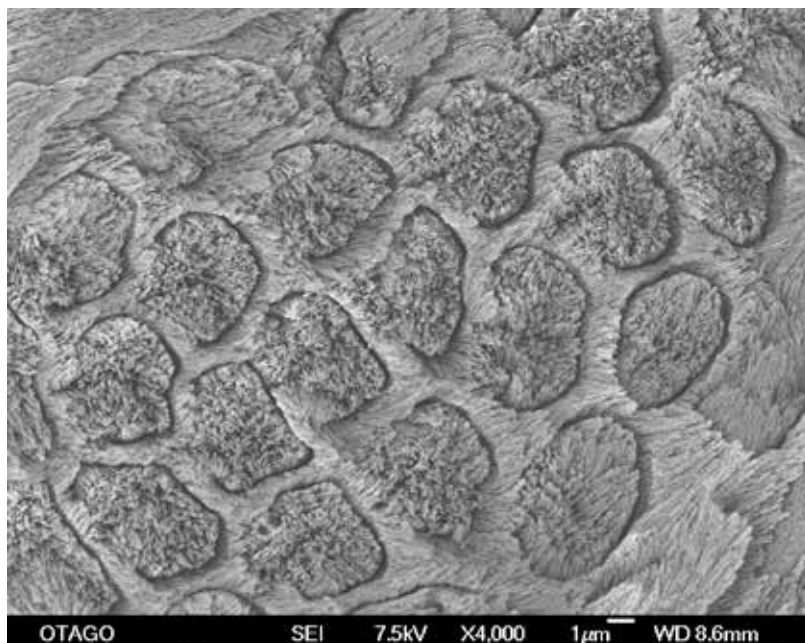
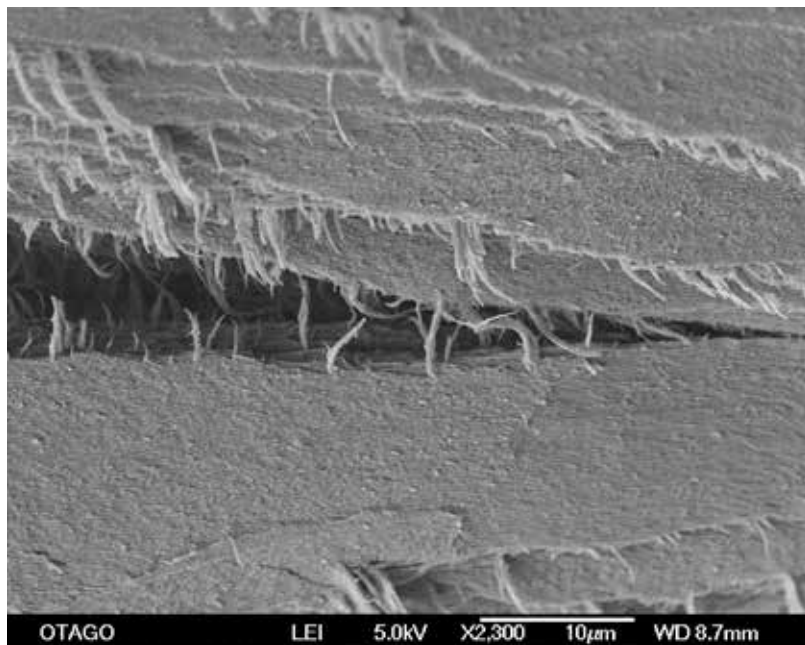
Activity 3. Soft and Hard Tissue Biomechanics and Forensic Biology.

Description: Investigating the basic properties of skin, teeth, broad aspects of evolutionary oral biology, comparative dental morphology and bone related to the craniofacial region and forensic issues.

Aims: Teeth and bone are special as they preserve a record of their formation in the adult end-product. Hence, an examination of adult morphology can be used to reveal some of the processes that were involved, as well as some of the perturbations of such processes. By studying teeth and other biological materials we are attempting to understand the biology, life history, evolution and interactions with the environment of fossil and recent mammal species. Comparative dental morphology and ultrastructure are key elements of this activity.

This knowledge can then be linked to clinical findings that can result in better therapeutic outcomes. Our research has mainly been focused on the structure and function of enamel and dentine in different species, the forces generated during swallowing, and the behaviour of skin and bones during events such as ballistic and blunt force trauma.

Sources of funding: New Zealand Dental Research Foundation, Leverhulme Fund (UK), Lottery Health Grant, University of Otago Research Grant, OMRF Laurensen Award, MBIE Unlocking Curious Minds Fund.



This page: Electron micrographs of dental structures in marine mammals, courtesy Dr C Loch.

Top: Microstructure of baleen, the grinding plates made of keratin fibres that are present in place of teeth in plankton-feeding baleen whales.

Bottom: Enamel prisms in the teeth of sea otters, visualised under electron microscopy.

Activity 4. Oral Implantology and Associated Superstructures.

Description: Our research teams have expertise with respect to conducting clinical (human) and preclinical (animal) trials and laboratory-based research relating to oral implants. Currently, funded research is being conducted into different oral implant systems, materials, surfaces, superstructures, and surgical and restorative protocols, as well as supporting biological and regenerative products. Our research encompasses immediate placement and/or loading of single implants and implant-supported over-dentures, fit of zirconia prostheses, implant analysis using micro-CT, and analysis of different implant systems and bone placement grafts in sheep femur and maxillary sinus models, in vitro modelling of strain distribution within implant overdentures and their supporting sub-structures and bone, in vivo analysis of implant fixture corrosion.

Aims: Evidence-based treatment that reduces the interval between oral implant placement and loading, by optimising the implant design and the surgical and prosthodontic protocols and materials.

Source(s) of funding: New Zealand Dental Research Foundation; JF Fuller Foundation; International Team for Oral Implantology ITI Switzerland; Straumann AG, Switzerland; NobelBiocare Australia; Southern Implants, South Africa; Korea Science and Engineering Foundation (KOSEF), Megagen Co Ltd., South Korea; Osstem Co. Ltd, South Korea; Neoss Australia Ltd; Keratec Ltd. New Zealand.

Funding highlights

2018

\$14,970 NZ Dental Research Foundation
Bonding universal dental adhesive resin to developmentally hypomineralized enamel. (PI – Ekambaram M. CI - Yiu CKY (UHKong), Waddell JN, Li KC, Lowrey S, Boyd D, Lee Y)

\$14,970 NZ Dental Research Foundation
Development of a simulant model for clinically relevant testing of implant- and natural tooth-supported all-ceramic restorations [Phase Two]. (PI – Jansen van Vuuren L, CI – Waddell JN, Duncan WJ, Broadbent J)

\$120,000 Lottery Health Research - Equipment
UFW200 Universal Multi-Function Wear Test System. (PI – Choi J, CI – Waddell JN, Loch C, Duncan WJ).

\$20,000 SJWRI TK Sidey Early Career Research Fund
Development of novel antimicrobial, wear and corrosion resistant coating for teeth and dental restorations. (PI: Choi J. CI – Duncan WJ and Waddell JN)

£294,391 Leverhulme Trust
Biorhythm of Childhood Growth. (PI Mahoney P (University of Kent UK). CI - Loch C, Guatelli-Steinberg D (Ohio State University, USA), Bayle P (Universite Bordeaux, France).

\$47,000 Lottery Health Research - Projects
A novel approach to treating root caries in the elderly using chlorhexidine-modified glass ionomer cements. (PI Brunton PA. CI - Lyons K, Loch C, Heng N, Cannon R, Ratnayake J, Ahmed HM)

\$25,931 University of Otago Research Grant
Dolphin teeth as a biomonitoring tool of heavy metal exposure. (PI Loch C. CI – Palin M, Kemper C, Taylor M, Stockin K, Duncan WJ).

2017

\$19,295 SJWRI TK Sidey Early Career Research Fund
Using teeth to understand mammal biology and evolution. (PI Loch C).

\$13,700. MBIE Otago Participatory Science Platform
Sugar in your diet: kino te pai!. PI Loch C and Cannon R. CI - Foster Page L, Beckett D, Te Morenga L, Kawe-Small T.

\$41,000 OMRF Laurensen Awards
What are the dental consequences of vitamin D deficiency in pregnancy and infancy? (PI - Wheeler B. CI - Beckett D, Loch C, Mahoney E.

\$26,800 Cure Kids Innovation Seed Grant
Development of tooth-coloured shell crowns to treat dental caries in children. (PI – Choi J, CI – Waddell JN, Foster-Page L, Duncan WJ).

\$23,000 University of Otago Research Grant
Development of a novel tooth-coloured shell crowns to treat dental caries in children. (PI – Choi J, CI – Waddell JN, Foster-Page L, Duncan WJ).

\$36,680 University of Otago Research Grant
Developing a simulant skull model with accurate mechanical properties using 3D-printed polymers. (PI – Li KC, CI – Waddell JN, Tong D, Hammer N, Duncan WJ).

Key publications

Aarts, J. M., Jansen van Vuuren, W.-A., Withy, K. E., Choi, J. E., & Waddell, N. J. (2017). A pilot study on the influence of two reinforcing materials (glass fibre mesh and electro-spun nylon nano fibres) on the flexural strength of a heat-cured poly (methyl methacrylate) denture base resin. *New Zealand Dental Journal*, 113(3), 11-15.

Atieh, M. A., Alsabeeha, N. H. M., Tawse-Smith, A., & Duncan, W. J. (2018). Piezoelectric versus conventional implant site preparation: A systematic review and meta-analysis. *Clinical Implant Dentistry & Related Research*, 20(2), 261-270. doi: 10.1111/cid.12555

Atieh, M. A., Tawse-Smith, A., Alsabeeha, N. H. M., Ma, S., & Duncan, W. J. (2017). The one abutment-one time protocol: A systematic review and meta-analysis. *Journal of Periodontology*, 88(11), 1173-1185. doi: 10.1902/jop.2017.170238

Barazanchi, A., Li, K. C., Al-Amleh, B., Lyons, K., & Waddell, J. N. (2017). Additive technology: Update on current materials and applications in dentistry. *Journal of Prosthodontics*, 26(2), 156-163. doi: 10.1111/jopr.12510

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Godoy Zanicotti, D., Coates, D. E., & Duncan, W. J. (2017). In vivo bone regeneration on titanium devices using serum-free grown adipose-derived stem cells, in a sheep femur model. *Clinical Oral Implants Research*, 28(1), 64-75. doi: 10.1111/clr.12761

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Clinical & Translational Research

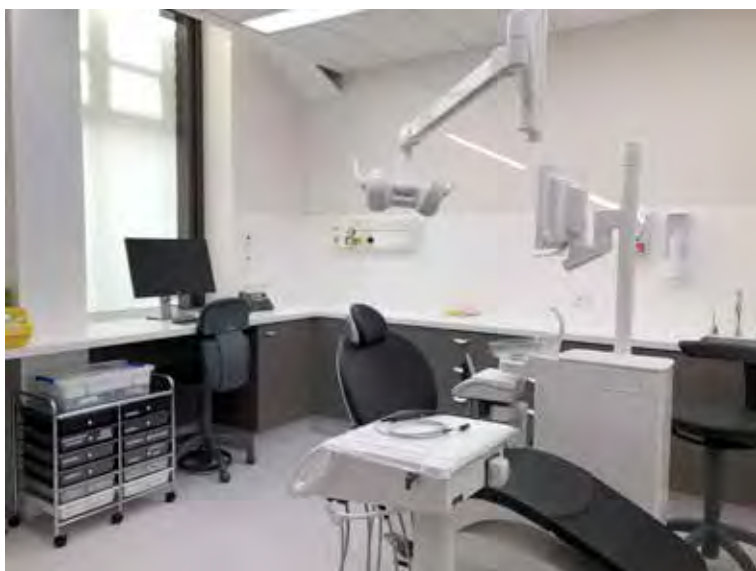
Programme leader

Professor Warwick Duncan

Deputy Programme Leader: Dr Mo'men Atieh

Programme overview

Te Kaupeka Pūniho, New Zealand's National Centre for Dentistry, is the centre of excellence in New Zealand for clinical and translational research in dentistry and oral health. The Research Programme groups together researchers and projects whose objective is to enhance care and achieve better outcomes for our patients. There is considerable overlap with other research programmes, particularly with respect to the translation from benchtop, in vitro and preclinical animal research into development of commercially-viable products or improvements in clinical practice.



KEY PERSONNEL

Staff

Professor Warwick Duncan
Professor Mauro Farella
Professor Paul Brunton
Professor Darryl Tong
A/Prof Nick Chandler
A/Prof Neil Waddell
A/Prof Vincent Bennani
A/Prof Andrew Tawse-Smith
A/Prof Lyndie Foster-Page
A/Prof Dawn Coates
Dr Sunyoung Ma
Dr Trudy Milne
Dr Carolina Loch
Dr Mo'men Atieh
Dr Joanne Choi
Dr Gemma Cotton
Dr Tanmoy Bhattacharjee
Dr Jithendra Ratnayake
Dorothy Boyd

ARCH dental practice-based research network

Dr Lara Friedlander
Suzanne Hanlin

Postgraduate students

Yevgeny Sheftel
Frances Ruddiman
Tatiana Tkatchenko
Anumala Ram
Saeideh Nobakht
Siddharth Kothari
Rachel Farrar (Walters)
Christina Gee
Dina Abdelmoneim
Asrar Elahi

Clinical facilities within the new Faculty of Dentistry Clinical Services Building



Current projects range from clinical trials conducted within the school and out in the community, of new products or modified treatment protocols, to development of new therapeutic agents and devices from benchtop through initial *in vitro* and preclinical animal trials with the objective of phase 1 clinical trials, to surveys conducted within the school or in the community regarding the techniques employed in clinical dental practice and their outcomes. Funding for this work ranges across contestable research grants, commercial sponsorship and contract research, and includes both researcher-initiated investigations and research driven by manufacturers of dental products.

The major part of Clinical and Translational Research involves diverse projects undertaken by the staff, postgraduate and undergraduate students of the School. Additionally, work has continued on the development of our dental practice-based research network, Applied Research through Clinicians' Hands (ARCH), with a view towards fostering research conducted outside the School by and for New Zealand dental practitioners, with the support of Dental faculty staff.

Collaborations

Within the University of Otago

Department of Applied Sciences, Clothing & Textile Sciences

Department of Geology

Department of Preventive & Social Medicine, Dunedin School of Medicine

Department of Physics

Department of Chemistry School of Pharmacy

Other Universities

Department of Mechanical Engineering, University of Auckland

MedTech CoRE (Centre for Research Excellence), New Zealand

University of Zürich, Switzerland

Companies and other entities

Aroa Biosurgery Ltd

Callaghan Innovation

Geistlich Pharma (Switzerland)

Ivoclar International (Liechtenstein)

Molteno Ophthalmic Ltd

Resorba Medical GmbH (Germany)

Southern Implants Ltd (South Africa)

Zimmer Biomet 3i (United States of America)

Current research

Novel therapeutic agents

- Silver nanoparticles (**Silverbone** project, more details on facing page) – *in vitro* and preclinical animal trial
- Optimisation of MoaBone® natural hydroxyapatite xenograft (with Molteno® Ophthalmic Ltd.) (*in vitro* and preclinical)
- Manuka honey as an antibacterial agent (*in vitro* and clinical trial)
- Manuka oil as an antibacterial agent (*in vitro*)
- Regenerative membrane for alveolar ridge preservation (with Aroa Biosurgery Ltd.) – preclinical trial
- Gel-loaded lactoferrin for oral bone grafting (with Auckland University and CReaTE Research Group) – *in vitro* and preclinical animal trial
- Novel grafting materials for sinus lift therapy (preclinical animal trial)
- Healing mechanisms in stem-cell driven regeneration of deer antler

Novel therapeutic approaches

- Hall technique for childhood caries – clinical trial
- Development of white crowns for Hall technique (over page) – *in vitro*
- Vital tooth bleaching - clinical trial
- Orthodontic tipping and bodily movement of premolars in a sheep model – preclinical trial

Implant therapy

- Titanium-zirconium narrow dental implants for replacing single posterior missing teeth - clinical trial
- Dental implant abutment-interface and marginal bone loss - preclinical animal trial

Diagnostics

- Ultrasonic devices for early diagnosis of periodontal diseases (**UltraD3** project, facing page) – benchtop, preclinical animal trial, clinical trial

Professor Warwick Duncan is working on two significant advances in dental technology that could cut the cost of treatments, improve general health and involve New Zealand's agricultural sector with a new high-value product.

Aside from his University research, Professor Duncan runs a private practice where he experiences problems first hand.

"As a periodontist I treat gum disease, take teeth out and graft bone to be able to implant new teeth as necessary. But as mouths are relatively filthy places, infections can occur and if grafts don't work you can actually lose bone. To a certain extent we can manage that with antibiotics, but we're trying to reduce their use."

The drive for improvement sees Duncan heading an international and interdisciplinary team including Chemistry's Dr Carla Meledandri and Dr Nina Molteno from Molteno Ophthalmic Ltd, a Dunedin manufacturer specialising in bone graft materials.

"Molteno uses cow bone as the basis of a grafting material in eye sockets and we use it for dental applications. An existing product uses New Zealand beef bones, which are exported to a company in Switzerland where they turn them into grafting material and send that back to us at a high mark-up.

"This doesn't make sense when beef bone is a by-product of our agricultural industry and just goes to make blood and bone instead of being turned into a high-value product. We need to improve upon that material, make it ourselves and get costs down."

The cost of dental treatment is increasingly important since research revealed significant links between oral and general health.

One of the team's main challenges is fighting infection, which is particularly prevalent in oral work where there is a higher likelihood of damage from bacteria than in ophthalmic and orthopaedic surgeries. There's also increasing concern about rising bacterial resistance to antibiotics.

Working with manufacturer Molteno and nano-scientist Meledandri, Duncan's team has come up with a new bone-based grafting material, **Silverbone**, that is robust enough for dental work and contains silver with anti-bacterial properties.

Cell culture work is now fine-tuning the new graft material to balance maximum protection from infection and maximum healthy bone growth.

"It would be nice not to have animal testing phases, but we have to show it is safe and promotes new, healthy bone



growth. So now we are working in the laboratory to create something that will be superior and save money and be sold and used in dental procedures every day."

Duncan is also working on developing **UltraD3** – a miniaturised ultrasound device to help with dental diagnosis – with Callaghan Innovation engineer Paul Harris and a world-leading team with capabilities in dental research, ultrasonics, electronics and materials science.

"We're trying to make a new tool to assist diagnosis of gum disease around teeth and dental implants. When Paul first asked how I diagnose gum disease I told him I poked it with a stick. It's actually called a periodontal probe, but it's much the same thing. We're aiming to do better than that."

The diagnostic technique hasn't changed for a century, so it's high time for an improvement, says Duncan.

Gum disease affects one in three adult New Zealanders and is the world's sixth most prevalent condition, with strong links to diseases with high morbidity and mortality. Early intervention should reduce both discomfort and late stage treatments, save money and improve health.

Ultrasound is used for many conditions, such as in breast cancer diagnostics, where it measures changes in tissue stiffness.

"The challenge is to make the device small enough to fit comfortably in the mouth and accurate enough dealing with very small amounts of tissue. We're now on version three and we're getting close. It should be a very useful diagnostic device and almost certainly will be able to be used in other ways in the future.

"Both SilverBone and UltraD3 are getting to very exciting stages, with likely results expected in the next couple of years. It's really cool science and it's really enjoyable."

Silverbone and UltraD3 are supported by the NZ Ministry of Business, Innovation and Employment's Endeavour Fund.

Development of novel tooth-coloured shell crowns to treat dental caries in children

Dental decay is the most common chronic childhood disease in New Zealand. Treatment is often delayed, for many reasons – including fear and cost – which only serves to exacerbate the severity of the problem; consequently, increasing the cost and fear associated.

Decay also has a greater impact on certain subsets of society, such as a Maori and Pasifika, as well as children from lower socioeconomic environments. The impact is further compounded by the significant impact restorative dental care has on the public health system.

Dr Joanne Choi (right) and colleagues from the SJWRI's Clinical and Translational Research programme are looking to improve upon a novel technique that could reduce some of the anxiety associated with going to the dentist. Known as the Hall Technique, this method allows for children to avoid the 'drill and fill' of conventional dental care.

Instead of the usual invasive measures, a stainless-steel cap is placed on the decaying tooth without any need for anaesthetic or drilling. The crown seals off the decaying tooth, preventing further tooth decay.

One downside to the Hall Technique is the crown's aesthetically unpleasant look. The appearance of the crown represents a very real obstacle to its use. Dr Choi and her team are developing an alternative crown to stainless steel; one that is tooth coloured and hence less visible as different from the surrounding teeth.



Producing a tooth-coloured cap is not as easy as it sounds; several attempts have been made, only to come up against similar issues around the malleability and plasticity required for the Hall Technique. Using a variety of materials, representing different required functionalities, Dr Choi and her team hope to create a strong crown that lasts.

The team plan to translate their lab-based research into a clinical trial and, ultimately, to make the tooth-coloured crowns available for use in all dental practices.

This project is supported by Cure Kids, Hitem Co. Ltd. and the University of Otago Research Committee.

Funding highlights

\$91,887; "Bovine-derived lactoferrin in a degradable PVA-tyramine hydrogel for oral bone regeneration in a tooth socket model". Medical Technology Centre of Research Excellence Seed Fund; (W Duncan, D Musson, K Lim, J Cornish, T Woodfield) 2018.

\$25,000; "EMG-Guard: a smart-phone assisted wireless EMG device for small superficial muscles". Medical Technology Centre of Research Excellence Seed Fund; (M Farella, R Cannon, M-L Huckabee, M Paulin) 2017

\$46,482; "A novel approach to the treatment of root caries in the elderly: a clinical and molecular investigation of chlorohexidine-modified glass ionomer cements". New Zealand Lottery Grants Board (P Brunton, H Ahmed, R Cannon, N Heng, C Loch, K Lyons, J Ratnayake) 2018

\$9,463; "Managing elderly patients requiring endodontic treatment - a New Zealand practice based research study". New Zealand Dental Research Foundation (NZDRF) and Continuing Dental Education Trust (L Friedlander, N Chandler, B Daniel, P Hamadani) 2018

\$15,000; "Development of an ovine model for investigating effects of orthodontic tooth movement". NZDRF (Farrar R, Farella M, Duncan W, Antoun J, Melsen B) 2018

\$49,458; "A novel approach for monitoring eating behaviour in children". Cure Kids Innovation Seed Fund (M Farella, G Idris, B Galland, C Smith, R Taylor, C Robertson) 2018

\$10,000; "Development of a simulant model for clinically relevant testing of implant-and natural tooth-supported all-ceramic restorations (Phase Two)" NZDRF (L Jansen van , J Broadbent, W Duncan, JN Waddell) 2018

\$220,000 (AUD); "Titanium-zirconium narrow (3.3mm) versus standard (4.1mm) diameter dental implants for replacing single posterior missing teeth". ITI Research Grant (M Atieh, W Duncan, A Tawse-Smith, S Ma). 2017

\$210,254; "Evaluation of an Endoform membrane combined with Bio-Oss bone graft in a sheep tooth extraction model." Aroa Biosurgery Ltd. (W Duncan) 2017

\$26,800; "Development of a novel tooth-coloured shell crowns to treat dental caries in children ". Cure Kids Innovation Seed Fund (J Choi, W Duncan, L Foster Page, JN Waddell) 2017

\$150,000; "Healing mechanisms in stem-cell driven regeneration of deer antler". Velvet Antler Research NZ (D Coates et al) 2017

\$13,425; "Effect of different surfactant concentration on bacterial power and shelf life". Dentalife Australia Pty Ltd (P Cathro, O Gonzalez) 2017

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Patents

MELEDANDRI CJ, SCHWASS DR, COTTON GC, DUNCAN WJ. Antimicrobial gel containing silver nanoparticles. Google Patents; Publication number WO2017061878 A; Application number PCT/NZ2016/050162; Apr 13, 2017.

Craniofacial Research

Programme leader

Professor Mauro Farella

Deputy Programme Leader: Dr Joseph Antoun

Programme overview

The Craniofacial Research programme encompasses a diverse range of exciting fields, including the basic and molecular sciences relevant to craniofacial growth, the impact of malocclusions on oral health, jaw function, self-esteem, psychological wellbeing, and the understanding of the peripheral and central mechanisms of orofacial pain and jaw dysfunction with their clinical correlates.

Several research approaches are used to study topics relevant to craniofacial research, including cell response to mechanical loading, animal models, and clinical genetics. The latter focuses on identifying genetic markers for some dentofacial anomalies which could potentially provide us with a clinically important window of opportunity to predict abnormal growth patterns at an early age and, possibly, to provide personalized orthodontic treatments.

An additional area of active research is focusing on the development of novel treatment strategies for clinical problems such as craniofacial syndromes, jaw discrepancies and misaligned teeth. Furthermore, the impacts of craniofacial anomalies and smile problems are quantitatively and qualitatively assessed at population and individual level using survey methods including social media. Social media enables us to gather opinions from the public about the importance of smiles for individuals themselves and also the perspective of their peers.

Craniofacial Research examines mastication and jaw kinematics, bruxism and non-functional oral behaviours, sleep disordered breathing including snoring and sleep apnea, intra-oral tongue pressure, dysphagia, tooth wear, eating behaviour, and novel food products. We are currently using wired and wireless sensors to monitor intraoral pH, temperature, and jaw activity for the purpose of identifying and evaluating ways of overcoming orofacial pain, dental wear, jaw dysfunction, jaw clicking sounds, snoring, and obstructive sleep apnea. We also use monitoring equipment to improve the quality of sleep in New Zealand children and adults.



Dr Li Mei, Professor Mauro Farella, Danielle Hodgkinson and Dr Austin Kang.

KEY PERSONNEL

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Florence Bennani
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A/Prof Jonathan Broadbent
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Dr Ajith Polonowita

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Collaborations

University of Otago

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A/Prof Barbara Galland (Women's and Children's Health)
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A/Prof Michael Paulin (Zoology)
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National

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International

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A/Prof David Healey (University of Brisbane)
Dr Jialing Li (Nanjing Medical University)
Prof Ambra Michelotti (University of Naples, Federico II)
Prof Sandro Palla (University of Zurich)

Current research

Smart-phone assisted monitoring of jaw muscle activity in freely moving individuals with and without myogenous temporomandibular pain

Investigators: Sabarinath Prasad, Divya Ramanan, Michael Paulin, Richard Cannon, Mauro Farella

Aim: To: 1) collect objective data on masticatory muscle activity during wake-time in the natural environment using a smart-phone assisted wireless electromyographic (EMG) device; and 2) compare the features of masticatory muscle activity between females with myogenous temporomandibular disorder (TMD) and age-matched pain-free controls.



Smart-phone assisted EMG device developed at the University of Otago for continuous monitoring of jaw muscle contractions. The device provides a comprehensive analytical tool to estimate when, how often, how long, and how strongly the jaw muscles contract.

EMG activity was detected unilaterally using a minimally invasive wireless EMG device attached to the skin overlying the masseter muscle and connected to a smart-phone serving as data logger. Study participants performed a series of standardised tasks in a laboratory setting, wearing both the wireless device and reference standard EMG equipment, and then wore the wireless device for at least eight hours while performing their normal routine activities. For Aim #2, EMG activity was collected in females with myogenous TMD and age-matched pain-free controls while performing their normal routine activity over two consecutive days. Contraction episodes were detected at three thresholds: 3, 5 and 10 per cent of maximum voluntary contraction (MVC). The frequency, duration and amplitude of masseter contraction episodes were calculated and compared across groups and conditions using intraclass correlation coefficients (ICC) and mixed model analysis.

The wireless device reliably detected masseter muscle contraction episodes under both laboratory and natural environment conditions. Most masseter contraction episodes during normal routine were of low amplitude (<10% of

MVC) and short duration (<10 seconds). A significant difference in total jaw contraction time (%) was found between groups, with longer contractions in the TMD pain group. No significant association was found between self-reported parafunction and masticatory muscle activity.

Conclusions: Myogenous TMD patients contract the masseter for longer than pain-free controls. Smart-phone assisted monitoring of the jaw muscles represents a promising tool to investigate oral behaviour patterns in orthodontic patients.

Three-dimensional analysis of lip changes in response to simulated maxillary incisor advancement

Investigators: Joanne Au, Li Mei, Florence Bennani, Austin Kang, Mauro Farella

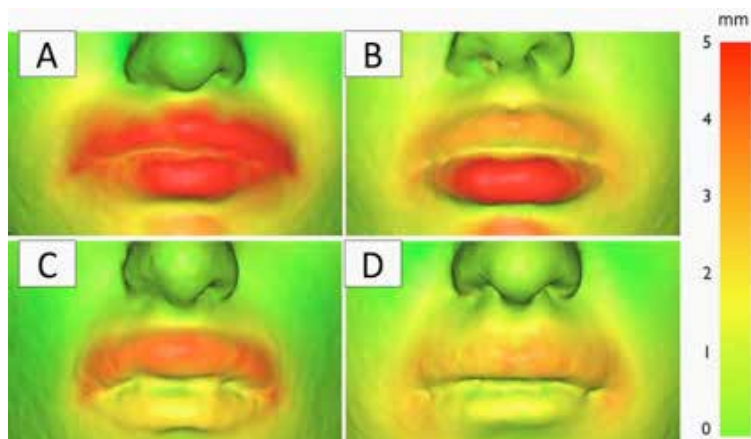
Aim: To assess three-dimensional (3D) lip changes in response to simulated maxillary incisor advancement.

Incremental maxillary incisor advancement was simulated by placing wax of increasing thickness (+2mm, +4mm, +6mm) on the incisors of 20 participants, and the induced lip changes were recorded using 3D stereophotogrammetry. The induced displacement of lip landmarks was quantified using 3D image analysis software. Data was analysed using a repeated-measures analysis of variance (ANOVA).

A large inter-individual variation in lip response to simulated incisor advancement was observed. A significant overall effect on 3D lip changes was found for increasing values of simulated incisor advancement as well as significant differences between anatomical landmarks of the lip. Most points moved outwards and antero-superiorly, except the midpoint and corners of the lip. Greatest movement was observed in the sagittal plane, followed by vertical and transverse planes.

Conclusions: Maxillary incisor advancement significantly affects upper lip change in three planes of space; particularly, the anteroposterior plane, in which the response to simulated advancement appears to be non-linear.

Examples of colour-coded scalar fields from four different female participants (A,B,C,D) with + 6 mm of incisor advancement. Green areas correspond to areas of little to no change (-0.5 mm to 0.5 mm); yellow and red correspond to increasingly positive values of displacement. Note the large interindividual difference in soft tissue response.



Is posterior crossbite a risk factor for temporomandibular joint clicking?

Investigators: Simon Olliver, Jonathan Broadbent, Murray Thomson, Mauro Farella.

Aim: The relationship between dental malocclusion and temporomandibular disorders (TMDs) remains controversial. The aim of this study was to investigate the putative association between posterior cross-bite in adolescence and self-reported temporomandibular joint (TMJ) clicking later in life.

The Dunedin Multidisciplinary Health and Development Study is a longitudinal study of a birth cohort of 1037 children born in Dunedin, New Zealand between April 1972 and March 1973. Health and development data have been collected periodically since then. Posterior cross-bite was clinically assessed when Study members were aged 15 years, and self-reported TMJ clicking (at least occasionally) was assessed at age 38. Cross-tabulations and logistic regression modelling were used to assess whether an association existed between posterior cross-bite and subsequent TMJ clicking.

A total of 726 Study members (70% of the original cohort) were dentally examined at age 15 and also participated at age 38 years. One in three had received orthodontic treatment by the age of 26 years. A total of 94 Study members (13%) had a unilateral or bilateral posterior cross-bite at age 15 years. Among those who had no posterior cross-bite at 15, 33% reported TMJ clicking at least occasionally by age 38 years, while it was 34% among those with a cross-bite at age 15. No association between cross-bite and TMJ clicking was observed, and this held after controlling for their history of orthodontic treatment.

Conclusions: Posterior cross-bite in adolescence is not a risk factor for TMJ clicking by the late thirties.

Ecological momentary assessment of pain in adolescents undergoing orthodontic treatment using a smartphone app

Investigators: Will Sew Hoy, Joseph Antoun, Wei Lin, Nick Chandler, Tony Merriman, Mauro Farella

The purpose of this study was to determine the feasibility of a smartphone application (app) to assess pain levels in real life, and to test their association with gender, age, time in orthodontic treatment, and type of orthodontic adjustment. Eighty-two participants undergoing orthodontic treatment were recruited. A newly developed app was used to assess pain scores at regular intervals in the three days after adjustment of braces. Resting and chewing pain were assessed using sliding digital visual analogue scales. The mean age of the sample was 15.2 ± 1.6 years, the mean time in treatment was 12 ± 8.4 months, and the majority (56.1%) were females.

Resting pain and chewing pain at the teeth rose steadily from baseline, peaked at approximately 20 hours, then decreased gradually over the next two days. Details of the orthodontic adjustments were associated with the total pain experienced at the teeth, with new bond-ups resulting in significantly more pain than routine orthodontic adjustments. Pain levels were not significantly associated with age, gender, or time in treatment.

Conclusions: This smartphone app shows promise in measuring orthodontic pain in the real world, and will aid future research projects which investigate various factors that could influence pain severity.

Funding highlights

Total research funding (external) obtained in the period 2017- 2018 amounted to \$266,311.

Funding highlights 2017-18:

Colgate SJWRI Research Grant. Development of novel bovine derived hydroxyapatite toothpaste for caries prevention (Cathro P, Ratnayake J, Mei L, Guan G, Dias GJ) \$13,423

University of Otago Research Grant. I just want my teeth straightened. (LF Page, JS Antoun, PW Fowler, HC Jack) \$36,000

Ministry of Oral Health Research Fund. Reading between the lines: how do young New Zealanders from lower socio-economic backgrounds feel about not getting their teeth straightened? (LF Page, JS Antoun, HC Jack) \$29,000

Ministry of Oral Health Research Fund. Efficacy of the oral probiotic *Streptococcus salivarius* in managing bio film formation in patients wearing fixed orthodontic appliances (Li Mei, Gareth Benic, Mauro Farella, Nick Heng) \$11,410

CureKids Innovation Seed. A novel approach for monitoring eating behavior in children (Mauro Farella, Ghassan Idris, Barbara Galland, Rachel Taylor, Claire Smith) \$49,458

Other Craniofacial Research projects include:

- Effect of orthodontic extractions on face profile.
- The psychological effect of malocclusion over the life course.
- Development of an ovine model to investigate orthodontic tooth movement
- Impact of psychological and genetic factors on orthodontic pain
- Management of biofilm formation with Air-Flow in patients with fixed orthodontic appliances
- A novel approach for monitoring eating behavior in children
- Relationship between sugar sweetened drinks, tooth wear and dental caries in Māori
- Jaw muscle overload as a possible cause of orofacial pain
- Assessing three-dimensional tooth movements during orthodontic activations using an E-typodont
- The effect of mechanical strain on the unfolded protein response of periodontal ligament cells in a three-dimensional culture
- Predictive factors of orthodontic pain
- Efficacy of a mandibular advancement appliance on Sleep Disordered Breathing in children
- A new approach to engineering 3-dimensional constructs of human bone matrix in a mechanically-active environment
- Genetic and environmental factors associated with hypodontia
- A novel model for exploring the causes and treatments of craniofacial birth defects
- Biofilm management with oral probiotics in orthodontic patients: a triple-blind randomised placebo-controlled trial
- Genetics aspects of the long face
- Growth factor expression in the rat condyle: implications for craniofacial development
- Intra-oral monitoring of oral pH and bruxism

MedTech CoRE Grant-in-Aid. EMG-Guard: a smart-phone assisted wireless EMG device for small superficial muscles. (Mauro Farella, Michael Paulin, Richard Cannon, Maggie-Lee Huckabee) \$25,000.

New Zealand Dental Research Foundation. Development of an ovine model for investigating effects of orthodontic tooth movement (Rachel Farrar, Mauro Farella, Warwick Duncan, Joseph Antoun, Birte Melsen) \$15,000.

New Zealand Dental Research Foundation. Do orthodontic extractions ruin faces? (Danielle Hodgkinson, Mauro Farella, Joseph Antoun, Li Mei, Austin Kang) \$11,654

New Zealand Dental Research Foundation. Effects of different adhesive removal methods on bacterial colonization on in vivo orthodontic bracket model (Ana Low, Joseph Antoun, Li Mei, Geoffrey Tompkins, Mauro Farella) \$11,965.

Key publications

- Chen, L., Liversidge, H., Chen, K., Farella, M., Sassani, S., Patel, D., Brook, A. (2018). Delay in dental development and variations in root morphology are outcomes of the complex adaptive system associated with the numerical variation of hypodontia. *International Journal of Design & Nature & Ecodynamics*, 13(1), 101-106
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- Ma, R., Hwang, K.-C., Murray, C., Thomson, W. M., Farella, M., & Mei, L. (2018). Clinical dental noise and its association with the hearing thresholds of New Zealand dental students and clinical staff. *New Zealand Dental Journal*, 114(2), 73-78.
- Jiang Q, Li J, Mei L, Du J, Levrini L, Abbate GM, Li H. Periodontal health during orthodontic treatment with clear aligners and fixed appliances: a meta-analysis. *Journal of the American Dental Association*. 2018;149(8):712-720.e12.
- Wang S, Lin H, Yang Y, Zhao X, Mei L, Zheng W, Li Y, Zhao Z. Use of autonomous maximal smile to evaluate dental and gingival exposure. *Korean J Orthod*. 2018 May;48(3):182-188.
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- Antoun JS, Thomson WM, Merriman TR, Rongo R, Farella M. Impact of skeletal divergence on oral health-related quality of life and self-reported jaw function. *Korean J Orthod*. 2017 May;47(3):186-194.
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- Chan A, Antoun JS, Morgaine KC, Farella M. Accounts of bullying on Twitter in relation to dentofacial features and orthodontic treatment. *J Oral Rehabil*. 2017 Apr;44(4):244-250.
- Al-Ani AH, Antoun JS, Stacknik S, Farella M. Management of missing mandibular second premolars: a review. *Aust Orthod J*. 2017 Feb;Spec No:87-98.
- Al-Ani AH, Antoun JS, Thomson WM, Merriman TR, Farella M. Hypodontia: An Update on Its Etiology, Classification, and Clinical Management. *Biomed Res Int*. 2017;2017:9378325.
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- Meredith, L., Mei, L., Cannon, R. D., & Farella, M. (2017). Interproximal reduction in orthodontics: Why, where, how much to remove? *Australasian Orthodontic Journal*, 33(2), 150-157.
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- Wen J, Liu S, Ye X, Xie X, Li J, Li H, Mei L. Comparative study of cephalometric measurements using three imaging modalities: 2D lateral cephalometric radiography, 2D CBCT-generated cephalogram and 3D CBCT. *Journal of the American Dental Association*. 2017;148:913-921.

Dental Education Research

Programme leader

Dr Lee Adam

Deputy Programme Leader: Dr Susan Moffat

Programme overview

Research in dental education focuses on enhancing theoretical and evidence-based policies and practices in teaching and learning. Researchers in the Dental Education Research Programme typically examine educational experiences in the Faculty and other dental education environments in order to foster a positive impact on education in both the clinical and traditional teaching and learning environments.

We seek to use research to identify strategies and practices that can improve experiences and support for students and educators, both within the University of Otago Faculty of Dentistry, and in other education environments.

KEY PERSONNEL

| | |
|---------------------------|----------------------|
| Dr Lee Adam | Dr Carolina Loch |
| Dr Susan Moffat | Prof Paul Brunton |
| Mrs Alison Meldrum | Mrs Hanna Olsen |
| Prof Alison Rich | Mrs Dorothy Boyd |
| Dr Lee Smith | Mrs Deanna Beckett |
| A/Prof Jonathan Broadbent | Dr Arthi Senthikumar |
| Dr Andrew Tawse-Smith | |

Current research

The value of clinical placements in Australasian dental education

Investigators: Lee Adam, Alison Meldrum, Susan Moffat, Lee Smith

This research, funded by the Australasian Council of Dental Schools, is a mixed methods study undertaken in 2018, exploring the educational benefits and logistics of dental and oral health therapy students' clinical placements in Australasia. Academic and administrative staff from Australasian dental schools, as well as staff from clinical host providers, were surveyed and interviewed.

The research found that across Australasia there are a variety of placement models and locations. Clinical placements are deemed by all stakeholders to have a multitude of advantages for students, institutions, and host providers and the communities they serve. However, they involved substantive workloads for both institutions and



Dr Lee Adam presenting dental education research at the 96th IADR General Session in London, July 2018.

providers, and providers reported that hosting students can lead to a decrease in clinical productivity for their organisation.

The research highlighted the need for increased communication between institutions and providers regarding the expectations of students and host organisation clinical supervisors.

Stress and mood states of New Zealand dental students

Investigators: Paul Brunton, Jonathan Broadbent, Lee Adam, Alison Rich, Alison Meldrum

This longitudinal study investigates the perceived stressors and transient mood states of BDS students at the University of Otago Faculty of Dentistry. All BDS students are surveyed twice yearly using the Perceived Stress scale, the Brief Resilience Scale and the Profile of Mood States instruments. Data will be used to gain an understanding of the perceived stressors and psychological functioning (including coping) of undergraduate BDS students, and how stress and functioning varies within and between each class group, between each year of study, and over the course of each year.

Preliminary results suggest the BDS students' stress scores are significantly higher than those of other tertiary students, and their resilience scores are lower than those found in other populations. When the students' mood states are matched against performance, early indicators suggest that there is a positive relationship between students feeling 'on top of things' and higher academic grades.

Comparing the microbiology syllabi between University of Otago and the world's top dental schools

Investigators: Yee En Chen, Wei Theng Chen, Desmond Cheong, Geoffrey Cannon, Geoff Tompkins, Lee Adam

Oral microbiology is a core component of dental education, however, what should be taught? There is a lack of studies comparing the oral microbiology syllabi of the general dental degree among dental schools.

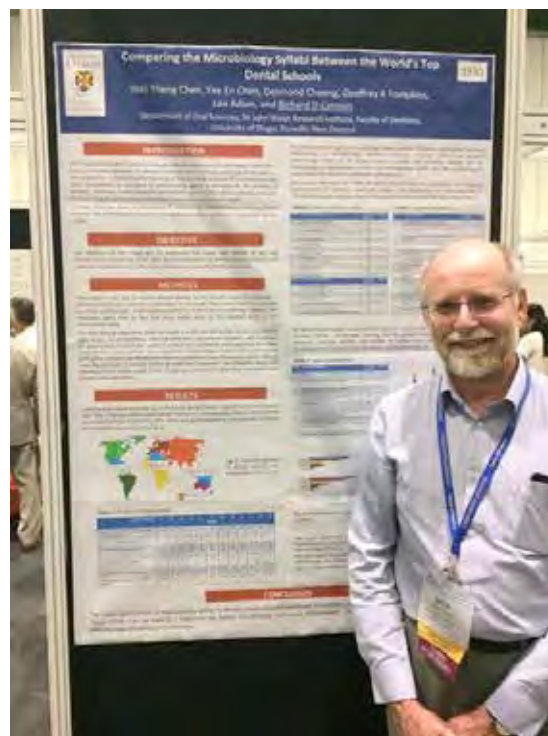
The objective of this study was to determine the scope and content of the oral microbiology components of the 2017 World QS Ranking top dental schools curricula, and assess the similarities and differences of course content and teaching methods.

A questionnaire was sent to 48 of the top 50 dental schools requesting course syllabi for the microbiology component of their dental degree. The syllabi were analysed using an open-coding method to produce a profile of topic areas and course objectives. The similarities and differences between microbiology teaching at the dental schools, including topics taught and course objectives, were determined. Questionnaires were returned by 12 of the dental schools (25%) and 11 provided their microbiology syllabi.

The most common topics taught were: an introduction to microbiology; oral microbial ecology; and the microbiology of periodontitis. The top course objectives were to: demonstrate understanding of the biological characteristics of bacteria, viruses and fungi; describe the involvement of microorganisms in infectious disease; and understand infection of hard and soft tissues of the oral cavity.

Lectures were the most commonly used teaching modality, employed by all of the participating dental schools, while the most commonly used assessment method was multiple-choice questions. One textbook was required or recommended reading for 73% of dental schools.

The scope and content of microbiology syllabi in dental schools showed significant similarities in a wide range of topic areas and course objectives. These results can be used as a reference for future microbiology curriculum development.



Prof Richard Cannon presenting research at the 96th IADR General Session in London, July 2018.

Clinical tutors and their teaching practice


Investigators: Lee Smith, Lee Adam, Alison Meldrum

Although many clinical educators (Dental Clinical Tutors and Professional Practice Fellows) have vast experience in clinical dental practice, many come into tertiary education with no formal teacher training. Clinical expertise is assumed as marking a dental professional as a good clinical educator, but this is not necessarily the case.

Students have reported that self-identifying dental 'experts' are frequently unable to disseminate their knowledge; instead, students rate good clinical educators as those who can define complex concepts, motivate students, maintain rapport, show enthusiasm, and are organised and caring.

Previous research with clinical tutors at the Faculty of Dentistry identified a number of barriers to the retention of tutors, including perceived lack of opportunities for career and pay progression, little support for teaching, few opportunities for undertaking research, and lower pay-rates than if they were employed as a practitioner outside of the University. Approximately two thirds of participants (n=47) said that they thought a formal teaching qualification should be mandatory for this role.

In 2018 we began researching the value that a cohort of clinical educators' placed on formal teaching training,



how they rated their own teaching ability, and how they thought the Faculty of Dentistry could support them with their teaching. Our overarching objective was to investigate challenges the clinical educators experienced in their teaching. The results of this research will inform professional development opportunities provided by the Faculty of Dentistry going forward.

Perceptions of stressors of Bachelor of Oral Health students

Investigators: Hanna Olson, Susan Moffat, Deanna Beckett, Lee Adam, Andrew Tawse-Smith

Despite a recent trend to investigate students' stressors in dentistry learning environments, there is little research on students' stressors in the oral health learning environments. This study aimed to identify self-perceived stressors of Bachelor of Oral Health students to determine if the learning support provided at the Faculty of Dentistry is meeting students' needs.

All Bachelor of Oral Health students (n=135) were invited to complete an online modified version of the Dental Environmental Stress Survey. The survey consisted of 39 questions: 7 collecting demographic information, 1 free comment box, and 31 items related to various potential sources of stress which students were asked to rate on a 5-point Likert-type scale ranging from 'not at all stressful' to 'extremely stressful'. Additionally, the student learning support system was examined. Around half of the group of respondents were first-year students, with participants from second and third years equally distributed. The items 'fear of being unable to catch up if behind' and 'examinations and assessments' scored the highest, indicating that the students perceived these to be their greatest stressors.

Overall, academic requirements were the highest scoring self-perceived stressors for students from all year groups. Stressors related to the clinical environment were highest for second-year students, which is when students start seeing patients. Although there is an existing network of support for students, the study identified several self-perceived stressors over 3 years of Bachelor of Oral Health study that have implications for student support.

Sustainable staff recruitment and retention in Dentistry

Investigators: Paul Brunton, Arthi Senthilkumar, Carolina Loch, Lee Adam

This study was conducted to identify factors that affect retention and recruitment of dental clinical teaching staff at the Faculty of Dentistry. The study has explored issues that influence the clinicians to take up teaching roles and

possible barriers to continue in their current role.

A short questionnaire survey was distributed to current dental clinical teaching staff to understand the retention strategies and barriers. The response rate was almost 96% with equal distribution of female and male clinicians. The majority of participants were European New Zealanders, followed by Asians. Themes identified to improve the retention strategies were the necessity of formal teaching skills, clinical teaching as a career pathway, pay progression, lack of support, and workload.

The study results suggested that the respondents were motivated to give back to their profession through engaging in dental clinical teaching. Clinical teaching staff can be retained by assigning a clear career pathway and encouraging career progression.

Feedback processes in the clinical dental learning environment

Investigators: Lee Adam, Alison Meldrum, Alison Rich

Creating an optimal clinical learning environment poses a challenge to health professions educators. To evaluate and improve the clinical learning environment, it is necessary to understand students' experiences of their environment and the factors they perceive as having an impact on their learning.

The aim of this explorative qualitative study was to examine Faculty of Dentistry students' perceptions of their clinical learning environment to gain insights into how learning outcomes could be enhanced. In 2015, all approximately 600 students at all levels of the Bachelor of Oral Health and Bachelor of Dental Surgery degrees were invited to participate in focus groups. Focus groups facilitated by the faculty education research fellow and another researcher employed for the project were conducted during the second half of the academic year.

Twenty-one students from all levels of the two programs attended one of six confidential focus groups. Three broad themes were evident in the results from all groups: feedback processes, assessments and grading, and tutor interactions. In the focus groups, students expressed dissatisfaction regarding current feedback practices, types of feedback to benefit learning, consistency in the grading system, and impact of different educators' teaching styles on learning.

These results indicated a need for further research and curricular efforts to promote good student-teacher relationships in the clinical learning environment, which are paramount for creating an optimal teaching and learning environment and enhancing student outcomes.

Practicing destination of past Bachelor of Dental Surgery graduates

Investigators: Paul Brunton, Arthi Senthilkumar, Carolina Loch, Lee Adam

In New Zealand (NZ), 11% of university students are international, generating 9.9% of the university sector's income. However, there is little research regarding international students' work intentions beyond graduation. This study investigated whether undergraduate students at the University of Otago Faculty of Dentistry intend to practice in NZ after graduation, and whether international dental students (Bachelor of Dental Surgery, Bachelor of Oral Health and Bachelor of Dental Technology) who graduated between 2001 and 2016 are currently practicing in NZ or overseas.

Almost 64% of current international students indicated their intention to stay in NZ after graduation. Only 22% of graduates since 2001 are currently practising in New Zealand, however this trend is increasing. The number of international graduates registered in NZ increased between 2001 and 2016. More than 70% of current students from Malaysia and China indicated their intention to practice in NZ. All students from Brunei and Oman intended to return to their home country. These findings can be used to prepare current and future graduates for a globalised society and multicultural workforce in NZ.

Funding highlights

2018: ACODS (Australasian Council of Dental Schools) grant: \$50,000. Assessment of the value of clinical placements in Australasian Dental Schools. Lee Adam (principal investigator), Alison Meldrum, Susan Moffat, Claire Gallop

2017: MBIE \$13,700. Otago Participatory Science Platform, Sugar in your diet: kino te pai! Carolina Loch, Richard Cannon, Lyndie Foster Page, Deanna Beckett, Lisa Te Morenga, and Tiahuia Kawe-Small (Te Kura Kaupapa Maori Otepoti).

2017, University of Otago Teaching Development Grant, \$19,982. Counteracting the CSI Effect: Enhancing and Developing Forensic Biology Curriculum Content and Delivery. Angela Clark, Elaine Webster, and Richard Cannon.

Other Dental Education Research projects

- Assessing improvements in academic writing in first year Bachelor of Oral Health students
Investigators: D Beckett, J Oranje, L Adam, S Moffat
- Professionalism for the undergraduate oral health professional
Investigators: R Ahmadi, L Smith, L Adam, A Meldrum, S Moffat.
- Evaluate to improve: Using student evaluations to inform teaching improvements
Investigators: L Adam, C Golding
- Inter-professional collaborative practice initiatives in oral health therapy education across Australasia
Investigators: H Olsen, A Senthilkumar

Student projects

- Learning experiences of 4th year Bachelor of Dental Surgery students in relation to perceived clinical tutor teaching approach
Investigators: P Choo, S Zhang, L Adam, C Loch
- Students' experiences of a compulsory undergraduate research paper
Investigators: R Heran, HW Yeang, D Boyd, L Adam, A Meldrum
- Dental students' perspectives of the long case examination
Investigators: T Paul, L Adam, S Moffat
- Perceptions of special needs dentistry
Investigators: A Ramasamy, L Adam, G Ting, A Rich
- The teaching of posterior composites: a survey of dental schools in Oceania
Investigators: Y Liaw, P Metussin, C Loch, P Brunton
- I am a lefty in a right-handed world: qualitative analysis of clinical learning experiences of left handed undergraduate dental students
Investigators: E Al Lawati, H Al Maskari, S Ma



Prof John Broughton presenting dental education research at the 95th IADR General Session in San Francisco, March 2017.

Key publications

Ebbeling, S., Adam, L., Meldrum, A., Rich, A., McLean, A., & Aitken, W. (2018). Oral health and dental students' perceptions of their clinical learning environment: A focus group study. *Journal of Dental Education*, 82(10), 1036-1042. doi: 10.21815/JDE.018.102

Smith, L., Adam, L., Moffat, S., Meldrum, A., & Ahmadi, R. (2018). How do educators in one New Zealand undergraduate Bachelor of Oral Health course teach and nurture professionalism? *European Journal of Dental Education*, 22(2), e212-e220. doi: 10.1111/eje.12274

The, A. J. M., Adam, L., Meldrum, A., & Brunton, P. (2018). Dental students' and staff perceptions of the impact of learning environment disruption on their learning and teaching experiences. *European Journal of Dental Education*, 22(3), 151-159. doi: 10.1111/eje.12293

Veerasamy, A., Loch, C., Adam, L., Howe, B. J., & Brunton, P. A. (2018). Challenges in clinical teaching investigated: Towards sustainable staff recruitment and retention in dentistry. *European Journal of Dental Education*, 22(4), 234-242. doi: 10.1111/eje.12336

Adam, L., Anderson, V., & Spronken-Smith, R. (2017). 'It's not fair': Policy discourses and students' understandings of plagiarism in a New Zealand university. *Higher Education*, 74(1), 17-32. doi: 10.1007/s10734-016-0025-9

Brunton, P. A., Ghazali, A., Tarif, Z. H., Loch, C., Lynch, C., Wilson, N., Blum, I. R. 2017. Repair vs replacement of direct composite restorations: A survey of teaching and operative techniques in Oceania. *Journal of Dentistry*. Advance online publication. doi: 10.1016/j.jdent.2017.02.010

Smith, L., Adam, L., Moffat, S., Meldrum, A., & Ahmadi, R. (2017). Undergraduate Bachelor of Oral Health student and educators' understandings of professionalism. *New Zealand Dental Journal*, 113(1), 4-10.

Lai, K.-W., & Smith, L. (2018). Socio-demographic factors relating to perception and use of mobile technologies in tertiary teaching. *British Journal of Educational Technology*, 49(3), 492-504. doi: 10.1111/bjet.12544

Lai, K.-W., & Smith, L. (2018). University educators' perceptions of informal learning and the ways in which they foster it. *Innovative Higher Education*. Advance online publication. doi: 10.1007/s10755-018-9434-2

Lai, K.-W., & Smith, L. A. (2017). Tertiary students' understandings and practices of informal learning: A New Zealand case study. *Australasian Journal of Educational Technology*, 33(2), 115-128. doi: 10.14742/ajet.2937

Raphael, S. L., Foster Page, L. A., Hopcraft, M. S., Dennison, P. J., Widmer, R. P., & Wendell Evans, R. (2018). A survey of cariology teaching in Australia and New Zealand. *BMC Medical Education*, 18, 75. doi: 10.1186/s12909-018-1176-4

Olson, H., Beckett, D., Moffat, S., Adam, L., & Tawse-Smith, A. (2018). Self-perceived stressors of Bachelor of Oral Health students and level of support in the oral health learning environment. *Journal of Dental & Craniofacial Research*, 3, (pp. 40). doi: 10.21767/2576-392X-C1-001

Senthilkumar, A., Adam, L., Loch, C., Howe, B. J., & Brunton, P. (2018). Challenges in clinical teaching investigated: Towards sustainable staff recruitment and retention in dentistry. *New Zealand Dental Journal*, 114(4), (pp. 185).

Dental Epidemiology & Public Health

Programme leader

Professor Murray Thomson

Deputy Programme Leader: Associate Professor Jonathan Broadbent

Programme overview

Our work has the two main strands of (1) dental epidemiological research and (2) dental health services research. In our dental epidemiological research, we study the occurrence, determinants and natural history of the common oral conditions. To do this, we employ a number of standard dental epidemiological approaches (most notably the prospective cohort study and the cross-sectional survey) and techniques. Our dental health services research (HSR) work is concerned with how the dental healthcare system works (including dental workforce research), and the extent to which users are benefitting from it. Key activities are measuring oral health outcomes and increasing understanding of how (and why) people use (or do not use) dental services. Our group also plays an important role in the development and epidemiological validation of self-report measures, working in collaboration with a number of overseas researchers.

Current research

Activity 1. Life-course research in oral health (the Dunedin Study)

Description: Prospective observational research into the natural history of oral health and disease in a representative birth cohort now in adulthood

Aim: Unprecedented information on the natural history of oral health and disease

Sources of funding: Health Research Council of New Zealand, National Institutes of Health (USA), Otago Medical Research Foundation

KEY PERSONNEL

Professor Murray Thomson
Professor John Broughton
Assoc Prof Jonathan Broadbent
Dr Lee Smith
Dr Susan Moffat
Assoc Prof Lyndie Foster Page
Ms Dara Shearer

Postgraduate student completions, 2017-18

DClinDent

Poppy Horne
Mohd Nor Hafizi Bin Mohd Ali
Nina Scott
Adlin Suhaimi
William Fogarty
Leonard Chia
Soo-Wee Ong

PhD

Norhasnida Nordin

Master of Health Science

Kay Hine Berryman

Master of Public Health

Deanna Beckett

Master of Community Dentistry

Ellen Johnson
Donna Kennedy Langley



The Dunedin Study Phase 45 team.

Collaborators

National

Dr Moira Smith (University of Otago Wellington)

Professor Ngaire Kerse (University of Auckland)

Raukura O Hauora Tainui

Waikato-Tainui College for Research and Development

Canterbury District Health Board

International

University of Adelaide

University of Melbourne

University of Toronto

McGill University

Osaka University

Universiti Malaya

Duke University

University of Michigan

University of North Carolina

GKT Dental Institute, UK

University of London

Sheffield University

Dundee University

University of Chile

Federal University of Pelotas, Brazil

University of Rio Grande do Sul, Brazil

Outcomes during 2017-18: Work in this area continues to attract international attention and to be published in the top international journals: 9 papers were published, and a number of conference presentations were made. We continued conducting the age-45 assessments, using funds from an HRC project grant. The funded aims of the dental research component for age 45 were to: (1) produce unprecedented information on the natural history of oral health and disease; (2) test hypotheses for genetic and environmental risk factors for chronic dental diseases; (3) identify treatable early-life antecedents of high-rate dental caries and periodontitis in adulthood; (4) quantify ageing of the teeth and dentition, and relate this to early life exposures to environmental factors, along with genetic factors; and (5) quantify the public health significance and financial burden of the cost of treating acute and chronic dental conditions through life.

Activity 2. Other dental epidemiological and clinical research

Description: Dental epidemiological and other studies in NZ and overseas.

Aims: Various – enhancement of the knowledge base for dental epidemiology, dental public health, and clinical practice. A key component of this work is our gerodentological research, which is growing in importance and scope as the dentate older population increases in size. Dr Moira Smith (UOW) and Professor Ngaire Kerse are key collaborators.

Sources of funding: Various, including NZ Ministry of Health, NZ Dental Research Foundation and the Health Research Council of NZ.

Outcomes during 2017-18: 25 papers were published.



Prof Murray Thomson and Dr Lee Smith.

Activity 3. Dental health services research

Description: Dental health services research in NZ, including ongoing, systematic dental workforce research, work on social accountability, barriers to oral health for Pacific adolescents, and access to orthodontic treatment for disadvantaged adolescents.

Aims: Enhancement of the knowledge base for dental public health and clinical practice.

Source(s) of funding: Various, including NZ Dental Research Foundation and the Health Research Council of NZ.

Work in this area uses both quantitative and qualitative approaches, and continues to be diverse and productive.

Outcomes during 2017-18: 33 papers were published (this total includes 1 dental educational research paper by our team which is included here because it did not fit the other categories).

Activity 4. Development of new dental epidemiological, clinical and health services researchers and research capacity

Description: Training of new researchers for NZ and the Asia-Pacific region.

Aim: to build research capacity in our field.

Outcomes during 2017-18: our successful postgraduate completions comprised 1 Doctor of Philosophy, 7 Doctors of Clinical Dentistry, and 3 Masters degrees. We are currently supervising 4 Doctors of Philosophy, 6 Doctors of Clinical Dentistry, and 5 Masters degrees. We also continue to informally mentor colleagues working in the wider health sector, both internationally and in New Zealand.



Prof John Broughton and Dr Mark Lawrence (Bay of Plenty District Health Board) at the 96th IADR General Session in London, July 2018.

Funding highlights

2018. Ministry of Health Oral Health Research fund. Estimating unmet dental need and associated resource utilisation costs, and exploring treatment funding options for dependent older New Zealanders. MB Smith (PI), W Leung, WM Thomson, GS Ting. \$42,649.

2018. Ministry of Health Oral Health Research fund. The barriers to, and facilitators for, maintaining oral health and hygiene among a cohort of 40 dentate older home-based residing people who require additional living support. L Smith (PI), MB Smith, WM Thomson. \$43,630.

2018. NIH (via University of Michigan). Phase II RCT of the effectiveness of silver diamine fluoride in arresting cavitated carious lesions. M Fontana (PI). \$39,474.

2017. NHMRC (Australia). Determinants of inequality in child oral health at school age – a prospective cohort study. Do GL (PI), Golley R, Ha D, Leary S, Manton D, Scott J, Thomson WM, Spencer AJ. AUD \$1,229,852.

2017. HRC Research partnerships for healthcare delivery. Barriers to treating tooth decay in children. With Foster Page LA, Whyman R, Anderson V, Keenan C. \$198,588. (Declined)

Key publications

In total, 66 papers and 2 book chapters were published in the peer-reviewed international scientific literature during the 2017-18 period (this does not include papers which were in press but did not have pagination assigned). In addition, 32 conference presentations were made, including including 4 keynote addresses.

Baker SR, Foster Page LA, Thomson WM, Broomhead T, Bekes K, Benson PE, del Carmen Aguilar-Diaz F, Do LG, Hirsch C, Marshman Z, McGrath C, Mohamed AR, Robinson PG, Traebert J, Turton BJ, Gibson BJ. Structural determinants and children's oral health: A cross-national study. *Journal of Dental Research* 97: 1129-1136 (2018).

Ballantyne PJ, Norris P, Parachuru VP, Thomson WM. Becoming a 'pharmaceutical person': medication use trajectories from age 26 to 38 in a representative birth cohort from Dunedin, New Zealand. *Social Science and Medicine Population Health* 4: 37-44 (2017).

Barazanchi A, Nabhani AL, Chen A, Smith M, Broadbent JM. Oral Health Care Needs Among Former Refugees of the war in Syria. *New Zealand Dental Journal* 114:3, 117-123 (2018).

Beckley AL, Caspi A, Broadbent JM, Harrington H, Houts RM, Poulton R, Ramrakha S, Reuben A, Moffitt TE. Association of childhood blood lead levels with criminal offending. *JAMA Pediatrics* 172: 166-173 (2018).

Cidro J, Maar M, Peressini S, Schroth RJ, Broughton J, Jamieson L, Lawrence HP. Strategies for Meaningful Engagement between Community-Based Health Researchers and First Nations Participants. *Frontiers in Public Health* 2017; 5: 138. (doi: 10.3389/fpubh.2017.00138).

Foster Page LA, Beckett D, Ahmadi R, Schwass DR, Leon de la Barra S, Moffat S, Meldrum A, Thomson WM. Resin infiltration of caries in primary molars in a community setting: 24-month RCT findings. *JDR Clinical & Translational Research* 2: 287-294 (2017).

Foster Page LA, Boyd DH, Fuge K, Stevenson A, Goad K, Sim D, Thomson WM. The effect of bitewing radiography on estimates of dental caries experience among children differs according to their disease experience. *BMC Oral Health* 18: 137 (2018). doi: 10.1186/s12903-018-0596-1.

He S, Thomson WM. An oral epidemiological comparison of Chinese and New Zealand adults in two key age groups. *Community Dentistry and Oral Epidemiology* 46: 154-160 (2018).

Moffat, S. M., Foster Page, L. A., & Thomson, W. M. (2017). New Zealand's School Dental Service over the decades: Its response to social, political, and economic influences, and the effect on oral health inequalities. *Frontiers in Public Health*, 5, 177. doi: 10.3389/fpubh.2017.00177

Moffat, S., Meldrum, A., Aitken, W., & Coates, D. (2017). The delivery of oral health messages by primary health care nurses. *New Zealand Dental Journal* 113(2), 4-9.

Reuben A, Caspi A, Belsky DW, Broadbent JM, Harrington H, Sugden K, Houts RM, Ramrakha S, Poulton R, Moffitt TE. Association of Childhood Blood Lead Levels With Cognitive Function and Socioeconomic Status at Age 38 Years and With IQ Change and Socioeconomic Mobility Between Childhood and Adulthood. *Journal of the American Medical Association* 317:12, 1244-1251 (2017).

Schwendicke F, Foster Page LA, Smith LA, Fontana M, Thomson WM, Baker SR. To fill or not to fill: A qualitative cross-country study on dentists' decisions in managing non-cavitated proximal caries lesions. *Implementation Science* 13: 54 (2018).

Shackleton N, Broadbent JM, Thornley S, Milne BJ, Crengle S, Exeter DJ. Inequalities in dental caries experience among 4-year-old New Zealand children. *Community Dentistry and Oral Epidemiology* 46: 288-296 (2018).

Shearer DM, Thomson WM, Cameron CM, Ramrakha S, Wilson G, Wong TY, Williams MJA, McLean R, Theodore RM, Poulton R. Periodontitis and multiple markers of cardiometabolic risk in the fourth decade: a cohort study. *Community Dentistry and Oral Epidemiology* 46: 615-623 (2018).

Shearer DM, Thomson WM, Mann J, Poulton R. Periodontitis is not associated with metabolic risk during the fourth decade of life. *Journal of Clinical Periodontology* 44: 22-30 (2017).

Smith, L., Adam, L., Moffat, S., Meldrum, A., & Ahmadi, R. (2017). Undergraduate Bachelor of Oral Health student and educators' understandings of professionalism. *New Zealand Dental Journal*, 113(1), 4-10.

Smith, L., Adam, L., Moffat, S., Meldrum, A., & Ahmadi, R. (2018). How do educators in one New Zealand undergraduate Bachelor of Oral Health course teach and nurture professionalism? *European Journal of Dental Education*, 22(2), e212-e220. doi: 10.1111/eje.12274

Thomson WM, Broder HL. Oral-Health-Related Quality of Life in children and adolescents. *Pediatric Clinics of North America* 65: 1073-1084 (2018).

Thomson WM, Smith MB, Ferguson CA, Kerse NM, Peri K, Gribben B. Oral health, cognitive function and dependency among New Zealand nursing home residents. *Gerodontology* 35: 185-191 (2018).

Tiwari T, Jamieson L, Broughton, J, Lawrence HP, Batliner TS, Arantes R, Albino J. Reducing Indigenous Oral Health Inequalities: A Review from 5 Nations. *Journal of Dental Research* 2018; 97: 869-877.

Molecular Microbiology

Programme leader

Associate Professor Brian Monk

Deputy Programme Leader: Associate Professor Geoffrey Tompkins

Programme overview

Molecular Microbiology research within the SJWRI encompasses microbiological investigations applied to a variety of disciplines relevant to Dentistry. These include endodontics, periodontics, implantology, cariology and treatment with antimicrobials, antifungal and antibacterial drug development, drug resistance, structural biology and microbial genomics. Research is primarily conducted in the Molecular Biosciences Laboratory, which in October 2018 relocated to a temporary facility in the ground floor of the Department of Biochemistry Building.

Major funding supporting research within the Programme during 2017-2018 came from the New Zealand Dental Research Foundation, the Ministry of Health Oral Health Research Fund, the New Zealand Health Research Council, the Marsden Fund, the Ministry of Business Innovation and Employment, the Catalyst Fund of the Royal Society of New Zealand, the Maurice and Phyllis Paykel Trust, the Fuller Scholarship, the SJWRI Sir Thomas Kay Sidey Postdoctoral Fellowship, Otago Innovation Ltd, the Otago Medical Research Foundation, KiwiNet, the Lottery Grants Board, the Otago Participatory Science Platform (supported by MBIE Curious Minds).

Current research

Structure-directed discovery of next-generation antifungals

Principal Investigators: Brian Monk, Mikhail Keniya, Rajni Wilson, Alia Sagatova

A paucity of structural information on existing antifungal targets and the emerging problem of antifungal resistance affect both medicine and agriculture. These problems are being addressed by overexpressing in yeast the azole drug target lanosterol 14 α -demethylase, the terbinafine drug target squalene monooxygenase, the echinocandin drug target glucan synthase and drug efflux pumps from the ATP binding cassette and major facilitator superfamilies. These constructs provide proteins for purification and structural resolution by X-ray crystallography plus key tools that enable targeted screens for antifungals and valuable tests of antifungal efficacy.

Since 2014 the group has deposited in the Protein Data Bank over 30 crystal structures of wild type and mutant lanosterol 14 α -demethylase from *Saccharomyces cerevisiae* in complex with a range of azole drugs and agrochemicals, plus the first crystal structures of a full-length lanosterol 14 α -demethylase from fungal pathogens (*Candida glabrata* and *Candida albicans*). This information is being used to design potent chimeric antifungals that combine the best attributes of existing antifungals and has enabled computer-based screens of large compound libraries in efforts to discover novel antifungals. Our research platform has also undertaken research on lanosterol 14 α -demethylase in other important and emerging fungal pathogens including the human pathogens *Aspergillus fumigatus*, *Cryptococcus neoformans* and *Candida parapsilosis* and the plant pathogens *Zymoseptoria tritici* and *Phakopsora pachyrhizi*.

KEY PERSONNEL

Associate Professor Vincent Bennani

Professor Richard Cannon

Dr Peter Cathro

Associate Professor Dawn Coates

Dr Gemma Cotton

Dr Nick Heng

Dr Ann Holmes (retired 2018)

Dr Mikhail Keniya

Dr Erwin Lamping

Dr Hee Ji Lee

Associate Professor Jonathan Leichter (retired 2018)

Professor Karl Lyons

Dr Li Mei

Dr Trudy Milne

Associate Professor Brian Monk

Dr Alia Sagatova

Dr Don Schwass

Associate Professor Geoffrey Tompkins

Dr Hamish Upritchard

Dr Rajni Wilson

Dr Mathew Woods

Postgraduate Students

Dina Abdelmoneim (PhD)

Zhen Dong (PhD)

Asrar Elahi (PhD)

Parham Hosseini (PhD)

Chitra Krishnan (PhD)

Golnoush Madani (PhD)

Yasmeem Ruma (PhD)

Syarida Safii (PhD, graduated 2018)

Amira Salem (PhD)

Shaikha Al Samahi (PhD)

Deepak Cheilappa (DClintDent)

James Millar (DClintDent)

Nurul Thiyahuddin (DClintDent)

Oswaldo Gonzales (MDS)

Joshua Donn (MS)

Summer and honours students

Lauren Allen (2017-18)

Bomi Aum (2018-19)

Danyon Graham (2017)

Anne Jude (2017-18, 2018-19)

Manish Kumar (2016-17, 17-18)

Hetal Shukla (2017-18)

Visiting researchers

Jasper James (2018-2019),
Universiti Kebangsaan
Malaysia, Kuala Lumpur

Associate Professor Michaela
Lackner (2018), Medical
University of Innsbruck, Austria

Dr Khoon Lim, CReaTE group,
Centre for Bioengineering and
Nanomedicine, UO Christchurch

Intramural collaborators

Dr Mihnea Bostina,
Department of Microbiology

Professor Kurt Krause,
Department of Biochemistry

Associate Professor Joel
Tyndall, School of Pharmacy

Dr Mihnea Bostina,
Department of Microbiology

Extramural collaborators

Associate Professor Marina
Bakri, University of Malaya

Dr Ariya Chindamporn,
Chulalongkorn University

Professor Gary Dunny,
University of Minnesota

Dr Edmund Fleischer,
MicroCombiChem, Germany

Associate Professor Maggie-Lee
Huckabee, Uni of Canterbury

Dr Anette Klinger,
MicroCombiChem, Germany

Professor Susumu Kajiwara,
Tokyo Institute of Technology

Professor Amarila Malik,
Universitas Indonesia

Associate Professor Alok Mitra,
University of Auckland

Dr David Musson, University of
Auckland

Dr Kyoko Niimi, Tokyo Institute
of Technology

Dr Masakazu Niimi, Tokyo
Institute of Technology

Professor David Perlin, Rutgers
University

Professor Rajendra Prasad,
Jawaharlal Nehru University

Associate Professor Jacinta
Santhanam, Universiti
Kebangsaan Malaysia

Dr Jan Schmid, Massey
University, Palmerston North

Professor Robert Stroud, UCSF

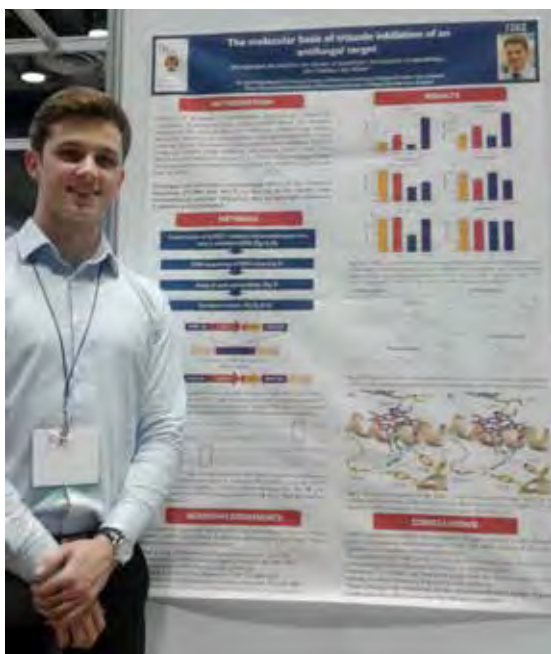
Dr Thomas Tomasiak,
University of Arizona



Visiting researcher Associate Professor Michaela Lackner and PhD students Yasmeen Ruma and Parham Hosseini discuss phenotypes obtained with recombinant yeast.

The group published 5 papers and a book chapter in 2017-2018. Our primary funding is a Health Research Council of New Zealand grant (2016-2019) entitled "Structure-directed discovery of next-generation antifungals", which built on a previous Marden Fund grant (2010-2015) and a Health Research Council of New Zealand grant (2013-2016). The Sir John Walsh Research Institute has supported the research of Thomas Kay Sidey Postdoctoral Fellow Alia Sagatova on squalene monooxygenase. This resulted in the expression and purification of this important antifungal target from yeast. The award of a Catalyst Fund grant supports collaboration with Associate Professor Michaela Lackner of the Medical University of Innsbruck (pictured above with PhD students Yasmeen Ruma and Parham Hosseini). This research is providing phenotypic and structure-based insight into the intrinsic azole resistance associated with the ancient mucormycete family of fungal pathogens.

Research collaborations have involved Associate Professor Joel Tyndall in the University of Otago School of Pharmacy, the laboratory of Professor Robert Stroud at UCSF (San Francisco), the combinatorial chemistry company MicroCombiChem (Wiesbaden, Germany) and Bayer AG Crop Protection Division (Monheim, Germany and Lyon, France).



BDS (Hons) student Danyon Graham presenting his summer student research at the 94th IADR General Session in Seoul, June 2016.



Above: Assoc Prof Brian Monk in the new temporary home for the Molecular Biosciences Laboratory in the Department of Biochemistry.

Fungal colonisation and drug-resistance

Principal investigators: Richard Cannon, Li Mei, Ann Holmes, Hee Ji Lee and Erwin Lamping

The increased incidence of infections caused by drug resistant microorganisms is a major global health concern. While the multidrug resistance of bacteria is most prominent, drug resistance of fungi is also of great concern. The main cause of high-level azole drug resistance in the most common oral fungal pathogens, *Candida albicans* and other non-*albicans* *Candida* species, is the over-expression of ATP-binding cassette (ABC) transporters that protect cells from azole antifungals. We have used our patented, and further optimised, *Saccharomyces cerevisiae* system for heterologously expressing membrane proteins to study *C. albicans* efflux pump Cdr1. In a project supported by the Marsden Fund, site-directed mutagenesis has been used to investigate the role of amino acids, particularly cysteines, in pump function. We have also used the expression system to study ABC efflux pumps from other important fungal species such as *Candida krusei*, *Candida utilis*, *Penicillium marneffeii*, and the *Fusarium solani* species complex. Other projects have i) identified the mutations increased ~100-fold expression of the major human multidrug efflux pump ABCB1 in our *S. cerevisiae* host and sequenced its entire genome; ii) created a functional, but cysteine-less, version of *C. albicans* Cdr1 for its structural characterization; and iii) studied the possible homo-dimerization of Cdr1 in live yeast cells.

Before organisms can cause oral infections, they must first colonise the oral cavity. Little is known about the range of fungal species and diversity of *C. albicans* strains that colonise people's mouths. We have used rDNA sequencing and multilocus sequence typing (MLST) to identify and investigate fungi colonising people with dentures, oral cancer and older people. Surface roughness of oral surfaces can facilitate oral colonization. We have investigated how interproximal reduction of teeth affects surface roughness and microbial adherence. Our group published 6 papers and 2 book chapters in 2017-2018. Our research has involved collaborations with Associate Professor Alok Mitra (University of Auckland), Dr Jan Schmid (Massey University, Palmerston North), Professors Lutz Schmitt and Holger Gohlke (Heinrich Heine University Düsseldorf, Germany), and recently with Associate Professor Jacinta Santhanam (Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia) and Professor Stefan Raunser (Max Planck Institute for Molecular Physiology, Dortmund, Germany).

Oral bacteriology

Principal investigators: Geoffrey Tompkins, Peter Cathro

Bacteria are involved in various diseases affecting the teeth and gingival tissues. Current projects in this group include: (i) development of new antimicrobials directed at the extremely alkaline-tolerant bacteria that cause root canal treatments to fail; (ii) evaluation of lasers to remove biofilms from dental implants; (iii) the involvement of dental plaque bacteria in the development of aspiration

pneumonia in stroke patients; (v) the effect of various antimicrobials, including chlorhexidine, and silver-based antimicrobials affect oral microbial ecology.

Developing novel antimicrobial agents for oral applications

Principal investigators: Dawn Coates and Gemma Cotton

Antibiotic resistance has become an increasing problem in clinical medicine. This team undertakes research on the development of novel antimicrobials for oral applications and as an adjunct to bone grafting materials. Research includes both chemically synthesised compounds and those derived from New Zealand native plants. Antimicrobial action, formulation, release profiles, molecular mechanisms of action, along with in vitro and in vivo trials on efficacy and compatibility are all conducted.

Microbial profiling and bacteria genome sequencing using next-generation DNA sequencing technology

Principal investigator: Nick Heng

The oral cavity of each human and animal harbours its own distinctive community of microbes, termed the "oral microbiota". The human oral microbiota alone is estimated to comprise over 700 species of microbes. Many species have long been associated with disease such as *Streptococcus mutans* (dental caries) and *Porphyromonas gingivalis* (periodontal disease). Bacterial profiling of oral samples from healthy or diseased participants using next-generation DNA sequencing technology have helped identify some species that may either contribute to disease progression or are associated with good oral health. This research group is also interested in revealing the genomic secrets of cultured species such as the antimicrobial-producing *Streptococcus salivarius* (from humans) and new oral streptococcal species isolated from other animals.

Development of tools to monitor probiotic bacteria using real-time quantitative PCR

Principal investigator: Trudy Milne and Nick Heng

Probiotic species are those that, when colonising humans or animals, are believed to confer beneficial effects on their hosts. Oral probiotics have been developed and are commercially-available to combat/prevent oral pathogens such as *Streptococcus mutans* (dental caries) and *Porphyromonas gingivalis* (periodontal disease). This research team is focused on developing real-time PCR probe sets to specifically detect particular probiotic species. These molecular tools would be useful in monitoring probiotic strains colonising their hosts and, in combination with next-generation DNA sequencing,

determine if they exert any influence on the oral microbiota.

Microbial biofilms

Principal investigators: Vincent Bennani and Li Mei

Most microorganisms live within biofilms and in the mouth these biofilms can cause diseases such as dental caries, periodontitis and peri-implantitis. We are interested in how biofilms form on oral surfaces including denture acrylic, implant titanium, and orthodontic appliances – and measuring how effective methods are for removing these biofilms. We have also investigated the use of *Streptococcal salivarius* strains as probiotics to inhibit the growth of oral pathogens and improve oral health in orthodontic patients.

Oral immunology

Principal investigator: Trudy Milne

Furthering our understanding in the area of immunopathogenesis of periodontal disease and the relationship between periodontal and systemic diseases will benefit clinicians. A study of periodontopathogens associated with periodontal disease and their ability to alter gene expression in various oral mucosal diseases, particularly oral lichen planus and squamous cell carcinoma is ongoing. We are also interested in the effect bacteria and Type 2 diabetes has on dental pulp vitality and healing. The group has published five papers in 2017-2018. Primary funding has been from the New Zealand Dental Research Foundation.

Funding highlights

Tools for drug discovery from an ancient fungal family. Catalyst Seeding Fund of the Royal Society of New Zealand. B.C. Monk and M. Lackner. \$80,000.

A pipetting robot. New Zealand Dental Research Foundation. H.J. Lee, R.D. Cannon and B.C. Monk. \$15,000.

Engineering yeast as an ideal expression host for human P-glycoprotein (ABC1). Otago Medical Research Foundation. E. Lamping and R.D. Cannon. \$15,000.

Drug resistance in the emerging fungal pathogen *Candida auris*. Maurice & Phyllis Paykel Trust. R.D. Cannon and E. Lamping. \$10,000.

Type2 diabetes – How do human pulp cells respond to glucose and lipopolysaccharides? New Zealand Dental Research Foundation. Lara Friedlander, Shaikha Al Samahi, Trudy Milne, Haizal Hussaini, Alison Rich. \$14,890.

Expression of vascular endothelial growth factor and associated pathways in oral squamous cell carcinoma. (2018) New Zealand Dental Dental Research Foundation. Haizal Hussaini, Harsha De Silva, Sajith Edirisinghe, Trudy Milne, Alison Rich. \$14,496.

Key publications

Monk, B.C., Keniya, M.V., Sabherwal, M., Wilson R.K., Graham, D.O., Hassan, H.F., Chen, D., Tyndall, J.D.A. (2018) Azole Resistance Reduces Susceptibility to the Tetrazole Antifungal VT-1161. *Antimicrobial Agents & Chemotherapy* 63(1). pii: e02114-18. doi: 10.1128/AAC.02114-18.

Our research platform provided key insights into azole resistance to a new investigation antifungal drug in clinical trials.

Keniya, M.V., Sabherwal, M., Wilson, R.K., Woods, M.A., Sagatova, A.A., Tyndall, J.D.A., Monk, B.C. (2018) Crystal Structures of Full-Length Lanosterol 14 α -Demethylases of Prominent Fungal Pathogens *Candida albicans* and *Candida glabrata* Provide Tools for Antifungal Discovery. *Antimicrobial Agents & Chemotherapy* 62(11). pii: e01134-18. doi: 10.1128/AAC.01134-18.

The first crystal structures of the full-length lanosterol 14 α -demethylases obtained from fungal pathogens.

Keniya, M.V., Ruma, Y.N., Tyndall, J.D.A., Monk, B.C. (2018) Heterologous Expression of Full-Length Lanosterol 14 α -Demethylases of Prominent Fungal Pathogens *Candida albicans* and *Candida glabrata* Provides Tools for Antifungal Discovery. *Antimicrobial Agents & Chemotherapy* 62(11). pii: e01131-18. doi: 10.1128/AAC.01131-18.

The development of an expression system allowing the production and phenotypic analysis of lanosterol 14 α -demethylases from two important fungal pathogens.

Caramalho, R., Tyndall, J.D.A., Monk, B.C., Larentis, T., Lass-Flörl, C., Lackner, M. (2017) Intrinsic short-tailed azole resistance in mucormycetes is due to an evolutionary conserved aminoacid substitution of the lanosterol 14 α -demethylase. *Scientific Reports* 7(1):15898. doi: 10.1038/s41598-017-16123-9.

The use of phenotypic information and structures obtained by homology modelling to understanding the intrinsic azole resistance of mucormycete pathogens.

Tanabe K., Bonus M., Tomiyama S., Miyoshi K., Nagi M., Niimi K., Chindamporn A., Gohlke H., Schmitt L., Cannon R.D., Niimi M., Lamping E. (2018) FK506 resistance of *Saccharomyces cerevisiae* Pdr5 and *Candida albicans* Cdr1 involves mutations in the transmembrane domains and extracellular loops. *Antimicrobial Agents and Chemotherapy* 63(1): e01146-18.

How the immunosuppressor FK506 inhibits fungal multidrug efflux pumps and how they become insensitive to FK506-inhibition.

Lamping, E., Zhu, J., Niimi, M. and Cannon, R.D. 2017. Role of ectopic gene conversion in the evolution of a *Candida krusei* pleiotropic drug resistance transporter family. *Genetics* 205(4): 1619-39.

Research highlight in the Genetics Society of America Genes to Genomes blog. This article describes how an entire multidrug efflux pump family of the fungal pathogen Candida krusei evolved, over 100s of millions of years, to combat antifungal attack.

Lamping, E., Madani, G., Lee, H.J., Niimi, M. and Cannon, R.D. 2017. Structure-function analyses of multidrug transporters. In *Candida albicans: Cellular and Molecular Biology*, Chapter 18: 379-406. 2nd Ed, R. Prasad. Springer International, ISBN 978-3-319-50409-4, doi: 10.1007/978-3-319-50409-4_18.

Invited book chapter summarizing our current understanding of the two major efflux pump super-families, MFS and ABC transporters, in the major human fungal pathogen, Candida albicans.

Cotton, G. C., Lagesse, N. R., Parke, L., & Meledandri, C. J. (2018). Antibacterial nanoparticles. In S. Hashmi, E. Bayraktar, G. Batalha, D. Brabazon, M. Buggy, I. A. Choudhury, ... C. Zavaglia (Eds.), *Reference module in materials science and materials engineering*. Elsevier. doi: 10.1016/B978-0-12-803581-8.10409-6.

Presentation of the synthetic methods, mechanism of action, and applications of inorganic nanoparticles as inherent antimicrobial agents.

Smith, M. M., Duncan, W. J., & Coates, D. E. (2018). Attributes of Bio-Oss® and Moa-Bone® graft materials in a pilot study using the sheep maxillary sinus model. *Journal of Periodontal Research*, 53(1), 80-90. doi: 10.1111/jre.12490.

Efficacy of regenerative bone scaffolds in an in vivo system, used in the development of the Silverbone project.

Cotton, G.C., Schwass, D.R., Duncan, W.J., Meledandri, C.J. Patent WO2017061878A1. Antimicrobial containing silver gel.

Cotton, G.C., Schwass, D.R., Meledandri, C.J. WO2018217104A1. Patent Glass ionomer cement containing silver nanoparticles.

Benn, A., Heng, N., Broadbent, J.M., Thomson, W.M. (2018) Studying the human oral microbiome: challenges and the evolution of solutions. *Australian Dental Journal* 63(1), 14-24. doi: 10.1111/adj.12565.

Grazia, S.E., Sumayah, S., Haiti, F.S., Sahlan, M., Heng, N.C.K., Malik A. (2017) Bacteriocin-like inhibitory substance (BLIS) activity of *Streptococcus macedonicus* MBF10-2 and its synergistic action in combination with antibiotics. *Asian Pacific Journal of Tropical Medicine* 10(12), 1140-1145. doi: 10.1016/j.apjtm.2017.11.001.

Heng, N.C.K., Yeh, C.-W., Malik, A. (2017) Draft genome sequence of *Weissella confusa* MBF8-1, a glucanase- and bacteriocin-producing strain isolated from a homemade soy product. *Genome Announcements* 5(4), pii: e01497-16. doi: 10.1128/genomeA.01497-16.

Hidayat, M.F.H., Milne, T., Cullinan, M.P., Seymour, G.J. (2017) Feasibility of the Salivary transcriptome as a novel biomarker in determining disease susceptibility. *Journal of Periodontal Research*. DOI:10.1111/jre.12522. *Journal of Periodontal Research* 49 (6) 817-826.

Al-Dujaili, M., Milne, T., Cannon, R.D., Farella M. (2018) Postnatal expression of chondrogenic and osteogenic regulatory factor mRNA in the rat condylar cartilage. *Archives of Oral Biology* 93, 126-132.

Parachuru V., Coates, D. Rich A., Milne T., Seymour G. (2018) FoxP3+ regulatory T-cells may play a more prominent role than IL17 in chronic inflammatory periodontal disease. *Journal of Periodontal Research*. DOI:10.1111/jre.12552

Jawadi, L.R., Parachuru, V.P.B., Milne, T., Seymour, G.J., Rich, A.M. (2018) Expression of IL33 and IL35 in oral lichen planus. *Archives of Dermatological Research*. 310(5):431-441. doi: 10.1007/s00403-018-1829-5.

Oral Molecular & Immunopathology

Programme leader

Professor Alison Rich

Deputy Programme Leader: Dr Lara Friedlander

Programme overview

Current information about cellular and molecular mechanisms involved in the pathogenesis of chronic oral diseases and in development and healing allows advancement of diagnostic and treatment modalities. Our group uses a range of cellular, molecular, immunological and pathological tools including cell culture, genomic and focused micro-arrays, real time PCR, laser microdissection and immunohistochemistry to investigate a range of dental and oral mucosal conditions. Of major interest is regulation of the microenvironment in oral squamous cell carcinoma (OSCC) with respect to local and nodal immune regulation, influences on local invasion, angiogenesis and the reaction to endoplasmic stress. Exosomes, membrane bound nanovesicles released by cells into their extracellular environment, contain potential biomarkers of OSCC. Salivary exosomes are easily accessible and we are investigating their extraction and identification. The interest in angiogenesis extends to pulpal tissues in terms of continued root development following pulp injury and the changes in angiogenesis in the pulp in people with diabetes.

Current research

Activity 1. Angiogenesis

Angiogenesis and pulp biology

The microvessel density (MVD) and spatial distribution of endothelial cells and angiogenic activity in immature and mature permanent teeth have been investigated using immunohistochemistry (IHC). Immature teeth were found to have a greater MVD and VEGF/VEGFR2 expression than mature teeth. The increased expression of these markers in the coronal region of both tooth types is important for pulp repair. Non-endothelial cells appear to have a functional role in contributing to angiogenesis.

KEY PERSONNEL

Staff

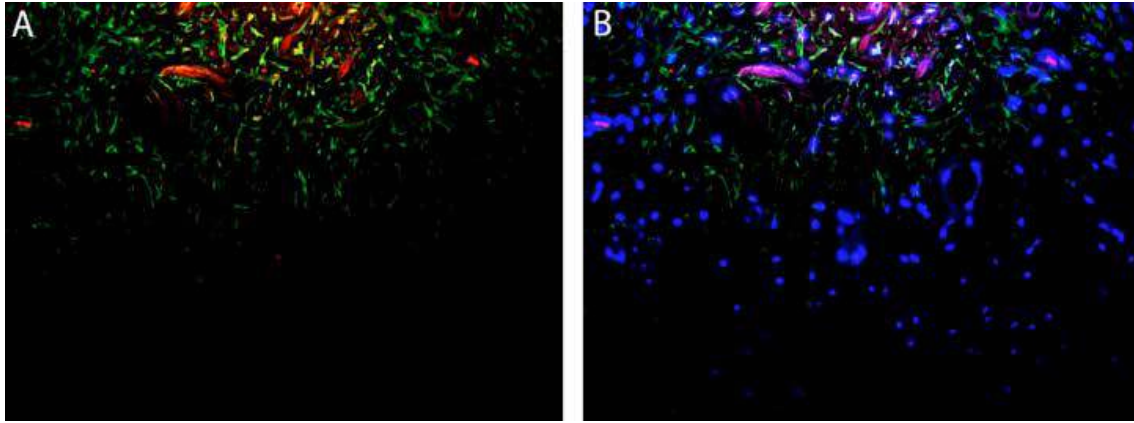
Associate Professor Dawn Coates
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Hina Narayan
Hitesh Navani
Aida Ngah
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Elizabeth Williams
Izyan Zainuddin



Members of the Oral Molecular and Immunopathology Programme (2019) with Dr Alexandra Tickle, Commercialisation Manager at Otago Innovation Ltd.



Double Immunofluorescence with vimentin and RAGE (receptor for advanced glycation end products) in the cell rich zone of the coronal pulp showing expression on fibroblasts which are positive for vimentin. Elsewhere in the body, RAGE leads to pro-inflammatory gene activation and is elevated in diabetes. This is part of the PhD project of Shaikha Al Samahi.

Effects of diabetes on angiogenesis in dental and oral tissues

Type 2 diabetes (T2D) is related to inflammatory responses and involves changes in markers that promote inflammation and those that suppress it. The first part of this study was to examine the expression and distribution of advanced glycation end products (AGE), the receptor (RAGE), inflammatory markers and immune cells using IHC in the pulps of normal uninflamed teeth in patients with T2D and normal controls.

The key learning points to date are as follows:

- T2D influences the morphology of the normal dental pulp with increased collagen deposition and reduced vascularity.
- T2D alters the immune response in the pulp which may impair healing
- T2D increased the expression of AGE, RAGE and the inflammatory markers in the pulp; these changes have been observed in other body sites.
- The general medical status of patients should be considered when making clinical decisions on the management of deep caries and vital pulp therapy.

This study will be broadened to investigate these markers in inflamed pulps. In addition, pulp tissue from extracted teeth will be used to grow primary cultures and the effect of different glucose conditions on fibroblast cell proliferation, migration following wounding, and the expression of genes associated with inflammation and healing will be examined.

Angiogenesis and oral squamous cell carcinoma

a) in primary OSCC

This research has shown an upregulation of VEGF, the main angiogenesis promoter in OSCC. In addition it has shown that angiogenic factors were expressed on epithelial cells as well as endothelial cells in OSCC. The findings offer an insight into upregulation of pro-angiogenic genes in oral cancer. In the future, anti-angiogenic therapies in OSCC could prove to be useful as an adjunct to conventional surgical and chemotherapeutic treatments.

International collaborations

Oral Cancer Research and Coordinating Centre (OCRCC), University of Malaya and MAHSA University, Malaysia
www.malaysiaoralcancer.org

Immune modulation in oral cancer, exosomes in oral cancer

Dr J-K Jung and colleagues, Kyungpook National University, Korea

Lymphangiogenesis in oral lichen planus

Dr M Weerasekera and colleagues, University of Sri Jayewardenepura, Sri Lanka
Joint projects investigating the role of Candida in oral carcinogenesis and vascular endothelial growth factor (VEGF) in oral cancer

b) in lymph nodes with metastases from OSCC

Two groups of formalin-fixed paraffin-embedded (FFPE) blocks were accessioned from the OCRCC, Malaysia; Group A comprised cervical lymph nodes with histologically confirmed metastatic deposits from primary OSCC (n=17) and Group B were cervical lymph nodes from patients with primary OSCC without metastatic deposits, (n=17). Immunohistochemistry showed significantly greater VEGF-C (marker associated with lymphangiogenesis) expression in Group A compared with Group B (p=0.0002). Significant positive correlation was found between VEGFC and TNM stage (p=0.004).

Lymphangiogenesis and oral squamous cell carcinoma

Lymphangiogenesis, the formation of new lymphatic vessels, is an essential process in normal growth and development and wound healing. The aim of this study was to investigate the differences, if any, in the expression profile of lymphatic markers and lymph vessel density (LVD) in OSCC in relation to non-specifically inflamed connective tissue (ICT) and normal oral mucosa (NOM) using IHC. The results established that the OSCC tumour microenvironment possessed significantly more lymphatic vessels expressing the lymphatic markers D2-40 and Prox-1 than the control groups. There was also higher expression of LYVE-1+ s in OSCC (compared with the ICT control tissue group). This increase in LVD may play a role in facilitating lymphatic invasion and later metastases. These molecular entities may serve as potential anti-oral cancer therapeutic targets or as potential prognostic markers.

Lymphangiogenesis in an immune-mediated lesion-oral lichen planus

Oral lichen planus (OLP) is a chronic inflammatory immune-modulated oral mucosal disease. As well as epithelial damage there is evidence that the local connective tissue environment is important in the evolution of OLP through the changes induced by chronic inflammation. Inflammatory cells secrete numerous cytokines and growth factors that alter the local fibrous tissue, blood vessels and possibly lymphatics. This study will determine the possible role of lymphangiogenesis in the pathogenesis of OLP by comparing the expression of lymphangiogenic markers in OLP groups with non-specifically inflamed oral mucosa. Clarification of the role of lymphangiogenesis in OLP may provide novel understanding on pathophysiology of OLP. Furthermore it may enhance understanding of the initial alterations towards malignant transformation of OLP, possibly leading the development of diagnostic markers and preventive drugs against malignant transformation of OLP by the modulation of lymphangiogenesis.

Activity 2. Endoplasmic reticulum stress and the unfolded protein response

• In a neoplastic model-oral squamous cell carcinoma

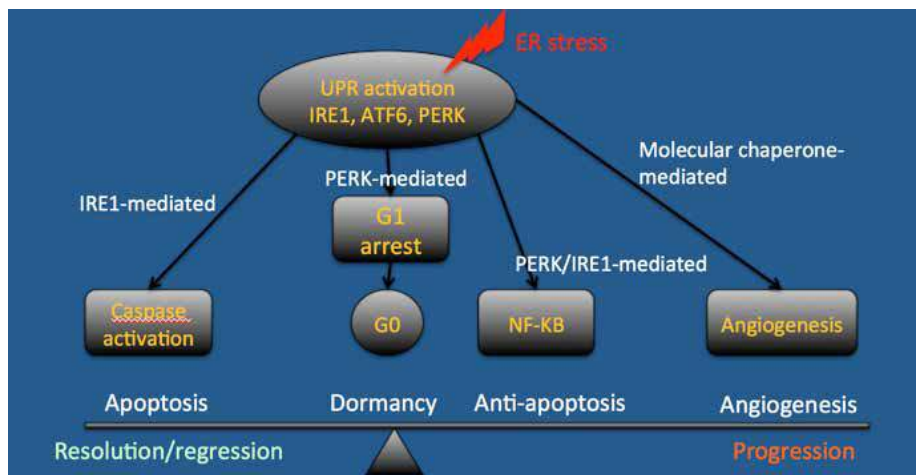
In this study we are investigating cellular stress pathways known as the unfolded protein response (UPR). These pathways are activated when the endoplasmic reticulum (ER), the protein-producing factory within the cell, is stressed. ER stress modulates UPR pathways, thus partially determining the cellular responses to disease. To investigate UPR in OSCC cell lines derived from normal, dysplastic and malignant oral keratinocytes were subjected to tunicamycin-induced ER stress of varying intensity and chronicity. OSCC cells maintained viability in the presence of ER stress at a significantly greater level compared to normal oral keratinocytes. Furthermore, caspase-3/7 activity and DNA fragmentation, hallmarks of cell death, were suppressed in OSCC. It was also discovered that UPR-induced apoptosis-related factors, most notably DDIT3, were significantly up-regulated in OSCC. Also, the master regulator of lipid metabolism, SREBP1, and CREB3L3, an ER-resident transcription factor closely related to ATF6, which plays an important role in linking ER stress with immune-inflammatory responses, were significantly up-regulated in OSCC. The identified factors should be further studied and validated *ex vivo* and, eventually, *in vivo*, in view of their potential diagnostic and prognostic role in improving the diagnosis, treatment and management of oral cancer.

• In relation to signalling pathways-STAT3

The molecule STAT3 is thought to lie at the centre of the mechanisms that affect cancer initiation, progression, and spread. Our objective in this project is to investigate the differential regulation of STAT3 pathway genes and proteins in oral cancer cell lines under induced cellular stress. This model will help us better understand the role of STAT3 pathways, and how cellular stresses in cancer modulate this pathway. The gene and protein regulation patterns showed that ER stress plays a role in immune-modulation in the tumour microenvironment in OSCC by up-regulating tumour-promoting cytokines.

• In relation to cell deformation

Orthodontic tooth movement occurs as teeth move through the surrounding bone following the application of appropriate force. This force results in mechanical loading, with remodelling of the bone and the connective tissue cells and fibres of the periodontal ligament (PDL). We intend to identify and profile the UPR genes expressed by PDL cells that are subjected to mechanical strain in order to examine ER stress markers and apoptosis. PDL cells have been obtained and cultured from premolar teeth that were removed for orthodontic reasons and



Outline of targeted UPR response in cancer which may promote or impede lesional progression. This was prepared by Benedict Seo as part of his PhD project.

will be used to assess the role of ER stress, the UPR, and apoptosis in mechanically strained PDL cells. This has clinical applications in the prevention of root resorption in association with acceleration of tooth movement.

Activity 3. Regulation of immune responses

- *In oral squamous cell carcinoma-regulatory T cells and various cytokines*

OSCC develops in an immune cell-rich environment, where inflammatory cells in the tumour microenvironment establish an anti-tumour response by secreting pro-inflammatory cytokines. At the same time the cancer cells may induce various mechanisms suppressing the anti-tumour response such as regulating a network of suppressive cytokines and the recruitment of suppressive Tregs. These escape mechanisms are seen at the local tumour site and similar mechanisms may also occur in regional lymph nodes (LN). In this project it was postulated that the escape of malignant oral keratinocytes from the primary site and their metastasis to regional lymph nodes is orchestrated by Tregs and their associated immune repertoire. Gene analysis studies demonstrated active regulation of T cell anergy and tolerance genes in primary OSCC and in metastatic lymph nodes. The immune suppression mechanisms were similar in lymph nodes with and without extracapsular (ECS) spread, though the suppression mechanism was stronger in lymph nodes with ECS.

- *In oral lichen planus*

The aim of these studies was to compare the numbers of cells expressing FoxP3 or IL-17 in OLP with non-specifically inflamed oral mucosa and to determine which cell types expressed FoxP3 and/or IL-17 and their distribution, using IHC and quantitative real-time reverse transcriptase

polymerase chain reaction (qPCR). The IHC results showed that the balance between Tregs and IL-17+ cells was altered in OLP, thus supporting the proposition that disturbance in local immune regulation is important in the pathogenesis of OLP. The observation that the IL-17+ cells were mast cells has not previously been reported in OLP and again raises questions about the role of mast cells in this condition. The gene expression experiments revealed a significantly higher expression of FoxP3 in OLP when compared to the controls. IL17 gene expression was not different between the groups. These findings suggest FoxP3+ Tregs have a more prominent role in the pathogenesis of OLP when compared to IL17+ cells.

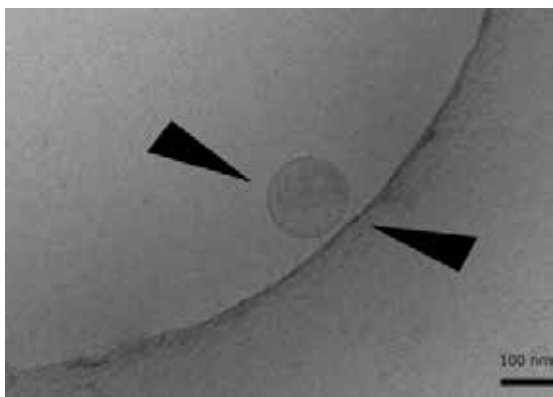
- *In relation to LOX family proteins and odontogenic tumours*

The lysyl oxidase family is a group of copper dependant enzymes comprising lysyl oxidase (LOX) and four enzymes known as lysyl oxidase-like (LOXL)1-4. The primary function of these enzymes is to crosslink collagens and elastin in the extracellular matrix thus stabilizing the matrix. In our study the LOX family proteins and genes showed differential patterns of expression in each odontogenic lesion examined. Significant reduction of LOXL3 was observed in ameloblastoma at both protein and gene levels. LOXL4 protein was overexpressed in the epithelium, but underexpressed in the connective tissue of ameloblastoma and odontogenic keratocyst. The examination of LOX family genes and proteins, in representative odontogenic tumours, will help deepen our understanding of the pathogenesis of these lesions and potentially lead to better patient management.

Activity 4. Exosomes in oral cancer

- *In squamous cell carcinoma*

In the first part of this study we developed methodology to extract and identify exosomes from oral cancer and normal oral keratinocyte cell lines. To extract exosomes from OSCC cells grown in culture ultracentrifugation and an exosome isolation kit (Exoquick TC plus) were used. The extracted vesicles were characterised with a Zetasizer which uses dynamic light scattering to determine the size of particles for the size range 0.6 nm to 6 µm, in addition to using Transmission electron microscopy. Having extracted an adequate number of vesicles and confirmed they were exosomes, we were then able to extract RNA from them. Having completed this baseline cell culture work and refined the techniques to be used going forward, we are now moving on to study exosomes in saliva and blood samples from patients with OSCC and normal controls using samples sourced from ORCCC.



Transmission electron microscopy image of an exosome from an oral cancer cell line. This is part of the PhD project of Mohammad Aziz.

Funding highlights

Analysing expression of heat shock proteins and oncogenes associated with cell cycle and proliferation within exosomes derived from oral cancers. M Aziz, B Seo, HM Hussaini, M Hibna, AM Rich. Funding: New Zealand Dental Association Research Foundation Grant 2018-2019. \$15,000

Type 2 diabetes – How do human dental pulp cells respond to glucose and lipopolysaccharides? LT Friedlander, S Al Samahi, T Milne, HM Hussaini, AM Rich. Funding: New Zealand Dental Association Research Foundation Grant 2018-2019. \$14,890

Expression of vascular endothelial growth factor and associated pathways in oral squamous cell carcinoma. HM Hussaini, HL de Silva, EAST Edirisinghe, T Milne, AM Rich. Funding: New Zealand Dental Association Research Foundation Grant 2018. \$14,496

The regulation of galectin- I and implications for epithelial – mesenchymal transitioning in oral squamous cell carcinoma. P Greer, D Coates, B Seo, HM Hussaini, AM Rich. Funding: New Zealand Dental Association Research Foundation Grant 2017-2018. \$14,584

Human papillomavirus in oral verrucal-papillary lesions: detection by polymerase chain reactions. EP Williams, D Coates, B Seo, HM Hussaini, AM Rich. Funding: New Zealand Dental Association Research Foundation Grant 2017-2018. \$13,542

Lymphangiogenesis in metastatic lymph nodes of oral squamous cell carcinoma. N Ibrahim, BL Seo, AM Rich. New Zealand Dental Association Research Foundation Grant 2016-2018. \$10,800.

IL33 and IL35 expression in healthy and diseased gingival tissues. VPB Parachuru, W Duncan, E Knight. New Zealand Dental Association Research Foundation Grant 2016-2018. \$14,988.

Investigation of the presence of human papillomavirus in verrucal-papillary lesions of the oral cavity and comparison of viral detection methods. E Williams, BL Seo, HM Hussaini, D Coates, AM Rich. New Zealand Dental Association Research Foundation Grant. 2016-2018. \$8,962.

Investigation of the role of lymphangiogenesis in oral lichen planus. J-Kjung, BL Seo, AM Rich. New Zealand Dental Association Research Foundation Grant 2016-2017. \$12,114.

Type 2 diabetes and inflammatory markers in dental pulp. L Friedlander, S Al Samahi, AM Rich, HM Hussaini, T Milne. Ministry of Health Oral Health Research Fund Grant 2016-2018. \$14,891.

Expression of STAT 3 and cytokines (IL22, IL23, Th17) within metastatic lymph nodes of oral squamous cell carcinoma. HM Hussaini, A Alkharusi, AM Rich. New Zealand Dental Association Research Foundation Grant 2015-2017. \$12,134.

The effect of mechanical strain on the unfolded protein response of periodontal ligament cells in a three-dimensional culture. FA Firth, B Seo, T Milne, M Farella. New Zealand Dental Association Research Foundation Grant 2015-2017. \$15,000.

Oral cancer cells under stress: The intertwined roles of cell stress and the dynamic signalling pathways. M Yakin, BL Seo, AM Rich: New Zealand Dental Association Research Foundation Grant 2015-2017. \$15,000.

Angiogenesis in the apical papilla of immature permanent

teeth associated with healthy and inflamed dental pulps. LT Friedlander, H Navani, AM Rich, T Milne, P Cathro. New Zealand Dental Association Research Foundation Grant 2015-2017. \$14,990.

Effect of cigarette smoke on TGF- β expression in oral tissues and cells. HM Hussaini, H Narayan, T Milne, AM Rich. Ministry of Health Oral Health Research Fund Grant 2015-2017. \$10,517.

In vitro effect of cigarette smoke on DNA methylation in oral epithelial cells. H Narayan, HM Hussaini, T Milne, AM Rich. Ministry of Health Oral Health Research Fund Grant 2015-2017. \$15,489.

Key publications

Al-Hassiny, A., Friedlander, L. T., Parachuru, V. P. B., Seo, B., Hussaini, H. M., & Rich, A. M. (2018). Upregulation of angiogenesis in oral lichen planus. *Journal of Oral Pathology & Medicine*, 47(2), 173-178. doi: 10.1111/jop.12665

Avadhani, A. V., Parachuru, V. P. B., Milne, T., Seymour, G. J., & Rich, A. M. (2017). Multiple cells express interleukin 17 in oral squamous cell carcinoma. *Journal of Oral Pathology & Medicine*, 46(1), 39-45. doi: 10.1111/jop.12465

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Ebbeling, S., Adam, L., Meldrum, A., Rich, A., McLean, A., & Aitken, W. (2018). Oral health and dental students' perceptions of their clinical learning environment: A focus group study. *Journal of Dental Education*, 82(10), 1036-1042. doi: 10.21815/JDE.018.102

Friedlander, L. T., Coates, D., Seymour, G., Cullinan, M., & Rich, A. M. (2018). Vascularity and VEGF/VEGFR2 signaling in the dentine-pulp complex of immature and mature permanent teeth. *European Endodontic Journal*, 3(3), 153-159. doi: 10.14744/ej.2018.07269

Hasmun, N. N. b., Drummond, B. K., Milne, T., Cullinan, M. P., Meldrum, A. M., & Coates, D. (2017). Effects of environmental tobacco smoke on the oral health of preschool children. *European Archives of Paediatric Dentistry*, 18(6), 393-398. doi: 10.1007/s40368-017-0308-6

Hussaini, H. M., Parachuru, V. P. B., Seymour, G. J., & Rich, A. M. (2017). Forkhead box-P3+ regulatory T cells and toll-like receptor 2 co-expression in oral squamous cell carcinoma. *Acta Histochemica*, 119(3), 205-210. doi: 10.1016/j.acthis.2016.12.005

Kazantseva, M., Hung, N. A., Mehta, S., Roth, I., Eiholzer, R., Rich, A. M., Seo, B., Baird, M. A., Braithwaite, A. W., & Slatter, T. L. (2017). Tumor protein 53 mutations are enriched in diffuse large B-cell lymphoma with irregular CD19 marker expression. *Scientific Reports*, 7, 1566. doi: 10.1038/s41598-017-01800-6

Milne, T. J. (2017). A protocol for the determination of the methylation status of gingival tissue DNA at specific CpG islands. In G. J. Seymour, M. P. Cullinan & N. C. K. Heng (Eds.), *Oral biology: Molecular techniques and applications: Methods in molecular biology* (Vol. 1537). (2nd ed.) (pp. 299-306). New York, NY: Humana Press. doi: 10.1007/978-1-4939-6685-1_17

Parachuru, V. P. B., Coates, D. E., Milne, T. J., Rich, A. M., & Seymour, G. J. (2018). FoxP3+ regulatory T cells, interleukin 17 and mast cells in chronic inflammatory periodontal disease. *Journal of Periodontal Research*. Advance online publication. doi: 10.1111/jre.12552

Seo, B., Hussaini, H. M., & Rich, A. M. (2017). Second opinion oral pathology referrals in New Zealand. *Pathology*, 49(3), 277-284. doi: 10.1016/j.pathol.2016.11.007

Yakin, M., Gavidi, R. O., Cox, B., & Rich, A. (2017). Oral cancer risk factors in New Zealand. *New Zealand Medical Journal*, 130(1451), 30-38.

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1961

The Walsh Building
opens to the public

The Walsh Building is opened by the Minister of Education, the Hon. Blair Tennant. The new building is an aid to training, treatment, and research in dentistry.



Staff research profiles



JOHN M. AARTS

BEd (WellTec) BHealSc DipDentTech DipTertTchg (CIT) MHealSc PGDipCDTech (Otago)

Senior Lecturer, Department of Oral Rehabilitation

John Aarts has a strong research platform based in removable prosthodontics, with a focus on biomechanical and patient outcomes. His research is focused on innovative developments in dentistry, and the relationship of the biological, mechanical, functional, and aesthetic elements. This research combines a number of different research disciplines from various areas including; clinical dentistry, biomaterials, physics, and biomimetics in dentistry.

Mr Aarts is a founding member of the Biomimetics Research Group, which investigates the materials and techniques used to mimic life. The Biomimetic Research Group has a strong history of publishing and it is currently involved in several collaborative projects with other researchers from within the University of Otago, international universities, and dental profession. Some of the research he has published has been in the areas of dental materials and clinical treatment techniques. His research relating to pressure generated during dental impression techniques is based on a modelling system that he was instrumental in developing. His research interests fit well with his research supervisor role for the Master of Dentistry (with endorsed in aesthetic dentistry) which has seen him supervise four students through to completion of their Masters research projects during 2017 & 2018.

Key publications 2017-18

Chu, J., Bennani, V., Aarts, J. M., Chandler, N., & Lowe, B. (2018). The effect of different geometric shapes and angles on the fracture strength of IPS e.max computer aided designed ceramic onlays: An in vitro study. *Journal of Conservative Dentistry*, 21(2), 210-215. doi: 10.4103/JCD.JCD_242_17

Chai, S. Y., Bennani, V., Aarts, J. M., & Lyons, K. (2018). Incisal preparation design for ceramic veneers: A critical review. *Journal of the American Dental Association*, 149(1), 25-37. doi: 10.1016/j.adaj.2017.08.031

Aarts, J. M., Jansen van Vuuren, W.-A., Withy, K. E., Choi, J. E., & Waddell, N. J. (2017). A pilot study on the influence of two reinforcing materials (glass fibre mesh and electro-spun nylon nano fibres) on the flexural strength of a heat-cured poly (methyl methacrylate) denture base resin. *New Zealand Dental Journal*, 113(3), 11-15.



LEE A. ADAM

BEd PhD PGDipArts (Otago)

Dental Education Support Officer, Faculty of Dentistry
Programme Leader, Dental Education Research

Dr Adam's research concentrates on teaching and learning in higher education. Specifically, her research focuses on how students' learning experiences and outcomes can be enhanced. Her researches students' experiences in higher education in order to gain insights into how policy and practices might be structured to encourage students' retention and success. Other research involves examining what teachers do, in order to identify how higher education teaching practices can be improved

Dr Adam's current research includes the following: academic integrity policies and processes and how they are understood; feedback processes in the clinical dental learning environment; dental students' stress, mood states, and wellbeing; the value of clinical placements in Australasian dental education; how to support students' development of academic literacies.

Key publications 2017-18

Ebbeling, S., Adam, L., Meldrum, A., Rich, A., McLean, A., & Aitken, W. (2018). Oral health and dental students' perceptions of their clinical learning environment: A focus group study. *Journal of Dental Education*, 82(10), 1036-1042. doi: 10.21815/JDE.018.102

The, A. J. M., Adam, L., Meldrum, A., & Brunton, P. (2018). Dental students' and staff perceptions of the impact of learning environment disruption on their learning and teaching experiences. *European Journal of Dental Education*, 22(3), 151-159. doi: 10.1111/eje.12293

Adam, L., Anderson, V., & Spronken-Smith, R. (2017). 'It's not fair': Policy discourses and students' understandings of plagiarism in a New Zealand university. *Higher Education*, 74(1), 17-32. doi: 10.1007/s10734-016-0025-9



JOSEPH S. ANTOUN

BDS DClinDent (Otago)

Senior Lecturer, Department of Oral Sciences

Dr Antoun's research focuses on craniofacial growth and development, dentofacial genetics, clinical orthodontic research, and patient-centred outcomes. He is also particularly interested in emerging digital technologies that can be used in clinical orthodontics and craniofacial research.

In the 2017-18 period, Dr Antoun was a primary/co-supervisor of several DClinDent theses which investigated (1) the effects of different adhesive removal methods on bacterial colonization around orthodontic brackets; (2) the 3D effects of orthodontic activations using a novel digital model; and, (3) role of genetic and psychological factors in self-reported orthodontic pain. These research projects were supported by grants from the New Zealand Dental Research Foundation (NZDRF) and the Education and Research Development Group (ERDG). The latter research project involved close collaboration with Prof Tony Merriman (Biochemistry)

Key publications 2017-18

Antoun JS, Mei L, Gibbs K, Farella M. (2018) The effect of orthodontic treatment on the periodontal tissues. *Perio 2000*. 2017;74:140-157.

Nichols GAL, Antoun JS, Fowler PV, Al-Ani AH, Farella M. (2018) Long-term changes in oral health-related quality of life of standard, cleft, and surgery patients after orthodontic treatment: A longitudinal study. *Am J Orthod Dentofacial Orthop*. Feb;153(2):224-231.

Al-Ani AH, Antoun JS, Thomson WM, Merriman TR, Farella M. (2017) Maternal Smoking during Pregnancy Is Associated with Offspring Hypodontia. *J Dent Res*. Aug;96(9):1014-1019.

Austin C, Antoun JS, Morgaine KC, Farella M. (2017) Accounts of bullying on Twitter in relation to dentofacial features and orthodontic treatment. *J Oral Rehabil*. 2017;44:244-250.



MOMEN A. ATIEH

BDS (Jordan) MSc (Manchester) DclinDent PhD (Otago)

Senior Lecturer, Department of Oral Sciences

Dr Atieh's research interests are in the fields of periodontology, oral implantology and evidence-based dental care. His research has resulted in publishing over 40 significant papers in peer-reviewed high-impact dental journals with the majority of them as first author and h-index of 21.

Dr Atieh has established international research collaboration by working with the Cochrane Oral Health Group as a lead author of one of the Cochrane reviews in Oral Implantology. Lead authors of Cochrane reviews are experts and well-trained reviewers on the methodology and the use of resources available at the Cochrane Collaboration. Dr Atieh's Cochrane research group come from different countries (New Zealand, Italy, Germany and United Arab Emirates). All his research team members are known for their efforts in addressing questions in the field of periodontology/oral implantology and raising awareness about the importance of evidence-based dental practice.

In the past two years, Dr Atieh's research has been presented at several international conferences such as the 9th conference of European Federation of Periodontology (EuroPerio 9) in Amsterdam and the International Team for Implantology (ITI) World Symposium in Basel. Dr Atieh has also been invited to act as a reviewer for five peer-reviewed high impact dental journals in the field of Periodontology and Oral Implantology.

Dr Atieh is currently conducting a randomized controlled trial comparing titanium-zirconium narrow (3.3 mm) with standard (4.1 mm) diameter dental implants for replacing single posterior missing teeth. He managed to secure a research grant of AUD \$220,000 from the International Team for Implantology (ITI) to fund his clinical research. Besides his research, Dr Atieh is involved in clinical tutoring and mentoring undergraduate/postgraduate dental student research.

Dr Atieh's high standard of research has been recently recognised by way of being nominated as a Fellow of the ITI.

Key publications 2017-18

Atieh, M. A., Alsabeeha, N. H. M., Tawse-Smith, A., & Duncan, W. J. (2018). Piezoelectric versus conventional implant site preparation: A systematic review and meta-analysis. *Clinical Implant Dentistry & Related Research*, 20(2), 261-270. doi: 10.1111/cid.12555

Payne, A. G. T., Alsabeeha, N. H. M., Atieh, M. A., Esposito, M., Ma, S., & Anas El-Wegoud, M. (2018). Interventions for replacing missing teeth: Attachment systems for implant overdentures in edentulous jaws (Review). *Cochrane Database of Systematic Reviews*, 10. doi: 10.1002/14651858.CD008001.pub2

Atieh, M. A., Tawse-Smith, A., Alsabeeha, N. H. M., Ma, S., & Duncan, W. J. (2017). The one abutment-one time protocol: A systematic review and meta-analysis. *Journal of Periodontology*, 88(11), 1173-1185. doi: 10.1902/jop.2017.170238



ABDULLAH BARAZANCHI

BDS DClinDent (Otago)

Lecturer, Department of Oral Rehabilitation

Dr Barazanchi's primary research interest is in field of 3D printing and digital workflow in dentistry. 3D printing is becoming increasingly common in dentistry due to its low energy and low material wastage. It bypasses physical limitations of manual or other automated techniques, some international dental laboratory already use the technology in their manufacture of dental prostheses. He is also interested in digital workflow where automated design and manufacturing procedures occur digitally with very minimal manual handling, theoretically reducing the human error involved with handling materials. In the field of digital dentistry, Dr Barazanchi first-authored a publication in the Journal of Prosthodontics which has become one of their top cited articles of the 2017-2018.

Dr Barazanchi also has interests in the area of public health, particularly that of oral health of refugee and immigrant populations in New Zealand with the aim of addressing inequalities in care and shaping future public health policies. This work has brought about several collaborations within other departments within the dental school as well as local connections to the Red Cross and Dunedin Hospital

Key publications 2017-18

Barazanchi A, Nabhani AL, Chen A, Smith M, Broadbent JM. (2018) Oral Health Care Needs Among Former Refugees of the War in Syria. *New Zealand Dental Journal*. 2018 Sep 1;114(3).

Barazanchi, A., Li, K. C., Al-Amleh, B., Lyons, K., & Waddell, J. N. (2017). Additive technology: Update on current materials and applications in dentistry. *Journal of Prosthodontics*, 26(2), 156-163. doi: 10.1111/jopr.12510



DEANNA BECKETT

MPH DPH (Otago) DipDentTherp (Wgtn)

Lecturer, Department of Oral Sciences

Deanna Beckett's principal research interests are in the fields of dental public health, dental health promotion, dental enamel defects and vitamin D deficiency, and dental therapy/oral health therapy education.

Ms Beckett is currently involved with a team investigating the dental consequences of vitamin D deficiency during pregnancy and infancy. In 2017 she completed her Master of Public Health degree investigating economic evaluation and oral health related quality of life measures for children. She won the 'Three Minute Thesis' competition at both departmental and regional levels, going on to win the 'people's choice award' at the national competition in Wellington.

Ms Beckett commenced her PhD in July 2018, and is investigating several aspects of intergenerational oral health using data from the Family Health History study, Dunedin Multidisciplinary Health and Disability Study, and the Next Generation Study.

Key publications 2017-18

Olson, H., Beckett, D.M., Adam, L.A., Tawse-Smith, A., Moffat, S.M. (2019). Self-perceived stressors of Bachelor of Oral Health students and implications for student support. *Focus on Health Professional Education: A Multi-Professional Journal* 20:36-49.

Foster Page, L., Beckett, D., Ahmadi, R., de la Barra, S., Moffat, S., Meldrum, A., Schwass, D., and Thomson, W.M. (2017). Resin infiltration of caries in primary molars in a community setting: 24-month RCT findings. *JDR Clinical & Translational Research*. Doi: 10.1177/2380084417699400



VINCENT BENNANI

DDS (Reims) Docteur de l'Université de Nice Sophia Antipolis CertAdvPros (Tufts) CertAdvImpl (Bordeaux)

Associate Professor, Department of Oral Rehabilitation

Associate Professor Bennani has two research themes linking his clinical interests and his biomaterials expertise. His research interests are focused on innovative techniques in dentistry, on new processing techniques such as 3D printing and Biomimetic in dentistry. "Biomimetic" in dentistry means to copy what is life-like. When restoring teeth, the goal is to return the tooth to its original form and function. This research group investigates the biomaterials and techniques used to achieve that goal.

During 2017 and 2018 Associate Professor Vincent Bennani further developed his interdisciplinary research nationally with the Department of Geology and Department of Chemistry at the University of Otago and internationally with the University of Aristotle, University of Thessaloniki (Greece), Tufts University in Boston (USA), Bordeaux University (France) and has established collaborative research with the University of Geneva, Switzerland, Department of Prosthodontics and Operative Dentistry, Division of Prosthodontics.

Coordinated by Associate Professor Vincent Bennani, the new Master of Dentistry with endorsement in aesthetic dentistry (MDent), launched at the University of Otago in 2017, has generated 4 research projects that have been completed successfully.

In 2018 the Biomimetic research group, co-founded by Associate Professor Vincent Bennani, has initiated research collaboration with Additive Manufacture Solutions Ltd (Supported by Fuji Xerox New Zealand), which are currently developing 3-D printed Direct Metal Laser Sintered dental appliances. In 2018 this research was awarded a research grant from the New Zealand Institute of Dental Technology.

Key publications 2017-18

D Ko, P Wong, S Ma, V Bennani, A Tawse-Smith. Implants with Subcrestal Angular Correction Platform: A Solution To Avoid Facial Screw Access In Implant Crowns In The Anterior Maxilla. *EC Dental Science* 2018, 17,5:1-5.

Chu J, Bennani V, Aarts J M, Chandler N, Lowe B. Effects of different geometric shapes and angles on the fracture strength of IPS E.max CAD ceramic onlays: an in vitro study. *J. Conserv. Dent* 2018, 21,2:210-15.

Sy Yin Chai, V Bennani, J Aarts, K Lyons. Incisal Preparation Design For Ceramic Veneers: A Critical Review. *J American Dent Assoc* 2017; <http://dx.doi.org/10.1016/j.adaj.2017.08.031>

Bennani V., Ibrahim H., Al Harthi L., Lyons K. The periodontal restorative interface: aesthetic considerations. *Periodontology* 2000, 2017, 74:74-101.



TANMOY BHATTACHARJEE

BSc MSC (Mumbai) PhD (HBNI)

Postdoctoral Fellow, Sir John Walsh Research Institute

Dr Bhattacharjee is a postdoctoral fellow on the UltraD3 (Ultrasonic Dental Diagnostic Device) project led by Professor Warwick Duncan and supported by funding from the Endeavour Fund (Smart Ideas) of the Ministry of Business, Innovation and Employment. His primary interest is in the application of physics techniques to biological problems. He has a keen interest in disease screening and diagnosis using spectroscopy and ultrasound, specifically relating to dental disease and cancer diagnostics. Dr Bhattacharjee has also applied spectroscopy to understand protein structure and dynamics, detect pathogens, tendon rupture, and evaluate photodynamic therapy. He has interests in writing new scripts and developing software to automate routine tasks and calculations. He has developed MATLAB and R based automated software for multivariate statistical analysis of large spectroscopic data sets. He is also interested in adapting ultrasound and spectroscopic tools for forensic applications.

Key publications 2017-18

Bhattacharjee, T. T., Castilho, M. L., de Oliveira, I. R., Jesus, V. P. S., Hewitt, K. C., & Raniero, L. (2018). FTIR study of secondary structure changes in Epidermal Growth Factor by gold nanoparticle conjugation. *Biochimica et Biophysica Acta: General Subjects*, 1862(3), 495-500. doi: 10.1016/j.bbagen.2017.11.009

Bhattacharjee, T. T., Nicodemo, M. C., Sant' Anna, L. B., Arisawa, E. A. L. S., & Raniero, L. (2018). Tendinopathy diagnosis and treatment monitoring using attenuated total reflectance-Fourier transform infrared spectroscopy. *Journal of Biophotonics*, e201700256. Advance online publication. doi: 10.1002/jbio.201700256

Bhattacharjee, T., Fontana, L. C., Raniero, L., & Ferreira-Strixino, J. (2018). In vivo Raman spectroscopy of breast tumors prephotodynamic and postphotodynamic therapy. *Journal of Raman Spectroscopy*. Advance online publication. doi: 10.1002/jrs.5360

Gomes, R. N. S., Bhattacharjee, T. T., Carvalho, L. F. C. S., & Soares, L. E. S. (2018). ATR-FTIR spectroscopy and μ -EDXRF spectrometry monitoring of enamel erosion caused by medicaments used in the treatment of respiratory diseases. *Microscopy Research & Technique*, 81(2), 220-227. doi: 10.1002/jemt.22970



DOROTHY H. BOYD

BDS (Edin) MDS (Otago) FDSRCS

Senior Lecturer, Department of Oral Sciences

Dorothy Boyd is a Specialist in Paediatric Dentistry. She currently runs a group specialist private practice as well as working part-time as a senior lecturer in the University of Otago. Originally from Northern Ireland, she completed BDS in Edinburgh, Primary Fellowship in Dublin, and Part 2 Fellowship with the Royal College of Surgeons of England. She moved with her family to New Zealand in 1998, and completed a Master's in Paediatric Dentistry (with distinction) at the University of Otago in 2000. She is enrolled in a PhD, investigating outcomes of dental treatment in primary oral health care with a focus on the Hall Technique for placing stainless steel crowns, and on children's self-reported pain and anxiety.

Key publications 2017-18

Boyd DH, Foster Page LA, Thomson WM. The Hall Technique and conventional restorative treatment in New Zealand children's primary oral healthcare - clinical outcomes at two years. *International Journal of Paediatric Dentistry* 2018;28:180-188.

Boyd DH, Foster Page LA, Thomson WM, Innes NP, Marshall D. A feasibility study of stainless steel crowns placed with the Hall Technique for primary molar carious lesion management in New Zealand primary oral health care. *New Zealand Dental Journal* 2017; 113: 14-21.



JONATHAN M. BROADBENT

BDS PhD PGDipComDent (Otago)

Associate Professor, Department of Oral Rehabilitation

Associate Professor Broadbent conducts research in dental epidemiology and dental public health. His work over the years has had considerable impact in socio-dental epidemiology, health services research and the oral health of older people. His work in the renowned Dunedin Study has contributed to new knowledge on oral conditions. His published output includes 72 papers in the peer-reviewed international scientific literature (with 2090 citations), and his Scopus h index is 26.

In 2017 Associate Professor Broadbent was awarded the Liley Medal by the Health Research Council of New Zealand. During the 2017-2018 period, he published 15 papers in the peer-reviewed international literature, along with one commentary article and an editorial.

Associate Professor Broadbent is active in supervision of research, and is currently supervising three DClintDent theses (Emma Morelli, Gracie Nichols, Simon Olliver), two PhD theses (Angela Benn, Deanna Beckett) and one MComDent thesis (Manisha Narsinh).

Since January 2017, he has been the scientific editor of the New Zealand Dental Journal. During 2018 he commenced acting as a guest editor for the Journal of the Royal Society of New Zealand, but will become an associate editor from January 2019. He is also a member of the editorial advisory board for Community Dentistry and Oral Epidemiology since October 2018). He is the president of the New Zealand Section of the International Association for Dental Research .

Key publications 2017-18

Shackleton N, Broadbent JM, Thornley S, Milne BJ, Crengle S, Exeter DJ. Inequalities in dental caries experience among 4-year-old New Zealand children. *Community Dentistry and Oral Epidemiology* doi:10.1111/cdoe.12364 (2018).

Beckley AL, Caspi A, Broadbent JM, Harrington H, Houts RM, Poulton R, Ramrakha S, Reuben A, Moffitt TE. Association of childhood blood lead levels with criminal offending. *JAMA Pediatrics* 172(2):166-173. doi: 10.1001/jamapediatrics.2017.4005 (2018).

Reuben A, Caspi A, Belsky DW, Broadbent JM, Harrington H, Sugden K, Houts RM, Ramrakha S, Poulton R, Moffitt TE. Association of Childhood Blood Lead Levels With Cognitive Function and Socioeconomic Status at Age 38 Years and With IQ Change and Socioeconomic Mobility Between Childhood and Adulthood. *Journal of the American Medical Association* 317:12, 1244-1251 (2017) doi:10.1001/jama:2017.1712.

Barazanchi A, Nabhani AL, Chen A, Smith M, Broadbent JM. Oral Health Care Needs Among Former Refugees of the war in Syria. *New Zealand Dental Journal* 114:3, 117-123 (2018)



JOHN R. BROUGHTON

CNZM ED JP(Ret.) BSc (Massey) BDS PhD PGDipComDent DipGrad (Otago)

Professor in Māori Health, Department of Oral Diagnostic and Surgical Sciences
(joint appointment with Department of Preventive and Social Medicine)
Associate Dean (Māori)

Professor Broughton's research activity has been concerned in the main with oranga niho or Māori oral health. He was the Principal Investigator for the tri-nation International Collaborative Indigenous Health Research Partnership Grant, "Reducing disease burden and health inequalities arising from chronic dental disease among Indigenous children: an early childhood caries intervention" conducted in New Zealand, Australia and Canada. Whilst the New Zealand data from this study is still in the process of being analysed a number of collaborative papers and conference presentations have been made. A Master of Health Science candidate, Kay Hine Berryman who was a member of this research team completed her degree in December 2018. Her thesis, "Early childhood caries (ECC): A Waikato-Tainui Kaupapa Maaori approach to reducing chronic illness dental decay amongst tamariki and mokopuna; He awa o Mokopuna oranga niho" was awarded with Credit. John Broughton was the principal supervisor. John is a member of the research team for the hauora Māori (Māori health) research project, Oranga Tu: Māori Men and Prostate Cancer which was funded in New Zealand by Movember, a global mens' health organisation. This project is investigating the pathways to health that Māori men have taken once they have been diagnosed with prostate cancer.

In 2017-18 Professor Broughton made 20 presentations, both verbally and as a poster, at conferences in New Zealand and overseas. Research activity was also extended to the arts with national recognition for original writing for the New Zealand theatre. Recent productions throughout New Zealand included: Homecoming, Hell and Bullets, Michael James Manaia, Nga Puke (The Hills) and The Private War Of Corporal Cooper. A number of his plays are studied as part of the drama curriculum in many New Zealand high schools.

A particular research achievement (2017-2018) was the following presentation:

Broughton, J.R. Māori Oral Health Brief of Evidence (WAI 2575 and WAI 1315) to the Waitangi Tribunal. Invited key note presenter, Turangawaewae Marae, Ngaruawahia, 16 October 2018.

This is a very important claim brought before the Waitangi Tribunal which was originally lodged in 2005 and therefore took 13 years to get to the Hearing. Broughton's Brief of Evidence was based on his 40 years of research into Māori oral health was 60 pages long. He was on the stand for 2 hours where he was questioned by the Tribunal and cross-examined by the Crown.

Key publications 2017-18

Tiwari, T., Jamieson, L., Broughton, J., Lawrence, H.P., Batliner, T.S., Arantes, R. and Albino, J. "Reducing Indigenous Oral Health Inequalities: A Review from 5 Nations." *Journal of Dental Research*. Article first published online: March 19, 2018 <https://doi.org/10.1177/0022034518763605>

Cidro, J., Maar, M., Peressini, S., Schroth, R.J., Broughton, J., Jamieson, L., and Lawrence, H.P. "Strategies for Meaningful Engagement between Community-Based Health Researchers and First Nations Participants." *Frontiers in Public Health*, June 2017, Volume 5, Article 138. doi: 10.3389/fpubh.2017.00138

Broughton, J.R. Māori Oral Health Brief of Evidence (WAI 2575 and WAI 1315) to the Waitangi Tribunal. Invited key note presenter, Turangawaewae Marae, Ngaruawahia, 16 October 2018.

Broughton, J.R. Michael James Manaia, Stage play in Southern Stage, Series Ed. D. O'Donnell, Playmarket, Wellington, 2018. Pages 153 – 242.



PAUL A. BRUNTON

BChD(Leeds) MSc PhD(Manc) FDSRCSEd FDSRCS FFGDP(UK)

Dean, Faculty of Dentistry (to July 2018)

Pro-Vice-Chancellor, Division of Health Sciences

Professor Brunton's research interests are primarily clinical and centred around clinical trials and translational research. Recent projects include modification of restorative filling materials to improve their therapeutic properties and multidisciplinary research with colleagues in diabetes centred around obesity. He has a track record in clinical and translational research having been involved in several multicentre international trials of restorative materials and whitening systems. Other ongoing research projects have also included craniofacial research notably around opening jaw forces and concussive brain injury and surveys in Oceania focussing on the repair versus the replaces of restorations.

Professor Brunton collaborates with academics, both in New Zealand, the USA, Europe and the UK. Current collaborations include the University of Massey in New Zealand, the University of Leeds, Birmingham, Cardiff and Kings College London in the UK, the National University of Athens in Greece and the Universities of Ohio and Michigan in the United States of America. He continues to actively collaborate with the Academy of Operative Dentistry.

In July 2018 Professor Brunton was appointed Pro-Vice-Chancellor of the Division of Health Sciences. He is delighted and honoured to head the Division which is New Zealand's leading provider of education and research in health and the biomedical sciences.

Key publications 2017-18

Falland-Cheung, L., Scholze, M., Lozano, P. F., Ondruschka, B., Tong, D. C., Brunton, P. A., Waddell, J. N., & Hammer, N. (2018). Mechanical properties of the human scalp in tension. *Journal of the Mechanical Behavior of Biomedical Materials*. Advance online publication. doi: 10.1016/j.jmbbm.2018.05.024

Lynch, C. D., Farnell, D. J. J., Stanton, H., Chestnutt, I. G., Brunton, P. A., & Wilson, N. H. F. (2018). No more amalgams: Use of amalgam and amalgam alternative materials in primary dental care. *British Dental Journal*, 225(2), 171-176. doi: 10.1038/sj.bdj.2018.538

Brunton, P. A., Loch, C., Waddell, J. N., Bodansky, H. J., Hall, R., & Gray, A. (2018). Estimation of jaw-opening forces in adults. *Orthodontics & Craniofacial Research*, 21(1), 57-62. doi: 10.1111/ocr.12215

Falland-Cheung, L., Waddell, J. N., Li, K. C., Tong, D., & Brunton, P. (2017). Investigation of the elastic modulus, tensile and flexural strength of five skull simulant materials for impact testing of a forensic skin/skull/brain model. *Journal of the Mechanical Behavior of Biomedical Materials*, 68, 303-307. doi: 10.1016/j.jmbbm.2017.02.023



RICHARD D. CANNON

BA PhD (Camb)

Professor, Department of Oral Sciences
Associate Dean (Research), Division of Health Sciences
Director, Sir John Walsh Research Institute

Professor Cannon is a molecular microbiologist who is primarily interested in how microorganisms cause oral diseases and how treatments for patients with these diseases can be improved. His research covers a number of themes, from oral microbial colonization and biofilm formation to the molecular mechanism of drug efflux pumps.

A major focus of his research is the drug resistance of human fungal pathogens. He has found that clinically significant fungal drug resistance is due to energy-dependent drug efflux from the cell. His research group has developed, and is using, a versatile protein expression system to study these efflux pumps in baker's yeast *Saccharomyces cerevisiae*. Professor Cannon has extended this study to investigate the anthelmintic resistance of parasitic nematodes that infect livestock. Other research is examining the oral environment with wireless probes and investigating the formation, and removal, of oral biofilms.

Professor Cannon collaborates with several national and international research groups to investigate efflux-mediated fungal drug resistance. He is working with Associate Professor Alok Mitra (University of Auckland) on a Marsden-funded project to obtain structural insights into *C. albicans* efflux pump Cdr1. Professor Cannon is also collaborating with Professor Susumu Kajiwara (Tokyo Institute of Technology, Japan), Dr Ariya Chindamporn (Chulalongkorn University, Bangkok, Thailand) and Associate Professor Jacinta Santhanam to study drug efflux pumps from the important fungi *Candida utilis*, *Penicillium marneffeii*, and *Fusarium solani* species complex. Professor Cannon continues to collaborate with SJWRI researchers investigating the oral environment with on-body telemetry, the colonization of the mouth by fungi, and the role of oral biofilms in caries and halitosis.

Key publications 2017-18

Tanabe, K., Bonus, M., Tomiyama, S., Miyoshi, K., Nagi, M., Niimi, K., Chindamporn, A., Gohlke, H., Schmitt, L., Cannon, R.D., Niimi, M. and Lamping, E. (2018) FK506 resistance of *Saccharomyces cerevisiae* Pdr5 and *Candida albicans* Cdr1 involves mutations in the transmembrane domains and extracellular loops. *Antimicrobial Agents and Chemotherapy* 2018 Dec 21;63(1). pii: e01146-18. doi: 10.1128/AAC.01146-18

Zhang, N., Wheeler, D., Truglio, M., Lazzarini, C., Upritchard, J., McKinney, W., Rogers, K., Prigitano, A., Tortorano, A.M., Cannon, R. D., Broadbent, R. S., Roberts, S., & Schmid, J. (2018). Multi-locus next-generation sequence typing of DNA extracted from pooled colonies detects multiple unrelated *Candida albicans* strains in a significant proportion of patient samples. *Frontiers in Microbiology*, 9, 1179. doi: 10.3389/fmicb.2018.01179

Choo, K. H., Lee, H. J., Knight, N. J., Holmes, A. R., & Cannon, R. D. (2017). Multilocus sequence typing (MLST) analysis of *Candida albicans* isolates colonizing acrylic dentures before and after denture replacement. *Medical Mycology*, 55(6), 673-679. doi: 10.1093/mmy/myw128

Lamping, E., Zhu, J.-Y., Niimi, M., & Cannon, R. D. (2017). Role of ectopic gene conversion in the evolution of a *Candida krusei* pleiotropic drug resistance transporter family. *Genetics*, 205(4), 1619-1639. doi: 10.1534/genetics.116.194811



PETER R. CATHRO

MDS PG Cert Tert T (Otago) PhD (Adel)

Senior Lecturer, Department of Oral Rehabilitation
Associate Dean (Clinical)

Dr Cathro's research underpins both endodontic (root canal) practice and clinical teaching. His PhD thesis was entitled *Proteomic analysis of Enterococcus faecalis cell membrane proteins under high alkaline stress conditions*. A seminal finding has been the identification of up and down-regulated proteins which now forms the basis of on-going investigations as a PhD project.

A current trend in Endodontics is the use of a more biological approach for the management of roots that have not fully developed due to infection, termed revitalisation. In order to facilitate research in this field, a suitable animal model is required. Dr Cathro proposed the use of sheep as a suitable model and this has formed the basis of a PhD which he co-supervised with three resulting publications.

The bleaching of stained teeth requires the use of toxic materials. Dr Cathro has been a supervisor in two DClintDent projects investigating the efficacy and safety of bleaching protocols.

Key publications 2017-18

Lee, R. J., Ratnayake, J., Veerasamy, A., Loch, C., Cathro, P., & Brunton, P. A. (2018). Demographics, practising arrangements, and standards: Survey among New Zealand dentists. *International Journal of Dentistry*, 2018, 7675917. doi: 10.1155/2018/7675917

Wang, S., Cathro, P., Heithersay, G., Briggs, N., Ratnayake, J., & Zilm, P. (2018). A colorimetric evaluation of the effect of bacterial contamination on teeth stained with blood in vitro: Evaluation of the efficacy of two different bleaching regimes. *Australian Dental Journal*, 63(2), 253-260. doi: 10.1111/adj.12604

Plutzer, B., Zilm, P., Ratnayake, J., & Cathro, P. (2018). Comparative efficacy of endodontic medicaments & sodium hypochlorite against *Enterococcus faecalis* biofilms. *Australian Dental Journal*, 63(2), 208-216. doi: 10.1111/adj.12580

Altai, M., Cathro, P., Broberg, M., & Richards, L. (2017). Endodontic regeneration and tooth revitalization in immature infected sheep teeth. *International Endodontic Journal*, 50(5), 480-491. doi: 10.1111/iej.12645



NICHOLAS P. CHANDLER

BDS PhD (Lond) MSc (Manc) LDSRCS FDSRCPSGlas FDSRCSEd FFDRCSI MRACDS

Professor, Department of Oral Rehabilitation

Professor Chandler is a specialist in endodontics with current interests in Practice Based Research and endodontic simulation. Projects involve the influence of educational information and delivery on patient understanding, managing elderly patients requiring endodontic treatment and the dental and general health of patients requiring root canal treatment. He is in the final stages of developing an improved model for teaching endodontic surgery.

Professor Chandler's 2017-2018 publications include papers in Seminars in Orthodontics, European Endodontic Journal, Australian Endodontic Journal, ENDO, New Zealand Dental Journal, Journal of Conservative Dentistry and British Dental Journal OPEN. Textbook contributions are Harty's Endodontics in Clinical Practice 2017 (chapters on Diagnosis and Root Canal Fillings) and Ingle's Endodontics 2018 (Vital Pulp Therapy).

Professor Chandler's collaborators include Dr Lara Friedlander within the Faculty of Dentistry, Dr George Bogen (now Brisbane), Professor Bun San Chong in London and Dr Alison Qualtrough in Manchester.

Key publications 2017-18

Russell, A.A., Chandler, N.P. & Friedlander, L.T. (2018) Crack formation following root-end preparations in roots with the butterfly effect. *European Endodontic Journal* 3:107-112.

Rajeevan, M., Chandler, N.P., Makhissi, J. & Chong, B.S. (2018) A survey of cone beam computed tomography (CBCT) use among endodontic practitioners in the UK. *ENDO (Lond, Engl)* 12:29-33.

Russell, A.A., Friedlander, L.T. & Chandler, N.P. (2018) Sealer penetration and adaptation in root canals with the butterfly effect. *Australian Endodontic Journal* 44:225-234.

Chandler, N., Gray, A. & Murray, C. (2017) Eyesight: a study of staff at a dental school. *British Dental Journal OPEN* (2017) 3: 17008.



JUNG EUN (JOANNE) CHOI

BDentTech(Hons) PhD (Otago)

Lecturer, Department of Oral Rehabilitation

Dr Choi conducts experimental and observational research in dental materials and oral sciences; 1) qualitative and quantitative analysis of the mechanical properties and failure mechanisms of restorative dental materials; 2) observational research in the oral environment using portable measurement systems; 3) studies to develop simulation systems to investigate pressure distribution in the oral environment and head injury.

In 2017-2018 Dr Choi was awarded \$189,800 in competitive research funding as Principal Investigator from funding bodies including Lottery Health Research, Cure Kids and the University of Otago. She has also developed a commercial research relationship with dental products company Hitem Co Ltd (Korea) to support research into the development of tooth-coloured shell crowns to treat dental caries in children.

In 2017 she was awarded the SJWRI Undergraduate Research Supervisor Award and Best Staff Poster Presentation at SJWRI Research Day.

Key publications 2017-18

Brooks T, Choi JE, Garnich M, Hammer N, Waddell JN, Duncan W, Jermy M (2018). Finite Element Models and material data for analysis of infant head impacts. *Heliyon*. 4: e01010. <https://doi.org/10.1016/j.heliyon.2018.e01010>

Choi JE, Ng TE, Leong C, Kim HS, Li P, Waddell N (2018). Adhesive evaluation of three types of resilient denture liners bonded to heat-polymerized, autopolymerized, or CAD-CAM acrylic resin denture bases. *Journal of Prosthetic Dentistry*. 120(5): 699-705.

Aarts JM., Jansen van Vuuren WA., Withy KE, Choi JE, Waddell NJ. (2017). A pilot study on the influence of two reinforcing materials (glass fibre mesh and electro-spun nylon nano fibres) on the flexural strength of a heat-cured poly (methyl methacrylate) denture base resin. *New Zealand Dental Journal*. 113(3), 11-15.

Choi JE, Lyons KM, Kieser JA, Waddell JN (2017). Diurnal variation of intraoral pH and temperature. *British Dental Journal Open*. 3:17015.



ANGELA CLARK

BSc (CLancs) MSc (Brad) PhD (Otago)

Lecturer in Forensic Biology, Sir John Walsh Research Institute

Dr Angela Clark is a forensic anthropologist with research expertise in bioarchaeology. Her research examines the social and cultural factors that influence human skeletal and dental development. This includes examining human adaptability and variability, to better understand how culture buffers or facilitates the stress response.

As an expert forensic anthropologist, Dr Clark has conducted casework for New Zealand Police, New Zealand Pathology Services, and Forensic Group Ltd. In 2018, she had the honour of participating in operation *Te Auraki* led by the New Zealand Defence Force. Dr Clark is particularly interested in establishing research projects in the emerging field of forensic bioarchaeology. The field examines the human skeleton as more than just biological, but how the bones and teeth are impacted by society and culture, and how this information can be used to empower forensic human identification.

Dr Clark is also interested in pedagogical research, particularly regarding the portrayal of forensic science in the media, and how this affects the ways in which forensic science is taught and learnt.

In 2018, Dr Clark advised on an honours dissertation, entitled *Returning Loved Ones: Geochemical Alteration in Bone and Teeth After Exposure to the Extreme Temperatures of a Fire* (2018). This thesis was motivated by the inability to formally identify four victims of the fire in the CTV building resulting from the 22 February 2011 Caterbury earthquake. The dissertation by Georgia McLeod examined whether oxygen isotopes can aid in the assessment of geographically origin or deceased individuals from fire.

Key publications 2017-18

Clark A.L. (2018) Physiological Stress. In: Trevathan W, Cartmill M, Dufour D, Larsen CS, O'Rourke D, Rosenberg K, et al., editors. *The International Encyclopedia of Biological Anthropology*. Hoboken, NJ, USA: John Wiley & Sons. doi:10.1002/9781118584538

Clark, A.L., King, C.L., Buckley, H.R., Collins, C.J., Dhavale, N., Elliott, G.E., Gosling, A., Halcrow, S.E., Ivory, B., Matisoo-Smith, E., McDonald, S.K., Stantis, C., Tromp, M., Ward, S., and West, K. (2017) Biological anthropology in the indo-pacific region: new approaches to age-old questions. *Journal of Indo-Pacific Archaeology*. 41: 78-94.



DAWN E. COATES

BSc PhD (Otago)

Research Associate Professor, Department of Oral Diagnostic and Surgical Sciences

Dr Coates undertakes research into the cellular and molecular mechanisms involved in tissue growth and remodeling in relation to dental health and disease. She has particular expertise in the process of angiogenesis, with over 20 years of experience working in this field. Current angiogenesis research has been in relation to bisphosphonate-related osteonecrosis of the jaw.

Stem cell research continues to be a major focus with projects investigating adipose, periosteum and dental pulp stem cells for tissue regeneration. She also conducts research using deer antler as a mammalian model to investigate stem cell regulation. Dr Coates is currently developing the stem cell research theme to encompass the field of 3D-bioprinting. Other areas of research include: ER stress and the Unfolded Protein Response, oral squamous cell carcinoma, and osteogenesis.

The period 2017-2018 resulted in 8 papers published in peer-reviewed journals and 2 book chapters. She received 6 new grants with \$200k of funding. Invited lectures were given at the University of Western Australia and the University of Malaya. Dr Coates gave the opening Plenary lecture at the International Symposium on Antler Science and Product Technology (China), and talks at the Dental Faculty Research Days and the DINZ annual conference. Students won travel awards, poster competitions and presentation awards.

In 2018 Dr Coates was awarded the Sir John Walsh Strategic Research Prize for a project centred around bioprinting of dental stem cells. She was involved in 2 PhD completions and has 5 current PhD students. A DClinDent research program was completed by 1 student and she has 4 current students. Collaborations include: Key State Lab in Changchun, China; University of Malaya; CReaTE research group, University of Otago; Dr Musson, University of Auckland; Dr Hore, Anatomy Department, University of Otago.

Key publications 2017-18

Zanicotti, D.J., Coates, D.E., & Duncan, W.J. (2017) In vivo bone regeneration on titanium devices using serum-free grown adipose-derived stem cells, in a sheep femur model. *Clinical Oral Implants Research*, 28(1): 64-75. DOI: 10.1111/clr.12761.

Zhang, W., Chu, W., Liu, Q., Coates, D., Shang, Y., & Li, C. (2018) Deer thymosin beta 10 functions as a novel factor for angiogenesis and chondrogenesis during antler growth and regeneration. *Stem Cell Research & Therapy*, 9(1): 166. DOI: 10.1186/s13287-018-0917-y.

Smith, M.M., Duncan, W.J., & Coates, D.E. (2018) Attributes of Bio-Oss® and Moa-Bone® graft materials in a pilot study using the sheep maxillary sinus model. *Journal of Periodontal Research*. 53(1):80-90. DOI: 10.1111/jre.12490.

Parachuru V.P.B., Coates D.E., Milne, T.J., Rich A.M., & Seymour G.J. (2018) FoxP3+ regulatory T-cells may play a more prominent role than IL17 in chronic inflammatory periodontal disease. *Journal of Periodontal Research*, 53(4): 622-235. DOI: 10.1111/jre.12552.



GEMMA C. COTTON

BSc MSc (Lincoln) PhD (Otago)

Postdoctoral Fellow, Sir John Walsh Research Institute

Dr Cotton is a postdoctoral fellow on the Silverbone project led by Professor Warwick Duncan and supported by funding from the Endeavour Fund of the Ministry of Business, Innovation and Employment. Her research involves the use of nanotechnology in the formulation of antimicrobial biomaterials for healthcare applications, focused on dental materials such as restoratives, preventative and therapeutic gels, bone grafts, and prosthodontic materials for tissue regeneration.

Dr Cotton is interested in the development of representative *in vitro* methodologies covering antimicrobial assays and biofilm models, cell culturing, and material characterisation; this also includes imaging techniques such as confocal laser scanning microscopy, electron microscopy, and micro-CT.

She has an active involvement in translational research, where research and development can have direct applications for the needs of society. She is co-founder of Silventum Ltd with Dr Don Schwass and Dr Carla Meledandri (2017), and was awarded the KiwiNet New Zealand Emerging Innovator Award for her initiative 'Triple action membrane for periodontal healing' (April 2018).

Key publications 2017-18

Cotton, G. C., Gee, C., Jude, A., Duncan, W. J., Abdelmoneim, D., & Coates, D. (2019). Efficacy and safety of alpha lipoic acid-capped silver nanoparticles for oral applications. *RSC Advances*, 9(12), 6973-6985. doi: 10.1039/c9ra00613c

Cotton, G. C., Lagesse, N. R., Parke, L., & Meledandri, C. J. (2018). Antibacterial nanoparticles. In S. Hashmi, E. Bayraktar, G. Batalha, D. Brabazon, M. Buggy, I. A. Choudhury, ... C. Zavaglia (Eds.), Reference module in materials science and materials engineering. Elsevier. doi: 10.1016/B978-0-12-803581-8.10409-6

Cotton, G.C, Meledandri, C.J., Schwass, D.R., Duncan, W.J. inventors; 2017. Antimicrobial gel containing silver nanoparticles. Patent WO/2017/061878.

Cotton, G.C., Meledandri, C.J., Schwass, D.R., inventors; 2018. Glass ionomer containing silver nanoparticles. Patent WO/2018/217104.



HARSHA L. DE SILVA

BDS (S Lanka) MS (Colombo) FDSRCS FFDRCS

Senior Lecturer, Department of Oral Diagnostic and Surgical Sciences

Harsha De Silva's research interests include studying clinical and epidemiological aspects of maxillofacial trauma, oral cancer and practice trends in oral surgery in general dental practice. Ongoing collaborative research with two groups of colleagues in Sri Lanka has been investigating the impact of *Candida albicans* infection in the clinic pathological behaviour of Potentially Malignant Oral Disorders. This project was supported through a research grant awarded by the New Zealand Dental Research Foundation.

His second area of research interest focuses on trends in general dental practice to investigate how general dental practitioners perceive and apply current evidence in surgical management of dental patients with complex medical needs. Furthermore, research interests extend towards refinement of management protocols to enhance patient comfort in wisdom teeth surgery by studying the impact of different pain and anxiety control methods.

Key publications 2017-18

Best, A. D., De Silva, R. K., Thomson, W. M., Tong, D. C., Cameron, C. M., & De Silva, H. L. (2017). Efficacy of codeine when added to paracetamol (acetaminophen) and ibuprofen for relief of postoperative pain after surgical removal of impacted third molars: A double-blinded randomised control trial. *Journal of Oral & Maxillofacial Surgery*, 75(10), 2063-2069. doi: 10.1016/j.joms.2017.04.045

De Silva, N., Samanmali, R., & De Silva, H. L. (2017). Managing occupational stress of professionals in large construction projects. *Journal of Engineering, Design & Technology*, 15(4), 488-504. doi: 10.1108/JEDT-09-2016-0066

Hong, C. L., Lamb, A. W., Broadbent, J. M., De Silva, H. L., & Thomson, W. M. (2017). An update on New Zealand oral health practitioners' preparedness for medical emergencies. *New Zealand Dental Journal*, 113(4), 5-12.

Siddiqi, A., Niazi, M. I. K., De Silva, H., Firth, N., Konthasingha, P., & Zafar, S. (2017). Percutaneous exposure incidents: A review of practice and awareness of current protocols at a dental faculty. *Oral Surgery*, 10(4), e80-e87. doi: 10.1111/ors.12282



ROHANA K. DE SILVA

BDS (S Lanka) FDSRCPSGlas FFDRCSI FDSRCS

Associate Professor, Department of Oral Diagnostics and Surgical Sciences

A/Prof De Silva's research interests are in improving quality of life for people with dental and oral health problems, in particular dental implants to rehabilitate people with missing teeth, management of postoperative complications after oral surgery procedures, management of oral carcinoma and maxillofacial trauma.

In implant-related rehabilitation, A/Prof De Silva's aims are to establish the most cost-effective implant supported teeth in the shortest possible time following extractions. This work further expands into exploring new sites in the upper and lower jaws for placing dental implants as well as feasibility of using metal-free implants. He has performed several clinical trials and anatomical experiments with the support of postgraduate students. These include the use of special implants to restore mandibular molar teeth immediately after extraction, use of ceramic implants to stabilise full dentures and gross and micro-anatomical structure analysis of the human cadavers to examine the bone structure in the anterior palatal area to use as a novel implant site for implant placement.

Research activities in relation to the management of postoperative complications after oral surgery procedures involve management of pain and other complications associated with surgical removal of wisdom teeth and evaluation of the metabolism of some analgesics in the body. A/Prof De Silva has supervised a research project to identify the position of the lingual nerve in New Zealand European cadavers to minimise damage during the surgical removal of lower wisdom teeth, and other surgical procedures of the floor of the mouth.

He collaborates with the University of Peradeniya, Sri Lanka, on a project to predict the nodal metastasis in the patients with Oral Squamous cell carcinoma, with the production of valuable data and the publication of a first paper in 2018. With the Injury Prevention Research Unit of the University of Otago, he published a paper in 2017 on orbital wall reconstruction after traumatic injuries in NZ.

Key publications 2017-18

De Silva, R. K., Siriwardena, B. S. M. S., Samaranayaka, A., Abeyasinghe, W. A. M. U. L., & Tilakaratne, W. M. (2018). A model to predict nodal metastasis in patients with oral squamous cell carcinoma. *PLoS ONE*, 13(8), e0201755. doi: 10.1371/journal.pone.0201755

Payne, A. G. T., Tawse-Smith, A., Wismeijer, D., De Silva, R. K., & Ma, S. (2017). Multicentre prospective evaluation of implant-assisted mandibular removable partial dentures: Surgical and prosthodontic outcomes. *Clinical Oral Implants Research*, 28(1), 116-125. doi: 10.1111/clr.12769

Samaranayaka, C., Samaranayaka, A., Barson, D., & De Silva, R. K. (2017). Factors influencing trends in trauma-associated orbital cavity reconstruction procedures and time delay: New Zealand national data 2000-2014. *Trauma*, 20(4), 258-267. doi: 10.1177/1460408617719477

Best, A. D., De Silva, R. K., Thomson, W. M., Tong, D. C., Cameron, C. M., & De Silva, H. L. (2017). Efficacy of codeine when added to paracetamol (acetaminophen) and ibuprofen for relief of postoperative pain after surgical removal of impacted third molars: A double-blinded randomised control trial. *Journal of Oral & Maxillofacial Surgery*, 75(10), 2063-2069. doi: 10.1016/j.joms.2017.04.045



WARWICK J. DUNCAN

ED MDS PhD (Otago) FRACDS FICD MRSNZ

Professor, Department of Oral Sciences
Programme Leader, Clinical and Translational Research

Professor Duncan's primary research involves Periodontology and Dental Implantology. He conducts clinical testing of dental implants and periodontal treatment approaches in human clinical trials, and is active in preclinical testing using animal models. Professor Duncan's personal expertise includes clinical periodontics, implant surgery, hard-tissue histomorphometry, and leading multi-disciplinary research teams. He leads the regional team for forensic dental victim identification and is active in forensic research. He is also Regimental Colonel of the Royal New Zealand Dental Corps and has published research in military medicine. He has active collaborations with researchers in Switzerland, Malaysia and Korea, and in New Zealand with Callaghan Innovation and the Department of Medicine in the University of Auckland. He has conducted commercial research for many international dental implant companies and producers of maxillofacial grafting products and has active collaborations with several New Zealand biotech firms. At Otago, Professor Duncan collaborates with the Chemistry Department, Department of Anatomy (School of Biomedical Sciences), Christchurch Regenerative Medicine and Tissue Engineering (CReaTE) research group (Christchurch School of Medicine) and with his colleagues in the Sir John Walsh Institute.

Current research includes:

- Regeneration of bone to support titanium implants with different modified surfaces
- Novel bone grafting materials - biomechanical, In vitro and in vivo analyses
- Ultrasound diagnosis of periodontal and peri-implant diseases
- Adjunctive chemotherapeutics for treatment of periodontitis and peri-implantitis

During 2017-18 Professor Duncan successfully attracted \$357K in research funding for new projects, as well as continuing the two large MBIE-funded projects, "UltraD3: Ultrasonic Dental Diagnostic Device" project (\$1.38M) and the "Silverbone - unique antibacterial biomaterial" project (\$1.15M). During this time he published 11 papers, 1 book chapter and 5 conference abstracts, gave 3 media interviews, delivered 15 invited presentations, and supervised 7 doctoral candidates to completion.

Key publications 2017-18

Duncan W, Loch Santos De Silva C, Cotton G, Sharma A, Tompkins G, Schwass D, Meledandri C. Development of a novel animal model for testing antimicrobial agents against periodontitis and peri-implantitis. in: Contemporary Concepts in Periodontology and Implantology, PM Bartold, Young K, eds., Asian Pacific Society of Periodontology: Adelaide, (2018) pp77-95, ISBN: 978-0-646-98981-5.

Duncan, W. J., Greer, P. F. C., Lee, M.-H., Loch, C., & Gay, J. H. A. (2018). Wool-derived keratin hydrogel enhances implant osseointegration in cancellous bone. *Journal of Biomedical Materials Research Part B*, 106(6), 2447-2454. doi: 10.1002/jbm.b.34047

Godoy Zanicotti, D., Coates, D. E., & Duncan, W. J. (2017). In vivo bone regeneration on titanium devices using serum-free grown adipose-derived stem cells, in a sheep femur model. *Clinical Oral Implants Research*, 28(1), 64-75. doi: 10.1111/clr.12761

Smith, M. M., Duncan, W. J., & Coates, D. E. (2018). Attributes of Bio-Oss® and Moa-Bone® graft materials in a pilot study using the sheep maxillary sinus model. *Journal of Periodontal Research*, 53(1), 80-90. doi: 10.1111/jre.12490



MANIKANDAN EKAMBARAM

BDS (Dr MGR) MDS PhD (HK) FDSRCSEd MPaedDent (RSCEd) MRACDS

Senior Lecturer in Paediatric Dentistry, University of Otago

Dr Ekambaram's research expertise is in remineralisation of early enamel caries lesions, enamel and dentine adhesion, molar incisor hypomineralisation (MIH), and paediatric oral health.

Through his research, he has established a niche in experimental strategies for enhancing dentine bond durability, enhancing bonding to developmentally hypomineralised enamel, studying the remineralisation potential of various contemporary remineralisation agents on early enamel carious lesions. Additionally, his ongoing research projects are aiming at other novel experimental strategies to remineralise such lesions.

Dr Ekambaram has ongoing research collaborations with The University of Hong Kong and University of Western Australia. He is an Honorary Associate Professor at the Faculty of Dentistry, The University of Hong Kong.

Key publications 2017-18

Sardana D, Zhang J, Ekambaram M, Yang Y, McGrath CP, Yiu CKY. Effectiveness of professional fluorides against enamel white spot lesions during fixed orthodontic treatment: A systematic review and meta-analysis. *Journal of Dentistry* 2019; 82: 1-10.

Bijle MN, Ekambaram M, Lo EC, Yiu CKY. The combined enamel remineralization potential of arginine and fluoride toothpaste. *Journal of Dentistry* 2018; 76: 75-82.

Bijle MN, Yiu CKY, Ekambaram M. Can oral ADS activity or arginine levels be a caries risk indicator? A systematic review and meta-analysis. *Clinical Oral Investigations*, 2018; 22: 583-596.

Ekambaram M, Anthonappa RP, Govindool SR, Yiu CKY. Comparison of deproteinization agents on bonding to developmentally hypomineralized enamel. *Journal of Dentistry* 2017; 67: 94-101.



MAURO FARELLA

DDS (Naples) Dottore di Ricerca (Reggio Calabria) SpecOrthodontics (Naples) SpecMedStat (Milan)

Professor, Department of Oral Sciences

Deputy Director, Sir John Walsh Research Institute

Programme Leader, Craniofacial Research

Professor Farella's current main research interests include normal and abnormal craniofacial growth, clinical orthodontics, jaw function, and three-dimensional craniofacial imaging. In addition, he is a widely recognized expert in the pathophysiology of orofacial muscles, bruxism, and temporomandibular joint research.

Additional areas of his expertise include experimental design and randomized clinical trials in dentistry, craniofacial biomechanics, and the clinical evaluation of patient-centred interventions. Furthermore, he has introduced and developed, championed and supervised new research streams at the Faculty of Dentistry of the University of Otago, which include craniofacial genetics, translational craniofacial research using animal models, long-term monitoring of masticatory muscle activity and intra-oral pH, and use of oral appliances for the management of obstructive sleep apnoea in children.

In 2016-18, Professor Farella has published 20 full-length articles, and obtained 6 grants from various funding bodies, including Cure Kids, NZDA, and NZAO. He has been acting as main supervisor or co-supervisor of three PhD projects, fifteen DClinDent projects, two Honours projects, and four Elective undergraduate research projects. He has been appointed Associated Editor of the Journal Orthodontics and Craniofacial Research. He is on the Editorial Board of the Journal of Oral Rehabilitation and acts as reviewer for many international journals.

Professor Farella has served the Management Committee of the New Zealand Consortium for Medical Devices Technologies (MedTech Core) and the Steering Committee of the Research Theme *Pain@Otago* and the Management committee of the research network D4 (Diagnostics, Drugs, Devices and Discovery). He is also member of the Center for Bioengineering, of the Neuroscience Programme and of Genetics Otago.

Professor Farella has an ongoing collaboration with the University of Napoli Federico II (Italy), the University of Zurich (Switzerland), and the University of Witwatersrand (South Africa). Furthermore, he has collaborative projects at the University of Otago with the Department of Anatomy, the Department of Applied Sciences, the Department of Biochemistry, the Department of Chemistry, the Department of Human Nutrition, the Department of Computer sciences, the Department of Women's and Children's Health, the Department of Zoology, and the Otago Zebrafish Facility.

Key publications 2017-18

Al-Dujaili M, Milne TJ, Cannon RD, Farella M. Postnatal expression of chondrogenic and osteogenic regulatory factor mRNA in the rat condylar cartilage. *Arch Oral Biol.* 2018 Sep;93:126-132.

Idris G, Galland B, Robertson CJ, Gray A, Farella M. Mandibular advancement appliances for sleep-disordered breathing in children: A randomized crossover clinical trial. *J Dent.* 2018 Apr;71:9-17.

Al-Ani AH, Antoun JS, Thomson WM, Merriman TR, Farella M. Maternal Smoking during Pregnancy Is Associated with Offspring Hypodontia. *J Dent Res.* 2017 Aug;96(9):1014-1019.

Hutchinson EF, Farella M, Hoffman J, Kramer B. Variations in bone density across the body of the immature human mandible. *J Anat.* 2017 May;230(5):679-688.



LARA T. FRIEDLANDER

MDS PhD (Otago) FRACDS

Senior Lecturer, Department of Oral Rehabilitation

Dr Friedlander is a researcher within the Oral Molecular & Immunopathology, Clinical & Translational, and Dental Education research programmes. Her predominant area of interest is in endodontics, encompassing pulpal biology, healing, clinical research and endodontic curriculum development. A prominent theme is around the role of angiogenesis in pathology, permanent tooth development, healing and endodontic disease and the influence of systemic disease. Dr Friedlander is particularly interested in the influence of general health on oral health and in 2018 was awarded a competitive funding grant from the Ministry of Health to investigate the dental pulp of those with Type 2 diabetes. This basic research has facilitated Dr Friedlander's interest and development of translational clinical research and dental education.

Dr Friedlander is an active researcher in ARCH (Applied Research through Clinicians Hands), NZ's first dental practice based research network (PBRN). PBRNs involve research collaboration between private dental practitioners and academics to answer clinical questions and deliver research-led findings which are relevant to NZ healthcare. Dr Friedlander has led a number of PBRN projects and was awarded funding in 2018 to look at the endodontic needs in older adults and how general dentists are prepared for our enlarging older patient cohort. Ongoing PBRN projects are looking at the use of educational modes for improving patient perceptions and understanding of endodontics in practice.

Dr Friedlander supervises PhD, Clinical Doctorate students, BDS Honours students and summer research students to expand these research platforms and has been awarded substantial competitive funding grants associated with these as a principal or co-investigator. Projects during 2017-2018 have occurred within three main themes. In the Oral Molecular & Immunopathology group this has been around angiogenesis in tooth development, Type 2 diabetes and the pulp. Collaborators include Professor Alison Rich, Dr Trudy Milne, Dr Haizal Hussaini, Dr Hitesh Navani, Mr Ahmad Al-Hassiny, Ms Shaikhah AlSamahi, Professor Nick Chandler, Dr Assil Russell and Ms Lucy Prendergast. Dr Friedlander has international collaborations in pulp biology with Professor Ove Peters, Professor Gary Cheung and Professor Stephane Simone. Clinical collaborations have occurred with Dr Mike Morgan and Dr Denise Bailey (University of Melbourne), and Dr Jeff Ward (Evident PBRN) for the development of the ARCH network, and national collaborations have been established with interested general practitioners who have engaged with ARCH. Collaborative research is also occurring with Dr Ben Daniel (HEDC) to develop a blended learning for practitioners delivering clinical endodontics.

Key publications 2017-18

Friedlander LT, Coates D, Seymour GJ, Cullinan M, Rich AM (2018) Vascularity and VEGF/VEGFR2 signaling in the dentine-pulp complex of immature and mature permanent teeth, *European Endodontic Journal* 3, 153-159. doi: 10.14744/ej.2018.0063

Russell AA, Chandler NP, Friedlander LT (2018) Crack formation following root-end preparation in roots with the butterfly effect. *European Endodontic Journal* 3, 107-12. doi:10.14744/ej.2018.47965

Al-Hassiny A, Friedlander LT, Parachuru VPB, Seo B, Hussaini HM, Rich AM (2018) Upregulation of angiogenesis in oral lichen planus *Journal of Oral Pathology and Medicine* 47, 173-8. doi: 10.1111/jop.12665

Russell, A., Friedlander, L. and Chandler, N. (2017), Sealer penetration and adaptation in root canals with the butterfly effect. *Australian Endodontic Journal* 44, 225-234. doi:10.1111/aej.12238



GUANGZHAO (SIMON) GUAN

BDS MB ChB DclinDent (Otago)

Senior Lecturer, Department of Oral Diagnostic and Surgical Sciences

Dr Simon Guan is an Oral Medicine Specialist, with a special interest in oral diseases with systemic complications and systemic diseases with oral manifestations.

His main research interest is in oral cancer, particularly developing prognostic or predictive molecular markers that can be used for assessment of the severity of the disease, prognosis and therapy. His recent research activities are mainly focused on cell regulatory proteins, such as Cyclin D1 and hormone receptors, such as AR, ER α and ER β , in normal in normal oral mucosa, oral epithelial dysplasia, and OSCC with the aim of assessing the interrelationship between these proteins and also to determine their correlation with OSCC progression. The findings from these studies are expected to result in a better understanding of the pathogenesis and progression of OSCC. This may also provide potential evidence for the development of new targeted therapeutic strategies involving both Cyclin D1 and androgen/oestrogen receptors.

Key publications 2017-18

Bakr MM, Guan S, Firth N, Love RM. (2018) Cyclin D1 and P27KIP1: The Gatekeepers of Dysplasia. *J Immunological Sci.* 2(3): 30-39.

Guan G and Mei L. (2018) A Case Series: Zinc Deficiency as a Potential Contributor to Oral Dysgeusia. *Mod App Dent Oral Health.* 2(5) 2018. MADOHC.MS.ID.000146

Wilson E, Grant B, Tobin-stickings R, Hewthwaite H, Franklin G, Oh S, Guan S, Borowsk T, Thwaites K, Leaper T, Lee J, Jack S, Sopoaga F. (2018) Traditional medicine use in the Pacific community in Dunedin New Zealand. *Pacific Health Dialog.* 21(1):17-26.

Guan G, Bakr MM, Firth N, and R Love. (2018) Expression of cyclin D1 correlates with p27KIP1 and regulates the degree of oral dysplasia and squamous cell carcinoma differentiation. *Oral Surgery, Oral Medicine, Oral Pathology and Oral Radiology.* 26(2):174-183.



NICHOLAS C. K. HENG

BSc(Hons) PhD (Otago)

Senior Lecturer, Department of Oral Sciences

Dr Nick Heng's research expertise is in the field of molecular microbiology, specialising in the following areas:

- i. Bacterial and fungal genomics involving state-of-the-art DNA sequencing technologies and bioinformatics.
- ii. The use of next-generation DNA sequencing technology to investigate changes in the oral microbiota (oral microbial populations) in relation to oral health and disease.
- iii. Characterisation of antimicrobial proteins (bacteriocins) produced by (mainly) oral streptococci.

The scope of research conducted by Dr Heng's group during 2017-2018 included:

- i. Whole-genome sequencing (and bioinformatics) of bacterial and yeast species using the Pacific Biosciences SMRT ultra-long-read DNA sequencing platform,
- ii. Genomic characterisation of *Streptococcus equinus* and *Saccharomyces cerevisiae* in relation to bacteriocin production and UV-induced mutational studies, respectively; and
- iii. The analysis of Illumina short-read DNA sequence data to profile bacteriocin-producing streptococci.

Within the Faculty of Dentistry, Dr Heng currently has ongoing collaborations with Associate Professor Geoffrey Tompkins (Molecular Microbiology) and Dr Jithendra Ratnayake (Biomaterials) in relation to the microbiological aspects of cariology and biomaterials, respectively. In addition, he has ongoing research collaborations with (i) Professor A. Malik (Universitas Indonesia, Indonesia – bacterial genomics) and (ii) Professor J.R. Tagg (Blis Technologies – bacteriocins).

During 2017-2018, Dr Heng was awarded (as co-investigator) an Otago Medical Research Foundation grant (\$15,000) to develop yeast-based hosts for expression of genes encoding important human membrane (glyco)proteins. Two postgraduate students, Hassan Mohamed Ahmed and Aravind Parachuru Venkata, also graduated with their Doctor of Clinical Dentistry degrees.

Key publications 2017-18

Benn, A.M.L., Heng, N.C.K., Broadbent, J.M., & Thomson, W.M. (2018). Studying the human oral microbiome: challenges and the evolution of solutions. *Australian Dental Journal*, 63(1), 14-24. doi: 10.1111/adj.12565.

Grazia, S.E., Sumayyah, S., Haiti, F.S., Sahlan, M., Heng, N.C.K., & Malik, A. (2017). Bacteriocin-like inhibitory substance (BLIS) activity of *Streptococcus macedonicus* MBF10-2 and its synergistic action in combination with antibiotics. *Asian Pacific Journal of Tropical Medicine*, 10(12), 1140-1145. doi: 10.1016/j.apjtm.2017.11.001.

Heng, N.C.K., Yeh, C.W., & Malik, A. (2017). Draft genome sequence of *Weissella confusa* MBF8-1, a glucansucrase- and bacteriocin-producing strain isolated from a homemade soy product. *Genome Announcements* 5(4), pii: e01497-16. doi: 10.1128/genomeA.01497-16.

Seymour, G.J., Cullinan, M.P., & Heng, N.C.K. (2017). *Oral Biology: Molecular Techniques and Applications*, Second Edition. *Methods in Molecular Biology*, volume 1537, Springer Protocols, Humana Press, U.S.A.



HAIZAL MOHD HUSSAINI

BDS MDentSc (Leeds) PhD (Otago) FDSRCSEd

Senior Lecturer, Department of Oral Diagnostic and Surgical Sciences

Dr Hussaini is an oral pathologist with research interests in oral cancer. His research focus is in investigating immune responses in the tumour microenvironment of oral squamous cell carcinoma, particularly modulation of the immune system by cancer cells in the process of local invasion. This research interest began in 2007 with subsequent completion of his PhD thesis in 2013. Under the oral molecular and immunopathology research group, he has expanded his research area to look into immune tolerance in metastatic lymph nodes and early failure of our immune cells leading to pre-metastatic niche for oral cancer. He has received multiple grants mainly from the Otago Medical Research Foundation (OMRF) and the New Zealand Dental Association Research Foundation (NZDRF).

Over the 2017-2018 period, Dr Hussaini was co-supervisor of 3 PhD and 5 DClinDent students as well as assisting supervision of postgraduate and undergraduate from other dental specialty. His research during this period includes looking at angiogenesis in metastatic lymph nodes and myofibroblast in oral cancer progression and many other oral cancer related research. At international level, Dr Hussaini is the current councillor for the International Association of Oral Pathologist which assist international fellows in various diagnostic and research work.

Dr Hussaini has an international research collaboration with the Oral Cancer Research Coordinating Centre, Malaysia, a key research institute and oral cancer tissue bank in South East Asia. He is also a collaborator and assessor for malignant disorders, oral cancer and mucosal lesions screening programme in Cambodia and Malaysia. His has presented his research work in various platforms such as the International Association for Oral Pathologist (IAOP) and World Dental Federation (FDI). Currently, he is working closely with a pharmaceutical industry partner and the National School of Pharmacy, University of Otago in investigating the potential use of immunotherapy in various oral conditions.

Key publications 2017-18

Al-Hassiny, A., Friedlander, L. T., Parachuru, V. P. B., Seo, B., Hussaini, H. M., & Rich, A. M. (2018). Upregulation of angiogenesis in oral lichen planus. *Journal of Oral Pathology & Medicine*, 47(2), 173-178. doi: 10.1111/jop.12665

Chher, T., Hak, S., Kallarakkal, T. G., Durward, C., Ramanathan, A., Ghani, W. M. N., ... Hussaini, H. M., & Zain, R. B. (2018). Prevalence of oral cancer, oral potentially malignant disorders and other oral mucosal lesions in Cambodia. *Ethnicity & Health*, 23(1), 1-15. doi: 10.1080/13557858.2016.1246431

Hussaini, H. M., Parachuru, V. P. B., Seymour, G. J., & Rich, A. M. (2017). Forkhead box-P3+ regulatory T cells and toll-like receptor 2 co-expression in oral squamous cell carcinoma. *Acta Histochemica*, 119(3), 205-210. doi: 10.1016/j.acthis.2016.12.005

Saleh, A., Kong, Y. H., Haron, N., Aripin, S. F., Vadiveloo, M., Hussaini, H., ... Cheong, S. C. (2017). Oral cancer screening in private dental practices in a developing country: Opportunities and challenges. *Community Dentistry & Oral Epidemiology*, 45(2), 112-119. doi: 10.1111/cdoe.12266



LUDWIG JANSEN VAN VUUREN

BTechDent NatDipDentTech (Technicon Pretoria) MTechDent (Tshwane UT)

Senior Lecturer, Department of Oral Rehabilitation

Mr Jansen van Vuuren's research interests are the mechanical properties and microstructure of biomaterials and dental hard tissues. His current research aims to develop a bench-top simulation model that more accurately reflects the stresses generated as well as the response of substructures when dental restorations are in function. The findings of this work will provide dental clinicians and technicians with better advice on the design and reliability of all-ceramic crowns. Further to this, he is investigating the structure, microstructure and chemical composition of human and animal teeth, and relating the arrangement of these structures to their mechanical properties. With his current research on dental hard tissues, he is working with researchers within the Sir John Walsh Research Institute and collaborating locally with researchers from the Departments of Chemistry and Geology at the University of Otago.

During 2017-18, Mr Jansen van Vuuren's research activities have been focused on his PhD thesis research, which he is carrying out part-time in conjunction with his academic duties as a Senior Lecturer in Oral Rehabilitation and course convenor for Dental Technology. His PhD project is titled 'Development of a simulant model for clinically relevant testing of implant and natural tooth supported all ceramic restorations', and is supervised by Professor Warwick Duncan and Associate Professor Neil Waddell. Due to the relatively early stage of this PhD research, no publications have yet been produced from this work in the 2017-18 period.



WENDY-ANN JANSEN VAN VUUREN

BTechDent NatDipDentTech (Technicon Pretoria)

Lecturer, Department of Oral Rehabilitation

Mrs Jansen van Vuuren's research interests are in the field of mechanical properties and strength testing of dental bio-materials, with a focus on dental ceramics and indirect restorative materials. She conducts experimental and observational research investigating the structure and mechanical properties of bio-materials under different functional conditions. She is also interested in the field of Digital Dentistry and the impact thereof on the quality of Dental education. Wendy works with her colleagues in the Bio-materials research group within the Sir John Walsh Research Institute and is the main event organiser for the Dental Technology Research Conference, held every year in Dunedin.

Key publications 2017-18

Jansen van Vuuren, W.-A., Khoo, C. S. T., Ng, B. S. K., Waddell, J. N., & Al-Amleh, B. (2018). The effect of condensing on mechanical properties of feldspathic veneering porcelain. *New Zealand Dental Journal*, 114(1), 13-18.

Jansen van Vuuren, W.-A., Wong, P., Al-Amleh, B., Lyons, K. M., Li, K. C., & Waddell, J. N. (2018). Effect of a glaze layer on adhesion energy between resin cements to zirconia ceramic. *International Journal of Adhesion & Adhesives*, 84, 451-456. doi: 10.1016/j.ijadhadh.2018.03.003

Jansen van Vuuren, W.-A., Milmine, H., Al-Amleh, B., Lyons, K. M., & Waddell, N. J. (2017). Effect of multiple firings on the physical properties of a CAD/CAM produced lithium disilicate restorative material. *New Zealand Dental Journal*, 113(4), 31-38.

Aarts, J. M., Jansen van Vuuren, W.-A., Withy, K. E., Choi, J. E., & Waddell, N. J. (2017). A pilot study on the influence of two reinforcing materials (glass fibre mesh and electro-spun nylon nano fibres) on the flexural strength of a heat-cured poly (methyl methacrylate) denture base resin. *New Zealand Dental Journal*, 113(3), 11-15.



MIKHAIL V. KENIYA

Specialist (Hons) Kandidat Nauk (Rostov State) (equivalent to PhD)

Research Fellow, Department of Oral Sciences

Dr Keniya's has investigated mechanisms of microbial drug resistance and the structural biology of membrane transporters, based on his expertise in microbiology, protein chemistry, enzymology and molecular genetics.

He is a full-time associate investigator in the project "Structure-directed discovery of next-generation antifungals" (HRC of New Zealand grant 2016-2019, PI BC Monk). In part, this investigation is based on the discoveries made within the project "Multifunctional azoles: A triple whammy designed to defeat drug resistance" (Marsden Fund grant, 2011-2015, PI BC Monk) and HRC of NZ funded project: "Structure-directed antifungal discovery" (2013-2016, PI BC Monk). The research involves molecular biological, structural and genetic studies, with emphasis in creating yeast producer and tester strains that express functional drug targets from pathogenic fungi and screening scaffolds for novel azole inhibitors of lanosterol 14 α -demethylase.

In 2017-2018 Dr Keniya co-supervised two PhD candidates: Yasmeen Nazim Ruma (Project: Development of *Cryptococcus neoformans* and *Candida parapsilosis* CYP51s as drug targets) and Parham Hosseini (Project: Development of *Aspergillus fumigatus* CYP51 isoforms as drug targets). Work on co-expressing of drug targets (LDM and CPR) from agricultural pathogens *Z. tritici* and *P. pachyrhizi* was done in a research collaboration with Bayer AG, Monheim, Germany. The other collaborators are MicroCombiChem e.K, Germany, Professor DS Perlin (Rutgers University, USA) and Professor RM Stroud (UCSF, CA, USA).

In 2018 Dr Keniya trained visiting researcher Assoc. Prof. Michaela Lackner (Medical University of Innsbruck) on yeast microbiological and molecular-biological techniques and cell-based screening assays. This collaboration was funded by a Catalyst Fund Seeding grant: ("Tools for drug discovery from the an ancient fungal family" awarded to Assoc. Prof. Brian Monk). Dr Keniya participated in two conferences: 14th ASM Conference on *Candida* and Candidiasis (Providence, RA, USA) and NZMS-NZSBMB conference "Microbes & Molecules" with poster presentations. He co-authored 4 articles, and a book chapter.

Key publications 2017-18

Keniya, M. V., Ruma, Y. N., Tyndall, J. D. A., & Monk, B. C. (2018). Heterologous expression of full-length lanosterol 14 α -demethylases of prominent fungal pathogens *Candida albicans* and *Candida glabrata* provides tools for antifungal discovery. *Antimicrobial Agents & Chemotherapy*. Oct 24;62(11). pii: e01131-18. doi: 10.1128/AAC.01131-18.

Keniya, M. V., Sabherwal, M., Wilson, R. K., Woods, M. A., Sagatova, A. A., Tyndall, J. D. A., & Monk, B. C. (2018). Crystal structures of full-length lanosterol 14 α -demethylases of prominent fungal pathogens *Candida albicans* and *Candida glabrata* provide tools for antifungal discovery. *Antimicrobial Agents & Chemotherapy*. Oct 24;62(11). pii: e01134-18. doi: 10.1128/AAC.01134-18.

Monk, B. C., Keniya, M. V., Sabherwal, M., Wilson, R. K., Graham, D. O., Hassan, H. F., Chen, D., & Tyndall, J. D. A. (2018). Azole resistance reduces susceptibility to the tetrazole antifungal VT-1161. *Antimicrobial Agents & Chemotherapy*. Dec 21;63(1). pii: e02114-18. doi: 10.1128/AAC.02114-18.

Monk, B. C., & Keniya, M. V. (2017). Using yeast to discover inhibitors of multidrug efflux in *Candida albicans*. In R. Prasad (Ed.), *Candida albicans: Cellular and molecular biology*. (2nd ed.) (pp. 491-543). Springer. doi: 10.1007/978-3-319-50409-4



ERWIN LAMPING

DiplIng PhD (TU Graz)

Senior Research Fellow, Sir John Walsh Research Institute

Dr Lamping studies drug resistance mechanisms of human fungal pathogens and cancer cells with a particular emphasis on the structure and function of multidrug efflux transporters of the major human fungal pathogens *Candida albicans* (CDR1) and *Candida krusei* (ABC1; ABC11; ABC12) and of human cancer cells (ABCB1).

Over the past two years (2017-2018) he has published 3 research articles and one invited book chapter (two as first author), and co-authored 7 poster and 7 oral presentations, 6 of which were personally presented, to national (6) and international (8) scientific conferences and meetings. He was PI of two successful research grant applications to the Otago Medical Research Foundation (\$15,000; Engineering yeast as an ideal expression host for human P-glycoprotein ABCB1) and the New Zealand Dental Research Federation (\$5,696; NanoBRET a novel and versatile protein reporter technology for oral health research).

Dr Lamping co-supervised two PhD (Golnoush Madani and Jasper James), one DClindent (Nurulhuda Thiyahuddin) and two summer students (Manish Kumar and Bomi Aum) in the 2017-18 period. In 2018 Golnoush was awarded a prestigious DAAD post-graduate scholarship to learn cryo-EM at Prof Stefan Raunser's laboratory, Max-Planck-Institute of Molecular Physiology, Dortmund, Germany (October 2018 - April 2019), and Manish Kumar was runner up in the junior section of the Colgate poster competition at the 58th IADR ANZ conference in Perth, Australia, winning a trip to the IADR General Session in Vancouver in June 2019 where he was invited to present a poster of his research achievements.

In Oct-Nov 2018 Dr Lamping was invited as a Visiting Professor to the School of Bioresources and Technology, KMUTT, Bangkok, Thailand, which led to a MOU to establish collaborative relations between KMUTT and the Faculty of Dentistry, University of Otago, signed in December 2018, to promote friendship and mutually beneficial co-operations.

Key publications 2017-18

Tanabe, K., Bonus, M., Tomiyama, S., Miyoshi, K., Nagi, M., Niimi, K., Chindamporn, A., Gohlke, H., Schmitt, L., Cannon, R. D., Niimi, M., & Lamping, E. (2018). FK506 resistance of *Saccharomyces cerevisiae* Pdr5 and *Candida albicans* Cdr1 involves mutations in the transmembrane domains and extracellular loops. *Antimicrobial Agents & Chemotherapy*. Advance online publication. doi: 10.1128/aac.01146-18. IF 4.3; most cited *Pharmacology and Pharmacy journal*.

Lamping, E., Madani, G., Lee, H. J., Niimi, M., & Cannon, R. D. (2017). Structure-function analyses of multidrug transporters. In R. Prasad (Ed.), *Candida albicans: Cellular and molecular biology*. (2nd ed.) (pp. 379-406). Springer. doi: 10.1007/978-3-319-50409-4. *Invited book chapter*.

Lamping, E., Zhu, J.-y., Niimi, M., & Cannon, R. D. (2017). Role of ectopic gene conversion in the evolution of a *Candida krusei* pleiotropic drug resistance transporter family. *Genetics*, 205(4), 1619-1639. doi: 10.1534/genetics.116.194811, IF 4.1; 3 citations; 9th most cited *Genetics and Heredity journal*. *This article was a research highlight of the Genetics Society of America, and it received attention by the Royal Society of NZ, the University of Otago and the New Zealand Herald*.

Reis de Sá, L. F., Toledo, F. T., Gonçalves, A. C., Sousa, B. A., dos Santos, A. A., Brasil, P. F., Duarte da Silva, V. A., Tassis, A. C., Ramos, J. A., Carvalho, M. A., Lamping, E., & Ferreira-Pereira, A. (2017). Synthetic organotellurium compounds sensitize drug-resistant *Candida albicans* clinical isolates to fluconazole. *Antimicrobial Agents & Chemotherapy*, 61(1), e01231-16. doi: 10.1128/aac.01231-16. IF 4.3; 3 citations; most cited *Pharmacology and Pharmacy journal*.



CAROLINA LOCH SANTOS DA SILVA

BSc (FU Santa Catarina) MSc (FU Paraná) PhD (Otago)

Lecturer, Department of Oral Sciences

Dr Loch's research focuses on evolutionary oral biology and comparative dental morphology. She uses teeth to understand the biology, life history, evolution and interactions with the environment of fossil and recent mammal species. Comparative dental morphology and ultrastructure are some of the key components of her research.

Dr Loch has also been involved in projects that characterise dental hard tissues and new biomaterials using modern analytical techniques such as electron microscopy, biomechanical testing, geochemical analysis and micro-computed tomography.

Dr Loch was awarded the prestigious IADR ANZ Oral Biology Award in 2018 and the SJWRI Strategic Research Award in 2017. She published 10 papers in international journals in 2017-2018, and presented 15 papers at national and international conferences during this period. Her research has been featured in national and international media vehicles, including the Otago Daily Times, Dunedin TV, Huffington Post, Science Daily, and IFL Science. She has research collaborations in Europe (University of Kent, Université Bordeaux, University of Leicester), USA (Smithsonian Institution, New York Institute of Technology College of Osteopathic Medicine, Hampden-Sydney College), Australia (University of Adelaide School of Dentistry, South Australian Museum), and South America (Museo de Historia Natural de Santiago, CENPAT Argentina and Universidade Federal de Santa Catarina).

Since 2017, Dr Loch has been involved in successful research funding applications of more than NZD \$900,000 in total, including grants from the Leverhulme Fund (UK), Lottery Health Grant, University of Otago Research Grant, OMRF Laurenson Awards and the MBIE Unlocking Curious Minds fund. She is a Guest Editor for the JRSNZ Special issue in dental research to be published in 2020, and organized successful symposiums on dental education outreach during IADR meetings in Adelaide (2017) and London (2018). She is also the organizer and host for the Faculty of Dentistry Get Together Seminar series, and is the Otago convenor for the NZ Association for Women in Sciences.

Key publications 2017-18

Rovaris, K., Sousa Melo, S. L., Queiroz, P. M., Loch, C., Schwass, D. R., & Haiter-Neto, F. (2018). Beam hardening correction tool improves the diagnosis of incipient caries lesions in Micro-CT images. *Dentomaxillofacial Radiology*. doi: 10.1259/dmfr.20180123. *IF* = 1.84

Duncan WJ, Greer P, Lee MH, Loch C, Gay J. (2017) Wool-derived Keratin Hydrogel enhances implant osseointegration in cancellous bone. *Journal of Biomedical Materials Research: Part B - Applied Biomaterials*. *IF* = 3.37

Jett, J., Visser, I. N., Ventre, J., Waltz, J., & Loch, C. (2017). Tooth damage in captive orcas (*Orcinus orca*). *Archives of Oral Biology*, 84, 151-160. doi: 10.1016/j.archoralbio.2017.09.031. *IF* = 2.05

Loch, C., Grando, L. J., Meurer, M. I., Zastrow, M., Fernandes, A., & Simões-Lopes, P. C. 2017. Radiographic assessment of dental pathology and abnormalities in dolphins. *Zoological Science*, 34(4), 295-299. doi: 10.2108/zs160151. *IF* = 1.00



KARL M. LYONS

MDS PhD (Otago) CertMaxillofacialPros (UCLA) FRACDS

Professor of Restorative Dentistry, Department of Oral Rehabilitation

Head of Department, Department of Oral Rehabilitation (to March 2019)

Acting Dean, Faculty of Dentistry (from March 2019)

Professor Lyons has carried out clinical and in vitro research in dental tooth whitening, dental implants, microbial adhesion to dental obturator prostheses as well as ceramics and other dental materials, including CAD/CAM and 3D printing. His research has included collaborative research with postgraduate students including DClintDent and PhD students.

In 2017-18, Professor Lyons has undertaken collaborative work with Associate Professor Azam Ali from the Centre for Bioengineering and Nanomedicine, Department of Food Science, that has included the award of an HRC Explorer Grant for a project titled "No Drill No Fill". He has also carried out work on dental tourism with Professor Brent Lovelock from the Department of Tourism on a project that received support from a University of Otago Research Grant and which resulted in a publication in *Tourism Management*, with Professor Grigoris Polyzois from the University of Athens on the use of flexible dentures that resulted in a publication in the *New Zealand Dental Journal*, with Professor John Beumer from UCLA that includes co-authoring a number of book chapters for a second edition oral implant textbook that is also including contributions from a number of colleagues in the Faculty of Dentistry, and he co-edited a volume of *Periodontology 2000* that also included contributions from a number of colleagues in the Faculty of Dentistry.

Professor Lyons has co-supervised four DClintDent completions in 2017-18 and is currently supervising five DClintDent projects and one PhD project. He was also elected Vice President (President-elect) of the Australia and New Zealand Division of the International Association for Dental Research, and is also a member of Council for IADR.

Key publications 2017-18

Lovelock, B.A., Lovelock, K., and Lyons, K. (2018). The impact of outbound medical (dental) tourism on the generating region: New Zealand dental professionals' perspectives. *Tourism Management* 67 399-410; doi:10.1016/j.tourman.2018.02.001

Abduo, J. and Lyons, K.M. (2017). Interdisciplinary interface between fixed prosthodontics and periodontics. *Periodontology 2000* 74: 40-62; doi: 10.1111/prd.12189

Lyons, K.M., Egan, J., Polyzois, G., Lagouvardos, P., Kranjcic, J., and Vojvodic, D. (2018). Flexible removable partial denture prostheses: A survey of dentists' and clinical dental technicians' attitudes and knowledge in New Zealand. *New Zealand Dental Journal*. 114: 79-84

Beumer, J., Lyons, K.M., Jayanetti, J., and Sung, E.C. (2017). Chapter 21: Restoration of acquired oral defects with osseointegrated implants; pages 302-324. In *Evidence-based Implant Treatment Planning and Clinical Protocols* edited by Steve Sadowsky (ISBN 978-1-119-08003-9) Wiley-Blackwell, Ames, IA, USA



SUNYOUNG MA

BDS DclinDent (Otago)

Senior Lecturer, Department of Oral Rehabilitation

Dr Ma's research interest includes conducting clinical trials using different treatment modalities involving dental implants for patients especially in the older age group that need to replace their missing teeth. The main research outcome of interest includes biological success of the treatment as well as long-term clinical maintenance/complications issues for both clinicians and patients including any treatment impact on oral health related quality of life for these patients. Dr Ma is also the primary investigator evaluating the clinical stability of zirconia abutments in association with low-temperature degradation and wear at the titanium-zirconia implant-abutment interfaces.

With ongoing national and international collaborations in addition to previous successful research grants and continuous external research funding support, Dr Ma continues to produce research outputs (7 articles in peer-reviewed international journals and 11 conference abstracts/presentations in national/international research meetings) in the areas of oral implantology and gerodontology. Dr Ma has had multiple international invitations to present her research in these areas and is currently working on several book chapters specifically in the area of implant overdentures. She has supervised multiple undergraduate and postgraduate research projects (DclinDent candidate, Dr Maggie Chen completed in 2018 with two accepted manuscripts in the International Journal of Prosthodontics) and is actively involved as a reviewer for multiple international peer-reviewed journals and grant applications. Dr Ma was also the recipient of the 2018 SJWRI Undergraduate Research Supervisor Award.

Key publications 2017-18

Chew, M., Tompkins, G., Tawse-Smith, A., Waddell, J. N., Ma, S. (2018). Reusing titanium healing abutments: Comparison of two decontamination methods. *International Journal of Prosthodontics* 31, 613-618. (IF: 1.333)

Payne, A. G., Alsabeeha, N. H., Atieh, M. A., Esposito, M., Ma, S., Anas El-Wegoud, M. (2018). Interventions for replacing missing teeth: attachment systems for implant overdentures in edentulous jaws. *Cochrane Database Systematic Reviews* 10:CD008001. (cited 1 time)

Atieh, M. A., Tawse-Smith, A., Alsabeeha, N. H. M., Ma, S., Duncan, W. J. (2017). The "one abutment – one time" protocol: a systematic review and meta-analysis. *Journal of Periodontology* 88, 1173-1185. (IF: 2.844, cited 8 times)

Tawse-Smith, A., Ma, S., Duncan, W. J., Gray, A., Reid, M. R., Rich, A. M. (2017). Implications of wear at the titanium-zirconia implant-abutment interface on the health of peri-implant tissues. *International Journal of Oral & Maxillofacial Implants* 32, 599-609. (IF: 2.263, cited 6 times)



ALISON M. MELDRUM

BDS MDS (Otago)

Senior Lecturer, Department of Oral Sciences
Associate Dean (Undergraduate Studies)

Alison Meldrum's research interests include the oral health of pre-schoolers and looking at teaching and learning in the dental environment. With increasing demands on health funding evidence is needed on how to provide most appropriate care to help children to reach adulthood with healthy permanent dentitions. With the input from two students, who were the recipients of summer scholarships and other co-researchers we analysed student and staff questionnaire and interview responses to feedback in dental settings and the impact on environmental changes on student outcomes. Student stress and resilience and clinical placements are other areas that influence student learning and Alison, along with a number of other investigators, are involved in longitudinal projects investigating these issues.

Key publications 2017-18

Smith, L., Adam, L., Moffat, S., Meldrum, A., & Ahmadi, R. (2018). How do educators in one New Zealand undergraduate Bachelor of Oral Health course teach and nurture professionalism? *European Journal of Dental Education*, 22(2), e212-e220. doi: 10.1111/eje.12274

Ebbeling, S., Adam, L., Meldrum, A., Rich, A., McLean, A., & Aitken, W. (2018). Oral health and dental students' perceptions of their clinical learning environment: A focus group study. *Journal of Dental Education*, 82(10), 1036-1042. doi: 10.21815/JDE.018.102

The, A. J. M., Adam, L., Meldrum, A., & Brunton, P. (2018). Dental students' and staff perceptions of the impact of learning environment disruption on their learning and teaching experiences. *European Journal of Dental Education*, 22(3), 151-159. doi: 10.1111/eje.12293

Moffat, S. M., Meldrum, A. M., Aitken, W. A. E., & Coates, D. E. (2017). The delivery of oral health messages by primary health care nurses. *New Zealand Dental Journal*, 113(2), 4-9.



TRUDY J. MILNE

PhD (Qld UT) NZCS

Senior Research Fellow, Department of Oral Diagnostic and Surgical Sciences

Dr Milne's research continues in the area of immunopathogenesis with the hope of further understanding the relationship between periodontal and systemic diseases. Of particular interest periodontopathogens associated with periodontal disease. The link between periodontopathogens and poor dental outcomes for smokers and Type 2 diabetics patients is under investigation with the identification of associated angiogenic and inflammatory markers in dental pulp. Bone repair is also under examination with the employment a sheep bone healing model. Dr Milne has an ongoing interest in the development of a multiplex qPCR assays for the identification and numeration of specific oral bacteria. qPCR has recently been used to determine the numbers of periodontopathogens in the saliva samples collected from elderly stroke patient to examined a possible link between bacteria numbers and the development of aspiration pneumonia.

During 2017-2018 Dr Milne has co-supervised a number of students on a number of collaborative projects, including DClinDent projects looking at the effect of mechanical strain on fibroblasts with Professor Mauro Farella, Professor Richard Cannon, Dr Benedict Seo and DClinDent (Orthodontics) candidate Fiona Firth. As a member of the Molecular and Immunopathology Research Group and in collaboration with Professor Alison Rich, Dr Lara Friedlander, Dr Haizal Hussaini and Dr Peter Cathro, Dr Milne is currently co-supervising PhD candidate Shaikhah Alsamahi and recent DClinDent (Endodontics) graduate Hitesh Navani. Dr Milne is also co-supervising DClinDent (Periodontology) candidates Anumala Ram, Tatiana Tkatchenko and Saeideh Nobakht along with PhD candidate Zhen Dong in collaboration with members of the Clinical and Translational Research Group Professor Warwick Duncan and Assoc. Professor Dawn Coates.

Dr Milne has been supported with grants from the New Zealand Dental Association Research Fund. Following a number of successful collaborations Dr Milne has published five co-authored peer-reviewed article in 2017-2018. Recent postgraduate completions include: DClinDent (Discipline of Orthodontics) Fiona Firth (2015 – 2017) and Hitesh Navani (Discipline of Endodontics) (2015 – 2017).

Key publications 2017-18

Al-Dujaili, M., Milne, T., Cannon, RD, Farella M. (2018) Postnatal expression of chondrogenic and osteogenic regulatory factor mRNA in the rat condylar cartilage. *Archives of Oral Biology* 93, 126-132.

Jawadi, LR., Parachuru, VPB, Milne, T., Seymour, GJ., Rich, AM (2018) Expression of IL33 and IL35 in oral lichen planus. *Archives of Dermatological Research*. 310(5):431-441.

Parachuru V., Coates, D. Rich A., Milne T., Seymour G. (2018) FoxP3+ regulatory T-cells may play a more prominent role than IL17 in chronic inflammatory periodontal disease. *Journal of Periodontal Research*. DOI:10.1111/jre.12552

Hidayat, M.F.H., Milne, T., Cullinan, M.P., Seymour, G.J. (2017) Feasibility of the Salivary transcriptome as a novel biomarker in determining disease susceptibility. *Journal of Periodontal Research*. *Journal of Periodontal Research* 49 (6) 817-826.



SUSAN M. MOFFAT

BA PhD DPH (Otago) CertDentTherp (Wgtn)

Senior Lecturer, Department of Oral Sciences

Susan Moffat's principal research interests are in the fields of dental public health, dental therapy history, and dental therapy/oral health therapy education and workforce.

Dental therapy is an academic discipline which has not (until fairly recently) had a research tradition of its own, having relied heavily on work undertaken in the disciplines of paediatric dentistry and dental public health. In that respect, Susan has been one of the pioneers in dental therapy research, and her work has laid some of the groundwork for an ongoing research foundation for both the dental therapy and oral health therapy disciplines.

Susan has collaborated with other Faculty staff on dental public health, dental workforce/education, and clinical research projects, and has collaborated internationally with researchers in Australia, the United States, and other countries, particularly on projects requiring knowledge of dental therapy or oral health therapy practice in New Zealand.

Susan's PhD research combined both workforce and dental public health research, centering on the development of the SDS within New Zealand's social, economic and political history. Her interest in historical research continues; she recently updated the 'Dental Care' pages for *'Te Ara - the Encyclopaedia of New Zealand'* (available online).

In 2018, Susan won the SJWRI Research Publication Award, for an article investigating the New Zealand School Dental Service's impact on oral health inequalities.

Key publications 2017-18

Smith, L., Adam, L., Moffat, S., Meldrum, A., & Ahmadi, R. (2018). How do educators in one New Zealand undergraduate Bachelor of Oral Health course teach and nurture professionalism? *European Journal of Dental Education*, 22(2), e212-e220. doi: 10.1111/eje.12274

Moffat, S. M., Foster Page, L. A., & Thomson, W. M. (2017). New Zealand's School Dental Service over the decades: Its response to social, political, and economic influences, and the effect on oral health inequalities. *Frontiers in Public Health*, 5, 177. doi: 10.3389/fpubh.2017.00177

Moffat, S., Meldrum, A., Aitken, W., & Coates, D. (2017). The delivery of oral health messages by primary health care nurses. *New Zealand Dental Journal* 113(2), 4-9.

Smith, L., Adam, L., Moffat, S., Meldrum, A., & Ahmadi, R. (2017). Undergraduate Bachelor of Oral Health student and educators' understandings of professionalism. *New Zealand Dental Journal*, 113(1), 4-10.



BRIAN C. MONK

BSc(Hons) (Well) PhD (Monash)

Associate Professor, Department of Oral Sciences

Director, Molecular Biosciences Laboratory

Programme Leader, Molecular Microbiology (2018-)

There is an urgent need for new antifungals due to the emerging problem of antifungal resistance, a problem made difficult due to the paucity of information on existing antifungal targets. A/Prof Monk has used expertise in the biochemistry, molecular genetics, and the structure and function of key membrane proteins to expedite antifungal discovery. This includes target identification using functional genomics, structure-directed drug discovery and advanced screening regimes. In 2017-18, the main experimental approach has involved the overexpression in yeast of the azole drug target lanosterol 14 α -demethylase, the terbinafine drug target squalene monooxygenase, the echinocandin drug target glucan synthase as well as drug efflux pumps from the ATP binding cassette and major facilitator superfamilies, to produce proteins for purification and structural resolution by X-ray crystallography as well as key tools enabling targeted screens for antifungals and valuable tests of antifungal efficacy. Since 2014, A/Prof Monk's group has deposited in the Protein Data Bank more than 30 crystal structures of wild type and mutant lanosterol 14 α -demethylase from *Saccharomyces cerevisiae* in complex with a range of azole drugs and agrochemicals, plus the first crystal structures of full-length lanosterol 14 α -demethylase from fungal pathogens (*Candida glabrata* and *C. albicans*). This information is being used to redesign antifungals by combining the best attributes of existing antifungals, and has enabled computer-based screens of large compound libraries in efforts to discover novel antifungals. It has also encouraged related research with other important fungal pathogens of humans (*Aspergillus fumigatus*, *Cryptococcus neoformans*, *Candida parapsilosis*, *Rhizopus arrhizus*) and major agricultural crops (*Phakopsora pachyrhizi* and *Zyoseptoria tritici*).

In 2017-18 the group published 5 papers and a book chapter. Funding includes a Health Research Council of NZ grant (Structure-directed discovery of next generation antifungals) and a Catalyst Fund Seeding grant (Tools for drug discovery from an ancient fungal family). The group has included 3 post-doctoral fellows, two PhD students, 1 MSc student and 2 summer students. Our experience with the structure and function of fungal lanosterol 14 α -demethylase, together with international collaborations with Prof DS Perlin at PHRI-Rutgers, the combinatorial chemistry company MicroCombiChem (Wiesbaden, Germany), Prof RM Stroud (University of California San Francisco) and A/Prof M Lackner (Medical University of Innsbruck), and local collaborations with A/Prof JDA Tyndall (Pharmacy) and Prof K Krause (Biochemistry), provide an optimal environment for structure-based discovery for this and other antifungal targets and the testing in yeast and clinical isolates to identify to novel drugs suitable for development by industry.

Key publications 2017-18

Monk B.C., Keniya M.V., Sabherwal M., Wilson R.K., Graham D.O., Hassan H.F., Chen D., Tyndall J.D.A. (2018). Azole resistance reduces susceptibility to the tetrazole antifungal VT-1161. *Antimicrob Agents Chemother*. doi: 10.1128/AAC.02114-18. epublished Nov 5.

Keniya M.V., Sabherwal M., Wilson R.K., Woods M.A., Sagatova A.A., Tyndall J.D.A., Monk B.C. (2018). Crystal structures of full-length lanosterol 14 α -demethylases of prominent fungal pathogens *Candida albicans* and *Candida glabrata* provide tools for antifungal discovery. *Antimicrob Agents Chemother*. 62(11) pii: AAC.01134-18. doi: 10.1128/AAC.01134-18.

Keniya M.V., Ruma Y.N., Tyndall J.D.A., Monk B.C. (2018) Heterologous expression of full-length lanosterol 14 α -demethylases of prominent fungal pathogens *Candida albicans* and *Candida glabrata* provides tools for antifungal discovery. *Antimicrob Agents Chemother*. 62(11) pii: AAC.01131-18. doi: 10.1128/AAC.01131-18.

Caramalho R., Tyndall J.D.A., Monk B.C., Larentis T, Lass-Flörl C., Lackner M. (2017) Intrinsic short-tailed azole resistance in mucormycetes is due to an evolutionary conserved amino acid substitution of the lanosterol 14 α -demethylase. *Sci Rep*. 7(1):15898. doi: 10.1038/s41598-017-16123-9



HANNA OLSON

Tandhygienistexamen (Gothenburg) MHS (Kristianstad)

Lecturer, Department of Oral Sciences

Hanna Olson holds a Master's Degree (2 years) in Integrative Health Sciences from the University of Kristianstad, Sweden. Hanna is a Lecturer at the University of Otago in the Department of Oral Sciences, and also the Deputy Convenor for the BOH Programme. Along with her lecturing position she is supervising BOH students in their clinical activities. Prior to coming to Otago, Hanna worked as a dental hygienist in Scandinavia, providing care for patients of all ages in different settings such as private practice, the Community Dental Service, Oral and Maxillofacial Surgery clinic, Hospital Dentistry, and outreach oral health care and Health Promotion. Some of her research interests are multi-professional teamwork, Inter-professional education, healthcare supervision and oral health education.

In her current position as the Programme IPE Convenor for BOH students, Hanna is engaged with multi-professional collaboration within the Division of Health Sciences' IPE Centre at the University of Otago.

In 2018, Hanna was part of an IPE pilot research team who worked together by forming activities between the Discipline of Oral Health, Dentistry and Medical Laboratory Science. Key collaborators in this project were Professor Alison Rich, Senior Lecturer Mrs Alison Meldrum and Senior Teaching Fellow Mrs Catherine Ronayne. An IPE Fund: Grant-in-Aid of NZ\$4206 was received for the project called "Working together in clinical pathology".

Together with Senior Lecturer Dr Jonny Geber, Hanna initiated a partnership between the Department of Oral Sciences, Faculty of Dentistry and the Department of Anatomy, School of Biomedical Sciences, University of Otago.

Hanna had two conference proceedings in 2017-2018. In 2017, Hanna gave a speech to the inaugural conference for the New Zealand Dental Hygienists' Association & The New Zealand Dental and Oral Health Therapists Association in Wellington. There, she presented and reported on research findings from Bachelor of Oral Health students' self-perceived stressors. The following year, Hanna was invited to present on the same topic overseas in the international conference in Dental & Dental Hygiene held in Edinburgh, Scotland. In her role as a keynote speaker she presented an additional speech on research findings from New Zealand and Swedish dental hygienists' perceptions of their chosen profession.

Key publications 2017-18

Olson, H., Beckett, D., Moffat, S., Adam, L., Tawse-Smith, A. (2018). Self-perceived stressors of Bachelor of Oral Health Students and level of support in the oral health learning environment. *J Den Craniofac Res* 2018, Volume 3 DOI: 10.21767/2576-392X-C1-001

Olson, H., Meldrum, A., Smith, L. (2018). Exploring New Zealand and Swedish dental hygienists' perceptions of their chosen profession. *J Den Craniofac Res* 2018, Volume: 3 DOI: 10.21767/2576-392X-C1-002



ALISON M. RICH

BDS (Otago) MDSc PhD (Melb) FRACDS FFOP(RCPA) FRCPath

Professor of Oral Pathology, Department of Oral Diagnostic and Surgical Sciences
Head of Department, Department of Oral Diagnostic and Surgical Sciences (to June 2018)
Deputy and Acting Dean, Faculty of Dentistry (to March 2019)
Programme Leader, Oral Molecular and Immunopathology

Professor Rich's research in the broad field of oral pathology is focused on the immunopathogenesis of various oral diseases. This research informs her work as a specialist diagnostic oral pathologist and Head of the Oral Pathology Centre, the national oral pathology diagnostic service. She leads the Oral Molecular and Immunopathology Research Programme within the Sir John Walsh Research Institute. The interests of the group are the regulation of the microenvironment in oral squamous cell carcinoma with respect to local and nodal immune control and interaction with vascular and lymphatic systems. Factors relating to angiogenesis and lymphangogenesis in immune-mediated oral mucosal diseases and in pulpal disease are also being investigated.

Professor Rich's research also relates to activities in student selection and teaching and learning (particularly student outplacements and inter-professional education). She has an ongoing collaboration with colleagues at the University of Adelaide evaluating undergraduate student selection.

Research achievements in 2018-19 included the enrollment and progression of excellent PhD and DCLinDent students under her supervision and our success in attracting significant grant funding from the New Zealand Dental Research Foundation and the Ministry of Health Oral Health Research Fund. Professor Rich's research collaboration with the Oral Cancer Research and Co-ordinating Centre of Malaysia has resulted in a number of ongoing projects.

Key publications 2017-18

Jawadi LR, Parachuru VPB, Milne TJ, Seymour GJ, Rich AM. (2018) Expression of IL33 and IL35 in oral lichen planus. *Archives of Dermatological Research* 310: 431-441

Parachuru VPB, Coates DE, Milne TJ, Rich AM, Seymour GJ. (2018) FoxP3+ regulatory T cells, interleukin 17 and mast cells in chronic inflammatory periodontal disease. *Journal of Periodontal Research* 53; 622-635

Al-Hassiny A, Friedlander LT, Parachuru VPB, Seo B, Hussaini HM, Rich AM. (2018) Upregulation of angiogenesis in oral lichen planus. *Journal of Oral Pathology and Medicine*. 47:173-178

Yakin M, Gavid O, Cox B, Rich AM. Oral cancer risk factors in New Zealand. (2017) *New Zealand Medical Journal* 130: 30-38



BENEDICT L. SEO

BDS DclinDent (Otago)

Senior Lecturer, Department of Oral Diagnostic and Surgical Sciences

Dr Benedict Seo is a specialist oral pathologist. He is a Senior Lecturer in Oral Pathology and a Consultant Oral Pathologist at the Oral Pathology Centre. He is an active member of the Oral Immunopathology Research Programme, Sir John Walsh Research Institute, and is involved in its various projects concerning oral squamous cell carcinoma (OSCC) pathobiology, with a special emphasis on cellular/metabolic stress and responses to those stimuli. His investigations include *in vitro* and *ex vivo* as well as blood and saliva models, and encompasses various techniques that examine gene, protein and cellular responses. He is also interested in the epidemiology of oral and maxillofacial pathology in New Zealand and abroad.

Between 2017 and 2018, Dr Seo was a principal/co-investigator in a number of projects concerning his research focus. He undertook a project profiling ER stress and UPR in OSCC, which was the basis for his completed PhD thesis. He was also involved in a project which examined UPR in mechanically strained cells in collaboration with the Craniofacial Research Programme. Other oral cancer research projects included the examination of 1) angiogenesis and lymphangiogenesis, 2) neuropilin-1 expression, 3) HPV in cancerous and verrucous lesions, and 4) exosomes and cancer biomarkers, which were supported through his national and international collaborations. Odontogenic tumours also remained an important area of his research. He co-supervised a project that studied the expression of LOX-family genes and proteins in ameloblastoma and odontogenic keratocyst, and another one that examined the relationship between BRAF-V600E mutation and biological behaviour in ameloblastoma.

During this period, Dr Seo co-supervised 8 doctoral students, attracted 7 competitive national-level research grants, published 5 peer-reviewed journal articles, and presented his research at IADR and FDI conferences. He was also invited to join the Editorial Board of *BDJ Open* as a foundation board member.

Key publications 2017-18

Yakin, M., Seo, B., Hussaini, H., Rich, A., & Hunter, K. (2018). Human papillomavirus and oral and oropharyngeal carcinoma: The essentials. *Australian Dental Journal*. Advance online publication. doi: 10.1111/adj.12652

Seo, B., Hussaini, H. M., & Rich, A. M. (2017). Second opinion oral pathology referrals in New Zealand. *Pathology*, 49(3), 277-284. doi: 10.1016/j.pathol.2016.11.007

Rich, A. M., Seo, B., Parachuru, V., & Hussaini, H. M. (2017). The nexus between periodontics and oral pathology. *Periodontology 2000*, 74(1), 176-181. doi: 10.1111/prd.12197

Kazantseva, M., Hung, N. A., Mehta, S., Roth, I., Eiholzer, R., Rich, A. M., Seo, B., Baird, M. A., Braithwaite, A. W., & Slatter, T. L. (2017). Tumor protein 53 mutations are enriched in diffuse large B-cell lymphoma with irregular CD19 marker expression. *Scientific Reports*, 7, 1566. doi: 10.1038/s41598-017-01800-6



LEE SMITH

BA BTchg PGDip MA PhD (Otago)

Research Fellow, Department of Oral Sciences

Dr Lee Smith has expertise in qualitative research involving young people, research on marginalised populations, and educational research. During 2017-2018 Dr Lee Smith undertook numerous collaborative studies on various topics ranging from professionalism in undergraduate Bachelor of Oral Health courses, through to managing non-cavitated proximal lesions. During the 2017-2018 period she co-authored 11 published articles in higher education, teaching, orthodontic and dental journals. Particular highlights for this period were obtaining a Ministry of Health research grant for a study titled *The barriers to, and facilitators for maintaining oral health and hygiene among a sample of 40 dentate older people who receive living support*. Other highlights included having results from her earlier Ministry of Health research funded project titled *Pasifika adolescents' understandings and experiences of oral health care* published, which in turn led to changes in the way that oral health information is disseminated to Pasifika communities in the region.

Key publications 2017-18

Smith, L.A., Cameron, C, Foster Page, L.A., Waqawai, A., & Richards, R. (2018). Pasifika adolescents' understandings and experiences of oral health care. *New Zealand Dental Journal* 114:165-173.

Schwendicke, F., Foster Page, L.A., Smith, L.A., Fontana, M., Thomson, W.M., Baker, S. (2018). To fill or not to fill: A qualitative cross-country study on dentists' decisions in managing non-cavitated proximal caries lesions. *Implementation Science*, 13(54): 10.1186/s13012-018-0744-7.

Smith, L.A., Tumilty, E, Foster Page, L.A., Thomson, W.M., Gibson, B. (2018). Children's Rights in their Oral Health Care: How Responsive are Oral Health Professionals to Children's Rights. *The International Journal of Children's Rights* 26(2):354-378.

Smith, L.A., Adam, L.A., Moffat, S.M., Meldrum, A, & Ahmadi, R. (2017). How do educators in one New Zealand undergraduate Bachelor of Oral Health course teach and nurture professionalism? *European Journal Of Dental Education* 22(2):e212-e220.



ANDREW A. TAWSE-SMITH

DDS (Colombian Sch of Dent) CertPeriodontology (Göteborg)

Student Affairs Officer and Associate Professor in Periodontics, Faculty of Dentistry
Associate Dean (International), Division of Health Sciences

Dr Tawse-Smith's research interests involve the fields of oral implantology, and periodontology. His main research focus in oral implantology comprises a long-term clinical evaluation of patients who have been rehabilitated with various implant prostheses. He is currently investigating tribocorrosion of the implant surface and the association of titanium particle leakage and its impact on peri-implant health. He has also developed novel in-vitro methodologies to complement his ongoing clinical studies to investigate the efficacy of different implant surface decontamination protocols. He has also carried out systematic review-based research in dental implantology and periodontology.

Dr Tawse-Smith completed his PhD "Presence and origin of titanium particles in peri-implant tissues" in 2018 and is working in collaboration with the Centre for Trace Element Analysis, Department of Chemistry and the Otago Micro and Nanoscale Imaging Unit of the University of Otago. He has international collaborations with universities and implant companies in South America, South Africa, Sweden and Australia.

Successful Research Grants applications were obtained in 2017 with the Australian Periodontology Research foundation, to evaluate the effect of titanium implant surface decontaminating procedures; and in 2018 with the ITI Research foundation, to evaluate an innovative treatment protocol to replace single posterior missing teeth with narrow and standard diameter dental implants.

Key publications 2017-18

Ko D, Wong P, Ma S, Bennani V, Tawse-Smith A. (2018) Implants with subcrestal angular correction platform: A solution to avoid facial screw access in implant crowns in the anterior maxilla. *EC Dental Science* 17.5: 493 – 497.

Atieh, M. A., Tawse-Smith, A., Alsabeeha, N. H. M., Ma, S., & Duncan, W. J. (2017). The one abutment-one time protocol: A systematic review and meta-analysis. *Journal of Periodontology*, 88(11), 1173-1185. doi: 10.1902/jop.2017.170238

Payne, A. G. T., Tawse-Smith, A., Wismeijer, D., De Silva, R. K., & Ma, S. (2017). Multicentre prospective evaluation of implant-assisted mandibular removable partial dentures: Surgical and prosthodontic outcomes. *Clinical Oral Implants Research*, 28(1), 116-125. doi: 10.1111/clr.12769

Tawse-Smith, A., Ma, S., Duncan, W. J., Gray, A., Reid, M. R., & Rich, A. M. (2017). Implications of wear at the titanium-zirconia implant-abutment interface on the health of peri-implant tissues. *International Journal of Oral & Maxillofacial Implants*, 32(3), 599-609. doi: 10.11607/jomi.5014



W. MURRAY THOMSON

MA (Leeds) BSc BDS MComDent (Otago) PhD (Adel) FICD FADI

Professor and Head of Department, Department of Oral Sciences
Programme Leader, Dental Epidemiology and Public Health

Professor Thomson conducts research in the broad fields of dental epidemiology, dental public health and dental health services research. His work over the years has had considerable impact in socio-dental epidemiology, health services research and the oral health of older people. His influential life-course work in the renowned Dunedin Study has been complemented by his pivotal role in the development and testing of a number of important self-report measures now in wide use in oral health care. His contribution to new knowledge is best evidenced by his inclusion as one of the top contributors to dental public health research in the last half century in a published bibliometric analysis (doi: 10.1111/cdoe.12249). His published output includes 342 papers in the peer-reviewed international scientific literature (with citations), and his Scopus h index is 46.

During the 2017-2018 period, he published 53 papers in the peer-reviewed international literature, along with one book chapter, a major report, two commentary articles and one editorial. He made (or was a co-author on) 13 conference presentations, including three keynote addresses, and gave five talks on his research to community groups and professional bodies. He was also a co-investigator on seven NZ research grants, totalling \$346,201, and one (of AUD 1,229,852) to the University of Adelaide. He supervised the completion of five DClintDent theses (Poppy Horne, Nina Scott, Will Fogarty, Leonard Chia, SooWee Ong), one PhD thesis (Norhasnida Nordin), two MComDent theses (Ellen Johnson, Kennedy-Langley) and one MPH thesis (Deanna Beckett) during 2017-18, making a career total of 71 doctoral or Masters theses so far supervised to completion. He is currently supervising a further four DClintDent theses (Hamid Mohammed, Adelyn Lau, Emma Morelli, Jessica Lee), four PhD theses (Joseph Antoun, Dorothy Boyd, Angela Benn, Deanna Beckett) and five MComDent theses (Philip Goh, Helen Lloyd, Manisha Narsinh, Kate Naysmith, Hayley Dixon).

Since January 2015, he has been the Editor-in-Chief of *Community Dentistry and Oral Epidemiology*. He has also continued as Associate Editor for the *European Journal of Oral Sciences* (having been in that role since November 2012). He is also Scientific Advisor to the IADR Latin American Geriatric Oral Research Group (GLIOG); a member of the International Scientific Advisory Board Network for Canadian Oral Health Research; and a member of the Scientific Advisory Board of the National Dental Centre, Singapore. Space constraints prevent a comprehensive listing of Prof Thomson's many collaborations (particularly the numerous NZ-based ones), but the most fruitful international ones to date have been with the University of Adelaide, University of Sheffield, Duke University, Harvard University, New York University, McGill University (Canada), University of Pelotas (Brazil), University of Chile, Charité-Universitätsmedizin Berlin and Osaka University.

Key publications 2017-18

Thomson WM, Broder HL. Oral-Health-Related Quality of Life in children and adolescents. *Pediatric Clinics of North America* 65: 1073-1084 (2018).

Thomson WM, Smith MB, Ferguson CA, Kerse NM, Peri K, Gribben B. Oral health, cognitive function and dependency among New Zealand nursing home residents. *Gerodontology* 35: 185-191 (2018).

He S, Thomson WM. An oral epidemiological comparison of Chinese and New Zealand adults in two key age groups. *Community Dentistry and Oral Epidemiology* 46: 154-160 (2018).

Ballantyne PJ, Norris P, Parachuru VP, Thomson WM. Becoming a 'pharmaceutical person': medication use trajectories from age 26 to 38 in a representative birth cohort from Dunedin, New Zealand. *Social Science and Medicine Population Health* 4: 37-44 (2017).



GRAEME S. TING

MSc MDS (Otago) FRACDS

Senior Lecturer, Department of Oral Diagnostic and Surgical Sciences

Mr Graeme Ting is interested in the oral health of people with special needs, with a particular focus on the oral health of older people with complex medical problems. He has researched the oral health of older people with dementia living in nursing homes in Auckland. Graeme has been involved at national level with the New Zealand Dental Association having helped to author a guidebook that teaches caregivers working in nursing homes, how to assist residents with oral health care. His interest in caring for people with special needs extends to those with hereditary bleeding disorders and he is current Chair of the Dental Committee for the World Federation of Haemophilia.

Mr Ting is the listed principal collaborating investigator for a research project entitled: *Oral health knowledge and attitudes of carers of home-based dependent older people*. This research aims to investigate the oral health practices, knowledge and beliefs of carers providing home-based support for dependent older people. Ageing in place allows carers to provide care for people in their own homes. Factors that hinder or assist carers in providing oral health care for older people living in their own homes will be investigated. This research is supported by a grant of \$44,208 from the University of Otago Research Grants Committee.

He is collaborating on research entitled: *The Enabling Oral Health and Nutritional Well-being in Ageing (OHNWA) Programme*. This has two research priorities: the first being, design and delivery of culturally relevant interventions for health promotion; and the second, design and delivery of effective and efficient health and social services for older people.

Other achievements under his supervision are DClinDent research projects for seven post-graduate students: New Zealand General Dentists' Perception of Special Needs Dentistry; *Candida albicans* in nursing home residents and their peers in the community; The Oral Health of Older People Presenting to a Hospital Dental Department; Head and Neck Cancer in Northland; Midwives and Oral Health for Expectant Mothers; Oral health status and Oral-Health-Related Quality of Life of a group of young adults using mental health services in Christchurch; and Perceived confidence in performing peripheral venipuncture among dental practitioners in New Zealand and Malaysia.

Key publications 2017-18

Faulks, D., Dougall, A., Ting, G., Ari, T., Nunn, J., Friedman, C., ... Newton, J. T. (2018). Development of a battery of tests to measure attitudes and intended behaviours of dental students towards people with disability or those in marginalised groups. *European Journal of Dental Education*, 22(2), e278-e290. doi: 10.1111/eje.12292



GEOFFREY R. TOMPKINS

BSc PhD PGDipSci (Otago)

Associate Professor, Department of Oral Sciences

Programme Leader, Molecular Microbiology (2017)

A/Prof Tompkins' principal research pursuit is in determining how the bacteria involved in periodontal disease acquire iron, an essential nutrient for all living cells. Additional interests involve collaborations with members of the Faculty of Dentistry from diverse disciplines including orthodontics, endodontics, periodontics, cariology, material sciences and respiratory infection.

A/Prof Tompkins co-supervised Dr. Andrew Tawse-Smith in his PhD research 'Presence and origin of titanium particles in peri-implant tissues' involving the destruction of microbial biofilms that form on titanium implants resulting in subgingival inflammation and deterioration of the implant. Andrew graduated in 2018. In collaboration with Dr Joseph Antoun and Dr Li Mei, he supervised DCLinDent candidate Dr Ana Low (graduated 2018, thesis title: Development of an in vivo model to investigate the effects of three adhesive removal methods around orthodontic wires.) In collaboration with Prof Warwick Duncan, A/Prof Natalie Medlicott (School of Pharmacy) and Dr Dawn Coates, he co-supervised PhD student Syarida Safii in developing antimicrobial formulations of manuka-derived products for treatment of periodontal disease. Syarida graduated in 2018. Thesis title: Subgingivally delivered manuka-derived products as an adjunct to scaling and root-planing in the treatment of periodontal disease. He is primary supervisor to PhD student Amira Salem whose has submitted her thesis "Novel therapeutic targets of endodontic infections." This project is in collaboration with Dr Peter Cathro. In conjunction with Dr Cathro, he co-supervises the research component of DCLinDent candidate Deepak Chellappa (endodontics). Thesis title: An innovative root canal medicament in the removal of *Enterococcus faecalis* from molar roots. Deepak is anticipated to graduate in 2019. With Prof Richard Cannon, he co-supervises PhD student Chitra Krishnan (proposed thesis title: Evaluation of electrolysed oxidising water storage duration on its antimicrobial efficacy, effects on microbial cell structure, properties of dental materials and oral tissues: an *in vitro* study.) Chitra aims to submit her thesis in 2021. With Prof Bernadette Drummond and Dorothy Boyd, he co-supervised DCLinDent student Victoria Kashchuk (graduated in 2017, thesis title: Effect of 'MGO™ 400+ Manuka Honey with Cyclopower™) on dental plaque activity and gingival health in young adults. With Dr Sunyoung Ma, he guided BDS student Michelle Chew who compared methods of re-using implant abutments as a summer research project and as an honours project (2017). With Dr Nicholas Heng he co-supervised BOH summer student Lauren Allen, whose project was titled 'Comparison of F₁F₀-ATPase amino acid sequences between oral streptococci'.

Key publications 2017-18

Schwass, D.R., Lyons, K.M., Love, R., Tompkins G.R., Garden, A., Meladandri C.J. 2018. Antimicrobial activity of a AgNP suspension for treating dental caries. *Ad. Dent. Res.* 29 (1) 117-123.

Kim K., C. Loch, N. Waddell, G. Tompkins and D. R. Schwass. 2017. Surface characteristics and biofilm development on selected dental ceramic materials. *Int. J. Dent.* DOI 10.1155/2017/7627945.

Hsu B., Lee S. Schwass B., and Tompkins, G. 2017. Antimicrobial activity of chemo-mechanical gingival retraction products. *J. Am. Dent. Assoc.* 148 (7) 493-499.

Safii S., Tompkins G.R. and Duncan W.J. Periodontal application of manuka honey: antimicrobial and demineralising effects in vitro. *Int. Dent. J.* 2017 doi:10.1155/2017/9874535



DARRYL C. TONG

ED BDS MB ChB PhD (Otago) MSD (Wash) FFDRCSI FDSRCS FFACOMS ACS

Professor, Department of Oral Diagnostic and Surgical Sciences

Professor Darryl Tong's main research interests include military and civilian trauma with a particular focus on ballistic injuries to the head, face and neck, sports-related concussion, subconcussive impact force research and the development of an anatomical simulant head for forensic trauma investigations and surgical teaching.

His research achievements in the 2017-2018 period include the award of \$58,980 in research grants as a lead or co-investigator from funding bodies including the NZ Dental Research Foundation and the University of Otago Research Committee, authorship of nine publications and one book chapter. He has been involved in the supervision of three PhD students, three DClintDent students and one Masters student during this time.

Key publications 2017-18

Falland-Cheung, L., Scholze, M., Lozano, P. F., Ondruschka, B., Tong, D. C., Brunton, P. A., Waddell, J. N., & Hammer, N. (2018). Mechanical properties of the human scalp in tension. *Journal of the Mechanical Behavior of Biomedical Materials*. Advance online publication. doi: 10.1016/j.jmbbm.2018.05.024

Pittar, N., Winter, T., Falland-Cheung, L., Tong, D., & Waddell, J. N. (2018). Scalp simulation: A novel approach to site-specific biomechanical modeling of the skin. *Journal of the Mechanical Behavior of Biomedical Materials*, 77, 308-313. doi: 10.1016/j.jmbbm.2017.09.024

Falland-Cheung, L., Waddell, J. N., Li, K. C., Tong, D., & Brunton, P. (2017). Investigation of the elastic modulus, tensile and flexural strength of five skull simulant materials for impact testing of a forensic skin/skull/brain model. *Journal of the Mechanical Behavior of Biomedical Materials*, 68, 303-307. doi: 10.1016/j.jmbbm.2017.02.023

Best, A. D., De Silva, R. K., Thomson, W. M., Tong, D. C., Cameron, C. M., & De Silva, H. L. (2017). Efficacy of codeine when added to paracetamol (acetaminophen) and ibuprofen for relief of postoperative pain after surgical removal of impacted third molars: A double-blinded randomised control trial. *Journal of Oral & Maxillofacial Surgery*, 75(10), 2063-2069. doi: 10.1016/j.joms.2017.04.045



J. NEIL WADDELL

MDipTech(Dent Tech) (TN) PhD PGDipCDTech (Otago) HDE (UN)

Associate Professor, Department of Oral Rehabilitation
Programme Leader, Biomechanics and Oral Implantology

A/Prof Waddell conducts experimental and observational research in; Dental materials, toughening of advanced ceramics; Prosthodontic failure mechanisms and adhesion of dental restorations and materials, and intra-oral pressure dynamics; Cranio-facial biomechanics; Sub-concussive brain injury research, in vitro modelling of the effects of blunt force trauma to the head and accumulative damage to the brain; Forensic biology, in vitro modelling of blunt force trauma, forensic odontology, wounding and ballistic blood splatter analysis and development of simulant materials for forensic modelling.

His research achievements in the 2017-2018 period include the award of \$267,552 in research grants as a lead or co-investigator from funding bodies including the NZ Dental Research Foundation, Lottery Health Research and the University of Otago Research Committee, and the authorship of sixteen publications in peer-reviewed journals. Three postgraduate research students supervised by A/Prof Waddell completed their degrees during this period: Barazanchi A, 2018, DCLinDent; Mudliar V, 2018, MDentTech; and Falland L, 2017, PhD.

A/Prof Waddell is part of two key collaborations which underpin his current research:

Duncan WJ, Harris P, Chandler NP and Waddell JN. Collaborative group from University of Otago School of Dentistry and Callaghan Innovation that aims to develop an ultrasonic dental diagnostic device (UltraD3) to improve the early diagnosis of gum disease around teeth and titanium dental implants. Supported by Ministry of Business Innovation and Employment (MBIE) Targeted Research grant (PI - Duncan WJ and Harris P, CI - Chandler NP and Waddell JN). 2015 – present.

Waddell JN, Hammer N, Ondruschka B, Li KC Jermy M and Tong D. Collaborative group from University of Otago School of Dentistry and Department of Anatomy, Department of Mechanical Engineering, University of Canterbury and the Facharzt für Rechtsmedizin, Institut für Rechtsmedizin, Leipzig, Germany investigating biomechanical properties of human skin/skull/brain system for the purpose of developing simulant materials and mathematical modelling systems. 2015 – present.

Key publications 2017-18

Falland-Cheung L, Waddell JN, Chun Li K, Tong D, Brunton P. 2018. Anatomical head model to measure impact force transfer through the head layers and their displacement. *J Concussion*, Vol 2: 1–10, DOI: 10.1177/2059700218777829.

Jansen van Vuuren WA, Wong P, Al-Amleh B, Lyons KM, Li KC, Waddell JN, 2018. Effect of a glaze layer on adhesion energy between resin cements to zirconia ceramic. *Int J Adhes Adhes*. Volume 84, August 2018, Pages 451-456. <https://doi.org/10.1016/j.ijadhadh.2018.03.003>

Gee C, Waddell JN, Swain MV. 2017. Comparison of three and four-point bending evaluation of two adhesive bonding systems for glass-ceramic zirconia bi-layered ceramics. *Dent Mater*. Sep;33(9):1004-1011. doi: 10.1016/j.dental.2017.06.007. Epub 2017 Jun 26.

Barazanchi A, Li KC, Al-Amleh B, Lyons K, Waddell JN. 2017. Additive technology: update on current materials and applications in dentistry. *J Prosthodont*. Sep 23. doi: 10.1111/jopr.12510. [Epub ahead of print]



RAJNI K. WILSON

BSc(Hons) PhD (Otago)

Postdoctoral Fellow, Sir John Walsh Research Institute

Dr Rajni Wilson's research interests are in drug discovery through probing the structure, function and drug binding mechanisms of *S. cerevisiae* Erg11p and the homologous enzyme of human and plant fungal pathogens. The aim is to develop novel antifungals by implementing effective methods for structure-directed drug discovery.

Her molecular biological, biochemical and structural biology expertise includes the design and preparation of mutant constructs for the preparation of recombinant proteins, the solubilisation of recombinant proteins with detergent, purification by Ni-NTA affinity and size exclusion chromatography (SEC). She has set up successful crystal trials and analysed of X-ray crystallographic data for protein structure determination. Dr Wilson's chemical expertise includes multi-step organic and inorganic syntheses leading to polyfunctional compounds. She has characterised the resulting complexes by chromatographic and spectroscopic techniques as well as by more specialized techniques including magnetic moment, conductivity measurements, electrochemistry (cyclic voltammetry and controlled potential coulometry) and X-ray crystallography. She is an Associate Investigator on the Health Research Council of New Zealand Project Grant *Structure-directed discovery of next-generation antifungals* (PI, Associate Professor Brian Monk 2016-2019).

Key publications 2017-18

Monk, B. C.; Keniya, M. V.; Sabherwal, M.; Wilson, R. K.; Graham, D. O.; Hassan, H. F.; Chen, D.; Tyndall, J. D. A. Azole Resistance reduces susceptibility to the Tetrazole Antifungal VT-1161. *Antimicrob. Agents Chemother.*, 2018, 63, 1-19.

Keniya, M. V.; Sabherwal, M.; Wilson, R. K.; Woods, M. A.; Sagatova, A. A.; Tyndall, J. D. A.; Monk, B. C. Crystal structures of full-length lanosterol 14 α -demethylases of prominent fungal pathogens *Candida albicans* and *Candida glabrata* provide tools for Antifungal Discovery. *Antimicrob. Agents Chemother.*, 2018, 62, 1-16.

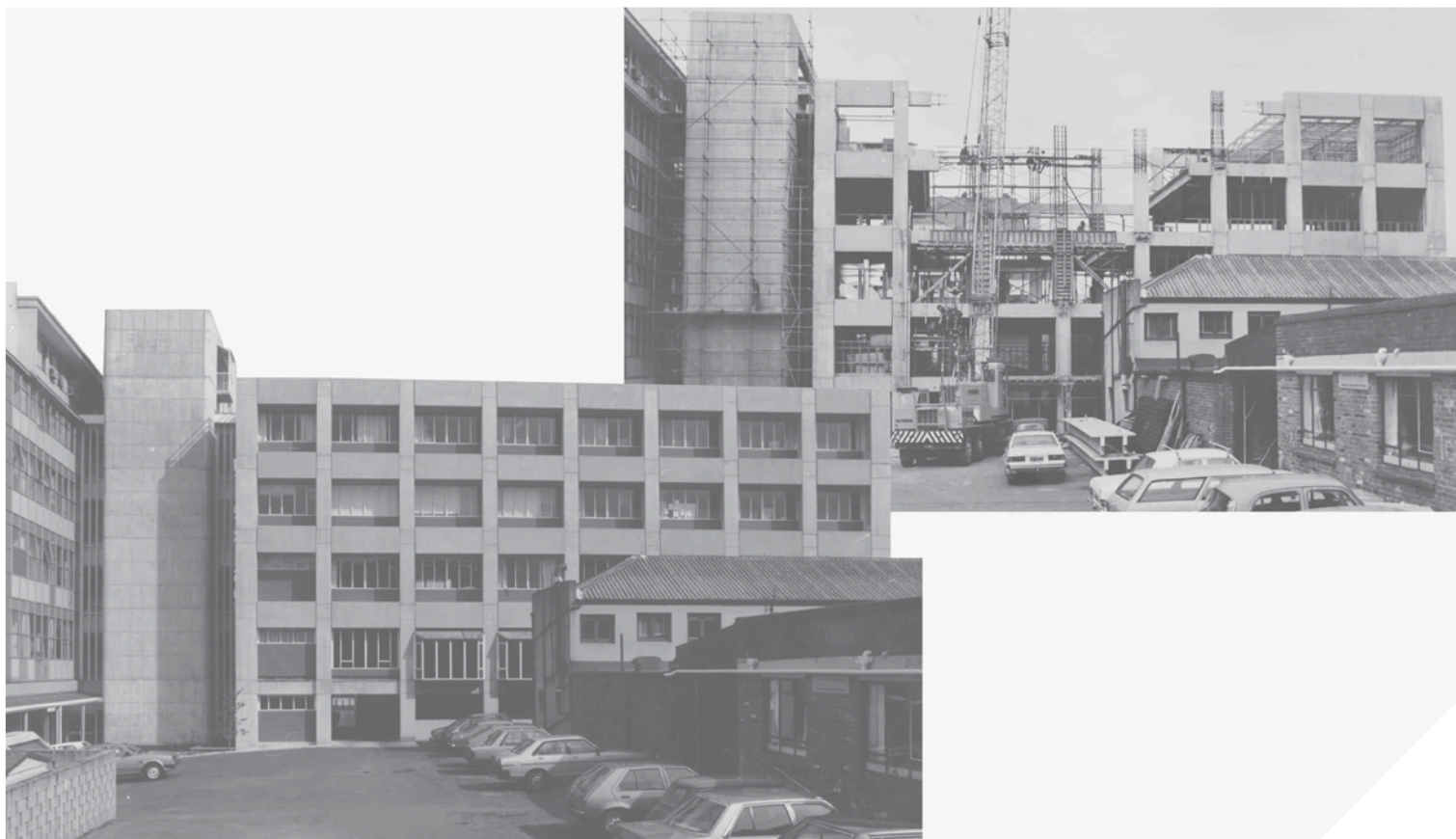
Mathus, S. J.; Wilson, R. K.; Aggarwal, A. V.; Cameron, S. A.; Larsen, D. S.; Brooker, S. Carbazole-based N4-donor Schiff-base macrocycles: obtained metal free and as Cu(II) and Ni(II) complexes. *Dalton Trans.*, 2017, 46, 3141-3149.

Our achievements

1981

Additional 'West Wing' is built

As the school expands, the additional 'West Wing' is built to house offices, research space and the dental library.



Research funding secured

Competitive and commercial research funding awarded to SJWRI investigators in 2017-2018

This includes projects led by other departments or institutions on which SJWRI staff or students are listed as co-investigators. Funding is in New Zealand dollars, GST exclusive. Awards are sorted by funding round, in chronological order of start date. Data courtesy Dr John Milnes and Lorraine Harris, Research and Enterprise.

PI = Principal Investigator

* Postgraduate student (at time of application)

Faculty of Dentistry academic department affiliations:

ODSS: Department of Oral Diagnostics and Surgical Sciences

OR: Department of Oral Rehabilitation

OS: Department of Oral Sciences

Other affiliations are University of Otago unless otherwise noted.

| Personnel | Project title | Funding body | Awarded | Start | End |
|--|--|---|----------|----------|----------|
| Wendy-Ann Jansen van Vuuren (PI, OR) John Aarts (OR) Suzanne Hanlin (OR) Ludwig Jansen van Vuuren (OR) Neil Waddell (OR) | Physical properties of denture base resin materials: CAD/CAM versus traditional heat-cured | New Zealand Institute of Dental Technologists | \$4,668 | Dec 2016 | Nov 2017 |
| Aravind Parachuru Venkata* (OS) Bernadette Drummond (PI, OS) Lyndie Foster Page (OS) Alison Meldrum (OS) | Children's oral health-related quality of life five to seven years after comprehensive care under general anaesthesia for early childhood caries | Downie Stewart (Fuller Scholarship) | \$2,875 | Jan 2017 | Dec 2017 |
| Abbey Corbett* (PI, OS) Alison Meldrum (OS) Bernadette Drummond (OS) | The management of dental caries in children and adolescents-restorative treatment decisions by oral health practitioners in New Zealand | Downie Stewart (Fuller Scholarship) | \$3,000 | Jan 2017 | Dec 2018 |
| Caleb Lawrence* (PI, OS) Mauro Farella (OS) | Relationship between sugar sweetened drinks, tooth wear and dental caries in Maori people | Downie Stewart (Fuller Scholarship) | \$4,000 | Jan 2017 | Dec 2018 |
| Hassan Ahmed* (PI, OS) Paul Brunton (OS) | A novel approach in the treatment and prevention of root caries in the elderly: a clinical and molecular investigation | New Zealand Dental Association Central Districts Branch | \$3,000 | Jan 2017 | Dec 2018 |
| Lee Smith (PI, OS) Lyndie Foster Page (OS) Rosalina Richards (Preventive and Social Medicine) | Pasifika adolescents' understandings of and experiences of oral health | New Zealand Dental Research Foundation | \$36,076 | Jan 2017 | Mar 2018 |
| Lyndie Foster Page (PI, OS) Joseph Antoun (OS) Peter Fowler (Canterbury DHB) Hannah Jack (OS) | I just want my teeth straightened | University of Otago Research Grant | \$36,281 | Jan 2017 | Dec 2017 |

| Personnel | Project title | Funding body | Awarded | Start | End |
|--|---|--|-------------------------------|----------|----------|
| Joanne Choi (PI, OS) | Development of tooth-coloured shell crowns for Hall Technique | HiTem Co. Ltd | \$9,132 | Apr 2017 | Dec 2017 |
| Carolina Loch Santos da Silva (PI, OS) Lyndie Foster Page (OS) Deanna Beckett (OS) Richard Cannon (OS) Lisa Te Morenga (Human Nutrition) | Sugar in your diet - <i>kino te pai!</i> | Otago Museum Trust Board | \$13,700 | Apr 2017 | Nov 2018 |
| Dawn Coates (PI, OS) | Healing mechanisms in stem-cell driven regeneration of deer antler | Velvet Antler Research NZ Ltd | \$150,000 | Apr 2017 | Mar 2020 |
| Warwick Duncan (PI, OS) Ajay Sharma* (OS) | In vivo evaluation of the Endoform collagen membrane in a sheep tooth socket model | Aroa Biosurgery Ltd | \$264,460 | Jun 2017 | Aug 2019 |
| Poppy Horne* (PI, ODSS) Lyndie Foster Page (OS) Murray Thomson (PI, OS) Ellie Knight (OS) Jonathan Leichter (OS) | Psychosocial aspects of periodontal disease diagnosis and treatments | Downie Stewart (Fuller Scholarship) | \$4,000 | Jul 2017 | Dec 2018 |
| Azam Ali (PI, Food Science) Karl Lyons (OR) Ajay Sharma* (OS) | No Drill, No Fill - a novel substitute to regrow teeth | Health Research Council of NZ | \$150,000 | Jul 2017 | Jun 2019 |
| Richard Cannon (PI, OS) Allan Gamble (Pharmacy) Hee Ji Lee (OS) Joel Tyndall (Pharmacy) | Overcoming drench resistance | Otago Innovation Limited | \$149,997 | Jul 2017 | Feb 2019 |
| Peter Cathro (PI, OR) Osvaldo Gonzalez* (OR) | Effect of different surfactant concentration on bacterial power and shelf life | Dentalife Australia Pty Ltd | \$13,425 | Aug 2017 | Dec 2017 |
| Erwin Lamping (PI, OS) Richard Cannon (OS) Nicholas Heng (OS) | Engineering yeast as an ideal expression host for human P-glycoprotein (ABCB1) | Otago Medical Research Foundation | \$15,000 | Aug 2017 | Feb 2019 |
| Murray Thomson (PI, OS) | Phase III RCT of the Effectiveness of Silver Diamine Fluoride in Arresting Cavitated Caries Lesions | University of Michigan (NIH subcontract) | \$34,326 | Sep 2017 | Aug 2021 |
| Lyndie Foster Page (PI, OS) Vivienne Anderson (HEDC) Murray Thomson (OS) Charrissa Keenan (OS) | Barriers to implementing a new technique for treating tooth decay in children | Health Research Council of NZ | \$198,588 (<i>declined</i>) | Oct 2017 | Mar 2019 |
| Deepak Chellappa* (PI, OR) Peter Cathro (OR) Geoffrey Tompkins (OS) | Comparing the antimicrobial efficacy of contemporary irrigation techniques in curved root canals | New Zealand Dental Research Foundation | \$3,500 | Nov 2017 | Oct 2019 |

| Personnel | Project title | Funding body | Awarded | Start | End |
|---|---|---|----------|----------|----------|
| Murray Thomson (PI, OS) Lyndie Foster Page (OS) Poppy Horne* (ODSS) Ellie Knight (OS) Jonathan Leichter (OS) | Psychosocial aspects of periodontal disease diagnosis and treatment | Ministry of Health Oral Health Research Fund | \$4,100 | Nov 2017 | Oct 2018 |
| Sabarinath Prasad* (PI, SJWRI) Mauro Farella (OS) Sandro Palla (U Zurich) Michael Paulin (Zoology) | Validation of a wireless device to assess EMG activity in freely moving subjects | New Zealand Dental Research Foundation | \$5,380 | Nov 2017 | Oct 2019 |
| Li Mei (PI, OS) Richard Cannon (OS) Mauro Farella (OS) | Management of biofilm formation with Air-Flow in patients with fixed orthodontic appliances | New Zealand Dental Research Foundation | \$5,512 | Nov 2017 | Oct 2019 |
| Erwin Lamping (PI, OS) Richard Cannon (OS) | NanoBRET - a novel and versatile protein reporter technology for oral health research | New Zealand Dental Research Foundation | \$5,696 | Nov 2017 | Oct 2019 |
| Oripa Waqa* (PI, ODSS) Benedict Seo (ODSS) Rohana De Silva (ODSS) Haizal Hussaini (ODSS) Alison Rich (ODSS) Darryl Tong (ODSS) | BRAF mutations in ameloblastoma: correlation with clinical and histopathological features and behaviour | New Zealand Dental Research Foundation | \$7,600 | Nov 2017 | Oct 2019 |
| Harsha De Silva (PI, ODSS) Haizal Hussaini (ODSS) Alison Rich (ODSS) | Role of <i>Candida albicans</i> in oral carcinogenesis | New Zealand Dental Research Foundation | \$9,589 | Nov 2017 | Oct 2019 |
| Adelyn Lau* (PI, ODSS) Rohana De Silva (ODSS) Harsha De Silva (ODSS) Murray Thomson (OS) Darryl Tong (ODSS) | The use of dexamethasone in the reduction of post-operative outcomes after wisdom teeth surgery: A comparison of two routes of administration | New Zealand Dental Research Foundation | \$9,700 | Nov 2017 | Oct 2019 |
| Joseph Antoun (PI, OS) Mauro Farella (OS) Li Mei (OS) Geoffrey Tompkins (OS) Ana Low* (OS) | Effects of different adhesive removal methods on bacterial colonisation on in vivo orthodontic bracket model | New Zealand Dental Research Foundation | \$11,965 | Nov 2017 | Oct 2018 |
| Elizabeth Williams* (PI, ODSS) Alison Rich (ODSS) Dawn Coates (OS) Haizal Hussaini (ODSS) Benedict Seo (ODSS) | Human papillomavirus in oral verrucal-papillary lesions: detection by polymerase chain reaction | New Zealand Dental Research Foundation | \$13,542 | Nov 2017 | Oct 2019 |
| Philippa Greer* (PI, OS) Dawn Coates (OS) Haizal Hussaini (ODSS) Alison Rich (ODSS) Benedict Seo (ODSS) | The regulation of galectin-1 and implications for epithelial-mesenchymal transition in oral squamous cell carcinoma | New Zealand Dental Research Foundation | \$14,584 | Nov 2017 | Oct 2018 |
| Amira Salem* (SJWRI) Geoffrey Tompkins (OS) Peter Cathro (OR) | Novel therapeutic targets for endodontic infections | New Zealand Dental Research Foundation | \$14,900 | Nov 2017 | Oct 2019 |

| Personnel | Project title | Funding body | Awarded | Start | End |
|--|--|---|----------|----------|----------|
| Nurulhuda Thiyahuddin* (PI, ODSS) Richard Cannon (OS) Erwin Lamping (OS) Alison Rich (ODSS) | Candida species and strains in the oral cavity of the elderly: a comparison between people in home-based care and in an aged care facility | Ministry of Health Oral Health Research Fund | \$9,970 | Nov 2017 | Jul 2019 |
| Sheila Skeaff (PI, Human Nutrition) Karl Bailey (Human Nutrition) Bernadette Drummond (OS) | Actual fluoride intakes of NZ children in fluoridated and non-fluoridated areas of the lower SI | Ministry of Health Oral Health Research Fund | \$14,968 | Nov 2017 | Sep 2019 |
| Moira Smith (PI, Public Health UOW) Murray Thomson (OS) | Public Sector Oral Health Service Provision for High Needs and Vulnerable New Zealanders | Ministry of Health Oral Health Research Fund | \$44,029 | Nov 2017 | Jun 2019 |
| Trudy Milne (PI, OS) Peter Reid (SJWRI) | Validation of triplex qPCR assay for the detection of S. salivarius K12 | BLIS Technologies Limited | \$3,981 | Dec 2017 | Jan 2018 |
| Joanne Choi (PI, OR) Warwick Duncan (OS) Lyndie Foster Page (OS) Neil Waddell (OR) | Development of a novel tooth-coloured shell crowns to treat dental caries in children | Cure Kids | \$26,800 | Jan 2018 | Dec 2019 |
| Siddharth Kothari* (PI, OR) Paul Brunton (OS) | Effect of vital bleaching (in office and at home) on oral health related quality of life | Downie Stewart (Fuller Scholarship) | \$3,000 | Jan 2018 | Dec 2019 |
| Simon Olliver* (PI, OS) Mauro Farella (OS) | Long term effect of occlusal risk factors on temporomandibular joint clicking and stability of incisor position | Downie Stewart (Fuller Scholarship) | \$3,000 | Jan 2018 | Dec 2019 |
| Wei Lin* (PI, OS) Mauro Farella (OS) | Factors associated with orthodontic pain in children and adolescents | Downie Stewart (Fuller Scholarship) | \$3,000 | Jan 2018 | Dec 2019 |
| Ghassan Idris* (PI, OS) Mauro Farella (OS) | Do overweight or obese adolescents chew differently from adolescents with a normal body mass index? | Downie Stewart (Fuller Scholarship) | \$3,000 | Jan 2018 | Dec 2019 |
| Lucy Sullivan* (PI, OR) Lara Friedlander (OR) | The influence of education information on patient understanding and perceptions of root canal treatment | Downie Stewart (Fuller Scholarship) | \$3,000 | Jan 2018 | Dec 2019 |
| Huda Mohammed* (PI, OR) Neil Waddell (OR) Kai Chun Li (OR) Karl Lyons (OR) | Bond strength of a direct composite resin to hybrid ceramic materials with two different surface treatments | Downie Stewart (Fuller Scholarship) | \$3,000 | Jan 2018 | Dec 2019 |
| Nurul Zainuddin* (PI, ODSS) Haizal Hussaini (ODSS) | Neuropilin-1 expression in tumour microenvironment of oral squamous cell carcinoma | New Zealand Dental Association Central Districts Branch | \$3,000 | Jan 2018 | Dec 2019 |

| Personnel | Project title | Funding body | Awarded | Start | End |
|--|--|---|-----------|----------|----------|
| Don Schwass (PI, OS) | Silventum - advisory role for Dr Don Schwass | Silventum Limited | \$17,489 | Jan 2018 | Dec 2018 |
| Murray Thomson (PI, OS) Moiria Smith (Public Health UOW) | Public-sector oral health service provision for high needs and vulnerable New Zealanders | University of Otago Research Grant | \$15,000 | Jan 2018 | Dec 2018 |
| Joanne Choi (PI, OS) Warwick Duncan (OS) Lyndie Foster Page (OS) John Waddell (OR) | Development of tooth-coloured shell crowns to treat dental caries in children | University of Otago Research Grant | \$23,000 | Jan 2018 | Dec 2018 |
| Kai Chun Li (PI, OR) Warwick Duncan (OS) Niels Hammer (Anatomy) Darryl Tong (ODSS) John Waddell (OR) | Developing a simulant skull model with accurate mechanical properties using 3D-printed polymers | University of Otago Research Grant | \$36,680 | Jan 2018 | Dec 2018 |
| Ben Wheeler (PI, Womens & Child Health DSM) Deanna Beckett (OS) Andrew Gray (Preventive and Social Medicine DSM) Carolina Loch Santos da Silva (OS) Erin Mahoney (Paediatrics UOW) | What are the dental consequences of vitamin D deficiency during pregnancy and infancy? | Otago Medical Research Foundation | \$25,000 | Mar 2018 | Jul 2019 |
| Joanne Choi (PI, OR) | Universal multi-function wear test system (UFW200) for use in dental and other multidisciplinary research | New Zealand Lottery Health Research - Shared Equipment | \$120,000 | Apr 2018 | Mar 2019 |
| Paul Brunton (PI, OS) Jithendra Ratnayake (SJWRI) Karl Lyons (OR) Carolina Loch Santos da Silva (OS) Hassan Ahmed* (OS) Nicholas Heng (OS) | A novel approach to the treatment of root caries in the elderly: a clinical and molecular investigation of chlorhexidine-modified glass ionomer cements | New Zealand Lottery Health Research - Research Projects | \$46,482 | May 2018 | Apr 2020 |
| Lee Adam (PI, OS) Mary Furnari (OS) Alison Meldrum (OS) Claire Gallop (OS) Susan Moffat (OS) | Assessment of Clinical Placements Proposal | Australasian Council of Dental Schools | \$54,000 | May 2018 | Mar 2019 |
| Mo'men Atieh (PI, OS) Warwick Duncan (OS) Sunyoung Ma (OR) | Titanium-zirconium narrow (3.3 mm) versus standard (4.1 mm) diameter dental implants for replacing single posterior missing teeth: a randomized controlled trial | ITI International Team for Implantology | \$242,004 | Jun 2018 | Jun 2024 |
| Gemma Cotton (PI, OS) | To develop triple action membrane for severe gum disease: enhancing ossification and gum formation with infection control | Kiwi Innovation Network Limited | \$20,000 | Jul 2018 | Jun 2019 |

| Personnel | Project title | Funding body | Awarded | Start | End |
|--|--|--|----------|----------|----------|
| Mauro Farella (PI, OS) | MedTech CoRE: EMG-Guard -a smart-phone assisted wireless EMG device for small superficial muscles | University of Auckland | \$25,000 | Aug 2018 | Jan 2019 |
| Murray Thomson (PI, OS) | Oral and Maxillofacial Surgeons, Oral Surgeons Workforce Study in New Zealand, 2017 | Australian and New Zealand Association of Oral and Maxillofacial Surgeons (ANZAOMS) Research and Education Foundation Inc. | \$2,725 | Aug 2018 | Aug 2019 |
| Warwick Duncan (PI, OS) Tim Woodfield (Orthopaedic Surgery and Musculoskeletal Medicine UOC) | MedTech CORE SEED Project: Bovine derived lactoferrin in a degradable PVA-tyramine hydrogel for oral bone regeneration in a tooth socket model | MedTech CoRE - University of Auckland | \$91,887 | Sep 2018 | Aug 2019 |
| Nicholas Heng (PI, OS) | Genomic sequence analysis of probiotic strains | BLIS Technologies Limited | \$5,000 | Oct 2018 | Mar 2019 |
| Yvonne Golpak* (PI, OS) Alison Meldrum (OS) | Effectiveness of bi-annual application of 38% silver diamine fluoride and 5% sodium fluoride varnish in primary teeth of children in a rural setting near Port Moresby, Papua New Guinea | Downie Stewart (Fuller Scholarship) | \$5,000 | Nov 2018 | Oct 2020 |
| Nurul Zainuddin* (PI, ODSS) Haizal Hussaini (ODSS) Alison Rich (ODSS) Benedict Seo (ODSS) | Neuropilin-1 expression in the tumour microenvironment of oral squamous cell carcinoma | New Zealand Dental Research Foundation | \$8,167 | Nov 2018 | Oct 2019 |
| Ludwig Jansen van Vuuren (PI, OR) Jonathan Broadbent (OR) Warwick Duncan (OS) John Waddell (OR) | Development of a simulant model for clinically relevant testing of implant-and natural tooth-supported all-ceramic restorations (Phase Two) | New Zealand Dental Research Foundation | \$10,000 | Nov 2018 | Oct 2020 |
| Danielle Hodgkinson* (PI, OS) Mauro Farella (OS) Joseph Antoun (OS) Li Mei (OS) | Do orthodontic extractions ruin faces? | New Zealand Dental Research Foundation | \$11,654 | Nov 2018 | Oct 2020 |
| Saeideh Nobakht* (PI, OS) Dawn Coates (OS) Trudy Milne (OS) | Pleiotrophin family gene and protein expression in a sheep tooth socket model of bone healing | New Zealand Dental Research Foundation | \$14,255 | Nov 2018 | Oct 2020 |
| Haizal Hussaini (PI, ODSS) Harsha De Silva (ODSS) Trudy Milne (OS) Alison Rich (ODSS) | Expression of vascular endothelial growth factor and associated pathways in oral squamous cell carcinoma | New Zealand Dental Research Foundation | \$14,496 | Nov 2018 | Dec 2019 |

| Personnel | Project title | Funding body | Awarded | Start | End |
|---|--|---|----------|----------|----------|
| Lara Friedlander (PI, OR) Haizal Hussaini (ODSS) Trudy Milne (OS) Alison Rich (ODSS) | Type 2 diabetes - how do human dental pulp cells respond to glucose and lipopolysaccharides? | New Zealand Dental Research Foundation | \$14,890 | Nov 2018 | Apr 2020 |
| Manikandan Ekambaram (PI, OS) Cynthia KY Yiu (U Hong Kong) Dorothy Boyd (OS) Kai Chun Li (OR) Sam Lowrey (Physics) Neil Waddell (OR) | Bonding universal dental adhesive resin to developmentally hypomineralized enamel | New Zealand Dental Research Foundation | \$14,970 | Nov 2018 | Oct 2020 |
| Rachel Farrar* (PI, OS) Mauro Farella Warwick Duncan (OS) Joseph Antoun (OS) Birte Melsen (U Aarhus) | Development of an ovine model for investigating effects of orthodontic tooth movement | New Zealand Dental Research Foundation | \$15,000 | Nov 2018 | Oct 2020 |
| Hee Ji Lee (PI, OS) Richard Cannon (OS) Brian Monk (OS) | Automated Pipetting System for Oral Health and Dental Research (Equipment grant) | New Zealand Dental Research Foundation | \$15,000 | Nov 2018 | Dec 2018 |
| Benedict Seo (PI, ODSS) Merilyn Hibma (Pathology DSM) Haizal Hussaini (ODSS) Alison Rich (ODSS) | Analysing expression of heat shock proteins and oncogenes associated with cell cycle and proliferation within exosomes derived from oral cancers | New Zealand Dental Research Foundation | \$15,000 | Nov 2018 | Oct 2020 |
| Lara Friedlander (PI, OR) Nicholas Chandler (OR) Ben Daniel Motidyang (HEDC) | Managing elderly patients requiring endodontic treatment - A New Zealand practice-based research study | Ministry of Health Oral Health Research Fund | \$9,463 | Nov 2018 | Apr 2020 |
| Maira Smith (PI, Public Health UOW) William Leung (Public Health UOW) Murray Thomson (OS) Graeme Ting (ODSS) | Estimating unmet dental need and associated resource utilisation costs, and exploring treatment funding options, for dependent older New Zealanders | Ministry of Health Oral Health Research Fund | \$42,649 | Nov 2018 | Dec 2019 |
| Lee Smith (PI, OS) Maira Smith (Public Health UOW) Murray Thomson (OS) | The barriers to, and facilitators for, maintaining oral health and hygiene amongst a cohort of 40 dentate older home-based residing people who require additional living support | Ministry of Health Oral Health Research Fund | \$43,630 | Nov 2018 | Oct 2019 |
| Brian Monk (PI, OS) | Tools for drug discovery from an ancient fungal family | Royal Society of New Zealand | \$80,000 | Nov 2018 | Oct 2020 |
| John Aarts (PI, OR) | 3-D printed Direct Metal Laser Sintered Cobalt Chrome for partial denture frameworks mechanical and physical properties | New Zealand Institute of Dental Technologists | \$4,930 | Nov 2018 | Jul 2020 |

| Personnel | Project title | Funding body | Awarded | Start | End |
|---|---|-------------------------------------|----------|----------|----------|
| Yen Je Lee* (PI, ODSS) Harsha De Silva (ODSS) Rohana De Silva (ODSS) Murray Thomson (OS) Darryl Tong (ODSS) | Pre-emptive analgesic and anti-inflammatory effects of etoricoxib and sustained-release ibuprofen following impacted mandibular third molar surgery | Downie Stewart (Fuller Scholarship) | \$5,000 | Dec 2018 | Nov 2020 |
| Finn Gilroy* (PI, OR) Lara Friedlander (OR) | Health Status of patients receiving root canal treatment in New Zealand general dental practice - A Practice Based Research Study | Downie Stewart (Fuller Scholarship) | \$5,000 | Dec 2018 | Nov 2020 |
| Mauro Farella (PI, OS) Ghassan Idris* (OS) Barbara Galland (Women's and Children's Health) Claire Smith (Women's and Children's Health) Rachael Taylor (Medicine) Christopher Robertson (OS) | A novel approach for monitoring eating behaviour in children | Cure Kids | \$49,458 | Jan 2019 | Dec 2019 |
| Richard Cannon (PI, OS) Erwin Lamping (OS) | Drug resistance in the emerging fungal pathogen <i>Candida auris</i> | Maurice and Phyllis Paykel Trust | \$10,000 | Jan 2019 | Dec 2019 |
| Manikandan Ekambaram (PI, OS) Murray Thomson (OS) | Family functioning and oral-health-related quality of life among children following dental treatment under general anaesthesia. | University of Otago Research Grant | \$8,060 | Jan 2019 | Dec 2019 |
| Peter Cathro (PI, OR) Subasinghe Dias (Anatomy) Jithendra Ratnayake (SJWRI) | Development of a novel bone graft material from waste bovine teeth for dental surgery applications | University of Otago Research Grant | \$11,490 | Jan 2019 | Dec 2019 |
| Carolina Loch Santos da Silva (PI, SJWRI) Catherine Kemper (SA Museum) James Palin (Geology) Karen Stockin (Massey) Mark Taylor (Macquarie) | Dolphin teeth as a biomonitoring tool of heavy metal exposure | University of Otago Research Grant | \$25,931 | Jan 2019 | Dec 2019 |
| Graeme Ting (PI, ODSS) Moir Smith (Public Health UOW) | Oral health knowledge and attitudes of carers of home-based dependent older people | University of Otago Research Grant | \$44,208 | Jan 2019 | Dec 2019 |
| Joanne Choi (PI, OR) Sunyoung Ma (OR) John Waddell (OR) Peter Xu (U Auckland) | Investigation of pressure distribution in edentulous patients: Development and validation of simulation systems | University of Otago Research Grant | \$44,900 | Jan 2019 | Dec 2019 |
| Kai Chun Li (PI, OR) Gemma Cotton (Chemistry) | Development of 3D-printed crowns to enable non-invasive treatment of dental caries in primary teeth | University of Otago Research Grant | \$57,000 | Jan 2019 | Dec 2019 |

Faculty of Dentistry redevelopment

2015

The University approves a major redevelopment, and construction commences on the new Clinical Services Building in 2016.



Research publications

Publications are listed by year (2017 then 2018). All data courtesy the PBRF and Publications Office, Research Division. Thanks to Dr Donna Hendry, PBRF & Publications Manager.

Edited Book - Research

Seymour, G. J., Cullinan, M. P., & Heng, N. C. K. (Eds.). (2017). *Oral biology: Molecular techniques and applications: Methods in molecular biology* (Vol. 1537) (2nd ed.). New York, NY: Springer, 503p. doi: 10.1007/978-1-4939-6685-1

Chapter in Book - Research

Beumer, III, J., Lyons, K., Jayanetti, J., & Sung, E. C. (2017). Restoration of acquired oral defects with osseointegrated implants. In S. J. Sadowski (Ed.), *Evidence-based implant treatment planning clinical protocols*. (pp. 302-324). Chichester, UK: Wiley Blackwell.

Cannon, R. D., Lyons, K. M., Chong, K., Newsham-West, K., Niimi, K., & Holmes, A. R. (2017). Adhesion of yeast and bacteria to oral surfaces. In G. J. Seymour, M. P. Cullinan & N. C. K. Heng (Eds.), *Oral biology: Molecular techniques and applications: Methods in molecular biology* (Vol. 1537). (2nd ed.) (pp. 165-190). New York, NY: Springer. doi: 10.1007/978-1-4939-6685-1_10

Chandler, N. P., & Chong, B. S. (2017). Diagnosis. In B. S. Chong (Ed.), *Harty's endodontics in clinical practice*. (7th ed.) (pp. 23-39). Edinburgh, UK: Elsevier.

Coates, D. E., Zafar, S., & Milne, T. J. (2017). Quantitative real-time gene profiling of human alveolar osteoblasts. In G. J. Seymour, M. P. Cullinan & N. C. K. Heng (Eds.), *Oral biology: Molecular techniques and applications: Methods in molecular biology* (Vol. 1537). (2nd ed.) (pp. 447-459). New York, NY: Springer. doi: 10.1007/978-1-4939-6685-1_27

Halcrow, S. E., Tayles, N., & Elliott, G. E. (2017). The bioarchaeology of fetuses. In S. Han, T. K. Betsinger & A. B. Scott (Eds.), *The anthropology of the fetus: Biology, culture, and society*. (pp. 83-111). New York: Berghahn Books.

Lamping, E., Madani, G., Lee, H. J., Niimi, M., & Cannon, R. D. (2017). Structure-function analyses of multidrug transporters. In R. Prasad (Ed.), *Candida albicans: Cellular and molecular biology*. (2nd ed.) (pp. 379-406). Springer. doi: 10.1007/978-3-319-50409-4

Milne, T. J. (2017). A protocol for the determination of the methylation status of gingival tissue DNA at specific CpG islands. In G. J. Seymour, M. P. Cullinan & N. C. K. Heng (Eds.), *Oral biology: Molecular techniques and applications: Methods in molecular biology* (Vol. 1537). (2nd ed.) (pp. 299-306). New York, NY: Humana Press. doi: 10.1007/978-1-4939-6685-1_17

Monk, B. C., & Keniya, M. V. (2017). Using yeast to discover inhibitors of multidrug efflux in *Candida albicans*. In R. Prasad (Ed.), *Candida albicans: Cellular and molecular biology*. (2nd ed.) (pp. 491-543). Springer. doi: 10.1007/978-3-319-50409-4

Zanicotti, D. G., & Coates, D. E. (2017). Growing adipose-derived stem cells under serum-free conditions. In G. J. Seymour, M. P. Cullinan & N. C. K. Heng (Eds.), *Oral biology: Molecular techniques and applications: Methods in molecular biology* (Vol. 1537). (2nd ed.) (pp. 439-446). New York, NY: Springer. doi: 10.1007/978-1-4939-6685-1_26

Encyclopaedia/Dictionary Entry

Clark, A. L. (2018). Physiological stress. In W. Trevathan (Ed.), *The international encyclopedia of biological anthropology*. John Wiley & Sons. doi: 10.1002/9781118584538.ieba0379 [Encyclopaedia/Dictionary Entry].

Cotton, G. C., Lagesse, N. R., Parke, L., & Meledandri, C. J. (2018). Antibacterial nanoparticles. In S. Hashmi, E. Bayraktar, G. Batalha, D. Brabazon, M. Buggy, I. A. Choudhury, ... C. Zavaglia (Eds.), *Reference module in materials science and materials engineering*. Elsevier. doi: 10.1016/B978-0-12-803581-8.10409-6 [Encyclopaedia/Dictionary Entry].

Chapter in Book - Other

Chandler, N. P. (2017). Root canal filling. In B. S. Chong (Ed.), *Harty's endodontics in clinical practice*. (7th ed.) (pp. 151-173). Edinburgh, UK: Elsevier.

Drummond, B., & Egger, G. (2017). Lifestyle and oral health. In G. Egger, A. Binns, S. Rössner & M. Sagner (Eds.), *Lifestyle medicine: Lifestyle, the environment and preventive medicine in health and disease*. (3rd ed.) (pp. 405-410). Academic Press. doi: 10.1016/B978-0-12-810401-9.00027-9

Journal - Research Article

2017

Aarts, J. M., Jansen van Vuuren, W.-A., Withy, K. E., Choi, J. E., & Waddell, N. J. (2017). A pilot study on the influence of two reinforcing materials (glass fibre mesh and electro-spun nylon nano fibres) on the flexural strength of a heat-cured poly (methyl methacrylate) denture base resin. *New Zealand Dental Journal*, 113(3), 11-15.

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Adam, L., Anderson, V., & Spronken-Smith, R. (2017). 'It's not fair': Policy discourses and students' understandings of plagiarism in a New Zealand university. *Higher Education*, 74(1), 17-32. doi: 10.1007/s10734-016-0025-9

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Ajay Sharma, L., Love, R. M., Ali, M. A., Sharma, A., Macari, S., Avadhani, A., & Dias, G. J. (2017). Healing response of rat pulp treated with an injectable keratin hydrogel. *Journal of Applied Biomaterials & Functional Materials*, 15(3), e244-e250. doi: 10.5301/jabfm.5000346

Al Balushi, S., Mei, L., & Farella, M. (2017). Patient's satisfaction with orthodontic care from an academic clinical service. *New Zealand Dental Journal*, 113(4), 13-20.

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Alayan, H., Fernandes, R., Thomson, W. M., Foster Page, L. A., & Ibrahim, H. (2017). The use of miswak among Muslim immigrants living in New Zealand. *New Zealand Dental Journal*, 113(2), 22-25.

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Conference Contribution - Poster Presentation (not in published proceedings)

Loo, Z. Y., De Silva, H. L., De Silva, R. K., & Farella, M. (2017, May). Comparison of airway space and hyoid bone changes of skeletal class II patients receiving combined orthodontic and surgical treatment to skeletal class II patients receiving orthodontic treatment alone. Poster session presented at the American College of Oral and Maxillofacial Surgeons and the Canadian Association of Oral and Maxillofacial Surgeons Joint Annual Conference, Vancouver, Canada.

Malthus, S. J., Cameron, S., Aggarwal, V., Wilson, R. K., Larsen, D. S., & Brooker, S. (2017, February). Carbazole-based Schiff base macrocycles and complexes for fluorescence, redox and catalytic properties. Poster session presented at the 2nd Southampton, Australia, New Zealand, Magnetism Workshop (SANZ-O-MAG2), Dunedin, New Zealand.

Sagatova, A. A., Keniya, M. V., & Monk, B. C. (2017, September). Expression and purification of a drug target squalene monooxygenase. Poster session presented at the Queenstown Molecular Biology (QMB) Meetings, Queenstown, New Zealand. Carrington, S. D., Wyeth, E., Norris, P., & Priest, P. (2018, December). Exploring Māori understandings of antimicrobial resistance in Aotearoa/New Zealand: A proposed qualitative investigation using a One Health Approach. Poster session presented at the Proceedings of the 4th One Health Aotearoa Symposium, Wellington, New Zealand.

Madani, G., Lamping, E., & Cannon, R. (2018, September). Structural characterization of the archetypal fungal efflux pump *Candida Albicans* Cdr1. Poster session presented at the Otago Spotlight Symposium on Infectious Disease, Wellington, New Zealand.

Ruma, Y., Keniya, M., Sagatova, A., Tyndall, J., & Monk, B. (2018, September). Interactions between newazole drugs and their target enzyme. Poster session presented at the Otago Spotlight Symposium on Infectious Disease, Wellington, New Zealand.

Conference Contribution - Verbal presentation and other Conference outputs

2017

Abdul Rahman, N. (2017, July). Lip squamous cell carcinoma: Multiple biopsies and excision by lip shave. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Al Kharusi, A. (2017, July). Orofacial pain. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Anderson, V. (2017, November). Internationalisation in Aotearoa New Zealand: Promoting or prohibiting "inclusive quality education for all". Verbal presentation at the 45th Annual Conference of the Oceania Comparative and International Education Society (OCIES): Education and sustainable development in Oceania and beyond, Nouméa, New Caledonia.

Broadbent, J. (2017, July). Variation in dentistry. Invited presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Chia, L. (2017, July). Coagulation: Too much of a good thing? Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Duncan, W., & Salis, S. (2017, July). S.O.S: My implant needs rescuing! Invited presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Firth, F. (2017, July). Now you see it, now you don't! The interdisciplinary management of impacted maxillary canines. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Gonzalez, O. (2017, July). Interdisciplinary dental management of a special needs patient. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Ibrahim, N. (2017, July). Are the margins clear? The use of intra-operative frozen section biopsies for a recurrent maxillary ameloblastoma. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Kang, A. (2017, July). Can we grow mandibles? Orthodontic management of a severe skeletal class II malocclusion. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Kashchuk, V. (2017, July). Biliary atresia: Dental considerations and management. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Mei, L. (2017, July). Clinical management of biofilm formation in orthodontics. Invited presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Moffat, S. (2017, July). Remembering the past, planning for the future. Invited presentation at the New Zealand Dental Hygienists' Association (NZDHA) and the New Zealand Dental and Oral Health Therapists Association (NZDOHTA) Joint Conference, Wellington, New Zealand.

Monk, B. C., Tomasiak, T. M., Sagatova, A., Keniya, M. V., Wilson, R. K., Sabherwal, M., Tyndall, J. D. A., & Stroud, R. M. (2017, September). Structure-function analysis of the antifungal target sterol 14 α -demethylase. Verbal presentation at the Queenstown Molecular Biology (QMB) Meetings, Queenstown, New Zealand.

Navani, H. (2017, July). Can we regrow dental pulps? Revitalisation of an immature permanent tooth: Treatment challenges. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Olson, H., Adam, L., Beckett, D., Moffat, S., & Tawse-Smith, A. (2017, July). Self-perceived stressors of BOH students at the University of Otago. Invited presentation at the New Zealand Dental Hygienists' Association (NZDHA) and the New Zealand Dental and Oral Health Therapists Association (NZDOHTA) Joint Conference, Wellington, New Zealand.

Ong, S.-W. (2017, July). Implant dentistry: A truly multi-disciplinary approach. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Parachuru Venkata, A. (2017, July). Fetal alcohol spectrum disorder (FASD) in a paediatric dental patient. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Polonowita, A. (2017, July). White lesions: Improving early diagnosis. Invited presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Schwendicke, F., Foster Page, L. A., Fontana, M., Thomson, W. M., Smith, L., Girdwood, J., & Baker, S. (2017, July). What are the barriers and enablers for dentists in managing proximal caries lesions? Verbal presentation at the 64th Congress of the European Organisation for Caries Research, Oslo, Norway.

Scott, N. (2017, July). Invasive cervical resorption. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Sew Hoy, W. (2017, July). A case of missing lower premolars: To close space or not to close space? Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Suhaimi, A. (2017, July). Pre-radiation dental assessment: Predicting the future. Verbal presentation at the Faculty of Dentistry Clinical Excellence Day, Dunedin, New Zealand.

Thomson, W. M. (2017, March). Lessons from combining findings of disparate national surveys. Verbal presentation at the IADR/AADR/CADR General Session & Exhibition, San Francisco USA.

2018

Ajay Sharma, L. (2018, April). Developing biocomposites to replace dental fillings. Verbal presentation at the University of Otago Centre for Bioengineering & Nanomedicine Symposium: Biomaterials and Regenerative Medicine, Dunedin, New Zealand.

Anderson, V. (2018, February). Educational migration and the New Zealand context: Are we promoting 'inclusive and quality education for all'? Verbal presentation at the Global Migrations Conference, Dunedin, New Zealand.

Beckett, D., Adam, L., Moffat, S., & Oranje, J. (2018, December). Assessing improvements in academic writing in first year Bachelor of Oral Health students. Verbal presentation at the College of Oral Health Academics (COHA) 17th Annual Meeting, Sydney, Australia.

Broughton, J. (2018, February). William Shakespeare and dental research. Verbal presentation at the Department of Preventive and Social Medicine In-House Convention, Dunedin, New Zealand.

Cotton, G. (2018, April). From benchtop to spin out: Silver nanoparticles in dentistry. Verbal presentation at the University of Otago Centre for Bioengineering & Nanomedicine Symposium:

Biomaterials and Regenerative Medicine, Dunedin, New Zealand.

Duncan, W. (2018, April). Oral bone regeneration at Te Kaupeka Pūniho - New Zealand's National Centre for Dentistry. Verbal presentation at the University of Otago Centre for Bioengineering & Nanomedicine Symposium: Biomaterials and Regenerative Medicine, Dunedin, New Zealand.

Monk, B. (2018, September). The hidden danger of fungal infections. Verbal presentation at the Otago Spotlight Symposium on Infectious Disease, Wellington, New Zealand.

Ratnayake, J. (2018, April). Development of a novel bone graft material from New Zealand sourced bovine bone. Verbal presentation at the University of Otago Centre for Bioengineering & Nanomedicine Symposium: Biomaterials and Regenerative Medicine, Dunedin, New Zealand.

Other Research Output

Department Seminar

Broadbent, J. (2018, March). Why is there a dental chair in the Department of Medicine's Clinic Room 6? Department of Medicine, University of Otago, Dunedin, New Zealand. [Department Seminar].

Inaugural Professorial Lecture

Chandler, N. (2017, July). Serendipity and the measurement of teeth. University of Otago, Dunedin, New Zealand. [Inaugural Professorial Lecture].

Research Presentation

Loch, C. (2018, November). Are there dental consequences of vitamin D deficiency during pregnancy and infancy?. New Zealand Dental and Oral Health Therapists Association (NZDOHTA) Otago CPD Roadshow, Otago Museum, Dunedin, New Zealand. [Research Presentation].

Loch, C. (2018, June). Community-based dental science outreach: The sugar in your diet: Kino Te Pai! experience. New Zealand Dental and Oral Health Therapists Association (NZDOHTA) Invercargill CPD Roadshow, Ascot Park Hotel, Invercargill, New Zealand. [Research Presentation].

Lyons, K. (2018, June). Ceramics in fixed prosthodontics. Invited presentation at the International Medical University, Kuala Lumpur, Malaysia. [Research Presentation].

Lyons, K. (2018, June). Implant overdenture in the edentulous mandible. Invited presentation at the International Medical University, Kuala Lumpur, Malaysia. [Research Presentation].

Awarded Doctoral Degree

Choi, J. J. E. (2017). Continuous measurement of intraoral pH and temperature (PhD). University of Otago, Dunedin, New Zealand. Retrieved from <http://hdl.handle.net/10523/7308>.

Cotton, G. C. (2017). Silver nanoparticle antibacterial materials for applications within the oral cavity (PhD). University of Otago, Dunedin, New Zealand.

Chai, S. Y. (2018). Effect of incisal preparation design on stress distributions and load-to-failure of ceramic veneers (DClinDent). University of Otago, Dunedin, New Zealand. Retrieved from <https://ourarchive.otago.ac.nz/handle/10523/8571>.

Chen, M. H.-M. (2018). Resonance frequency analysis in assessing implant stability: A retrospective analysis (DClinDent). University of Otago, Dunedin, New Zealand. Retrieved from <https://ourarchive.otago.ac.nz/handle/10523/8560>.

Greer, P. (2018). Effects of OTX008, a galectin-1 inhibitor, on oral squamous cell carcinoma cells in vitro (DClinDent). University of Otago, Dunedin, New Zealand. Retrieved from <https://ourarchive.otago.ac.nz/handle/10523/8529>.

Horne, P. E. (2018). Psychological aspects of periodontal disease diagnosis and treatment (DClinDent). University of Otago, Dunedin, New Zealand. Retrieved from <https://ourarchive.otago.ac.nz/handle/10523/8511>.

Safii, S. H. (2018). Manuka-derived products as an adjunct to scaling and root planning in the treatment of chronic periodontitis (PhD). University of Otago, Dunedin, New Zealand. Retrieved from <https://ourarchive.otago.ac.nz/handle/10523/8513>.

Awarded Masters Degree

Beckett, D. (2017). Oral-health related quality of life measures for use in economic evaluation in children (MPH). University of Otago, Dunedin, New Zealand. Retrieved from <http://hdl.handle.net/10523/7677>.

2018

New Auckland dental base

Plans are announced for a new University of Otago dental teaching facility and patient treatment clinic in South Auckland. Construction began on the \$28.31 million, two-storey, 32-chair building in mid-December 2018.



Research doctoral completions

PhD graduands 2017-18

Graduands are listed chronologically.

Advisor affiliations are Sir John Walsh Research Institute, University of Otago unless otherwise noted.

| Student | Advisors (Primary listed first) | Thesis title | Graduated |
|----------------------|---|---|---------------|
| Andrew Quick | Prof Mauro Farella A/Prof Gillian Johnson (Physiotherapy) | The influence of orthodontic and orthognathic therapy on mandibular motion | May 2017 |
| Joanne Jung Eun Choi | A/Prof Neil Waddell Prof Karl Lyons | Continuous measurement of intraoral pH and temperature | August 2017 |
| Lisa Falland | Prof Paul Brunton A/Prof Neil Waddell Prof Darryl Tong | Development of an anatomical head model, using simulatant materials, to measure traumatic brain injury | May 2018 |
| Norhasnida Nordin | Prof Murray Thomson A/Prof Lyndie Foster Page Dr Kate Morgaine | Parental perceptions of the impact of early childhood caries in Malaysia and New Zealand | May 2018 |
| Arunjith Ramawarrier | Prof Robert Love Prof George Dias (Anatomy) A/Prof Azam Ali (Centre for Materials Science and Technology) | A novel keratin-chitosan-tricalcium phosphate biocomposite as a potential scaffold for regenerative endodontics: an <i>in vitro</i> study | May 2018 |
| Jennifer Hughes | Prof Richard Cannon Prof Sue Black (U of Dundee) Prof Abby Smith (Marine Science) Prof Lynne Bell (Simon Fraser U) | Taphonomic alteration to juvenile porcine bone after exposure to a marine environment | August 2018 |
| Ghassan Idris | Prof Mauro Farella A/Prof Barbara Galland (DSM - Women's and Children's Health) Mr Christopher Robertson | Efficacy of a mandibular advancement appliance on sleep disordered breathing in children | August 2018 |
| Andrew Tawse-Smith | Prof Warwick Duncan A/Prof Geoffrey Tompkins | Presence and origin of titanium particles in peri-implant tissues | August 2018 |
| Mohammad Alansary | Prof Bernadette Drummond Dr Lara Friedlander A/Prof Dawn Coates | Primary tooth pulp as a source of progenitor cells for tissue regeneration | December 2018 |

DCLinDent graduands 2017-18

December 2017

| Student | Discipline | Advisors (Primary listed first) | Thesis title |
|----------------------------|----------------|--|---|
| Nawal Radhiah Abdul Rahman | Oral Pathology | Dr Benedict Seo Dr Haizal Mohd Hussaini Prof Alison Rich | Expression of the lysyl oxidase family in odontogenic lesions |
| Humza Ahmed | Endodontics | Prof Nicholas Chandler Dr Peter Cathro | The effect of an additional application of sealer during continuous wave of condensation obturation |
| 'Adil Al Kharusi | Oral Medicine | Dr Haizal Mohd Hussaini Prof Alison Rich | Lymph nodes as a pre-metastatic niche for oral squamous cell carcinoma |

| Student | Discipline | Advisors (Primary listed first) | Thesis title |
|---------------------------|-------------------------|---|--|
| Leonard Yit Fen Chia | Special Needs Dentistry | Prof Darryl Tong Prof Murray Thomson A/Prof Lyndie Foster Page | Clinicians' perspectives on special care dentistry in New Zealand |
| Fiona Firth | Orthodontics | Prof Mauro Farella Dr Trudy Milne Dr Benedict Seo | A mechanical strain model for the assessment of periodontal ligament cell endoplasmic reticulum stress in three-dimensional culture |
| William Fogarty | Paediatric Dentistry | Prof Murray Thomson Mr Mike Brosnan | Adolescent oral health in New Zealand in 2009 |
| Nurul Ruziantee Ibrahim | Oral Pathology | Dr Haizal Mohd Hussaini Dr Benedict Seo Prof Alison Rich | Lymphangiogenesis in metastatic lymph nodes of oral squamous cell carcinoma |
| Austin Kang | Orthodontics | Prof Mauro Farella Dr Joe Antoun A/Prof Azam Ali Dr Li Mei (CMST) | Digital assessment of three-dimensional tooth movement during orthodontic activation using an optimised typodont system |
| Victoria Kashchuk | Paediatric Dentistry | Prof Bernadette Drummond A/Prof Geoffrey Tompkins Mrs Dorothy Boyd | Effect of 'Manuka Honey with Cyclopower™ on dental plaque activity and gingival health in young adults |
| Hitesh Navani | Endodontics | Dr Lara Friedlander Dr Trudy Milne Dr Haizal Mohd Hussaini Prof Alison Rich | Angiogenesis in the apical papilla of immature permanent teeth |
| Soo-Wee Ong | Oral Surgery | A/Prof Rohana De Silva Prof Murray Thomson Prof Darryl Tong Dr Harsha De Silva | Third molar surgical outcomes: a comparison between intravenous sedation and general anaesthesia |
| Aravind Parachuru Venkata | Paediatric Dentistry | Prof Bernadette Drummond Dr Nicholas Heng Mrs Alison Meldrum | Children's oral health-related quality of life five to seven years after comprehensive care under general anaesthesia for early childhood caries |
| Frances Ruddiman | Periodontology | Prof Warwick Duncan Prof Patrick Schmidlin (U of Zurich) A/Prof Jonathan Leichter | Microbial leakage at the implant-abutment interface: Comparing original and aftermarket abutments in an ovine model |
| Assil Russell | Endodontics | Prof Nicholas Chandler Dr Lara Friedlander | The butterfly effect: An investigation of sealer penetration, adaptation and apical crack formation in filled root canals |
| Nina Scott | Endodontics | Prof Murray Thomson Dr Peter Cathro | Dental trauma in New Zealand adults: a secondary analysis of national survey and ACC data |
| William Sew Hoy | Orthodontics | Prof Mauro Farella Dr Joe Antoun Prof Nicholas Chandler | Genetic factors associated with orthodontic pain in children and adolescents: a pilot study |
| Yevgeny Sheftel | Periodontology | Prof Warwick Duncan Prof Patrick Schmidlin (U of Zurich) A/Prof Jonathan Leichter | Novel grafting materials for sinus floor elevation in the sheep model |
| Adlin Suhaimi | Special Needs Dentistry | Prof Alison Rich | Awareness of pre-radiation dental assessment of head and neck cancer patients among dentists in Malaysia and New Zealand |

December 2018

| Student | Discipline | Advisors (Primary listed first) | Thesis title |
|------------------------------|----------------------|--|---|
| Abdullah Barazanchi | Prosthodontics | A/Prof Neil Waddell Dr Kai Chun Li Prof Karl Lyons Dr Basil Al-Amleh | Evaluation of 3D printed and soft milled cobalt chromium alloy for prosthodontic applications |
| Sy Yin (Adeline) Chai | Prosthodontics | A/Prof Vincent Bennani Mr John Aarts Prof Karl Lyons | Effect of incisal preparation design on stress distribution and load-to-failure of ceramic veneers |
| Maggie Hsiao-Mei Chen | Prosthodontics | Dr Sunyoung Ma Prof Karl Lyons A/Prof Andrew Tawse-Smith | Resonance frequency analysis in assessing implant stability: a retrospective analysis |
| Abbey Corbett | Paediatric Dentistry | A/Prof Lyndie Foster Page Prof Bernadette Drummond Mr Mike Brosnan Prof Nicholas Chandler Mrs Alison Meldrum | The restorative management of dental caries affecting children and adolescents in New Zealand |
| Harsha De Silva | Oral Surgery | Dr Haizal Mohd Hussaini Prof Alison Rich | Does Candida albicans influence oral carcinogenesis? |
| Philippa Greer | Oral Medicine | A/Prof Dawn Coates Prof Alison Rich | Effects of OTX008, a galectin-1 inhibitor, on oral squamous cell carcinoma cells in vitro |
| Poppy Horne | Periodontology | Prof Murray Thomson A/Prof Jonathan Leichter Dr Ellie Knight | Psychosocial aspects of periodontal disease diagnosis and treatment |
| Caleb Lawrence | Orthodontics | Prof Mauro Farella Dr Joe Antoun Dr Louise Mainvil Dr Li Mei Mr Mike Brosnan | Dental caries, tooth wear and dietary sugar intake in a sample of Northland Maori |
| Ana Low | Orthodontics | Dr Joe Antoun Dr Li Mei A/Prof Geoffrey Tompkins Prof Mauro Farella | Development of an in vivo model to investigate the effects of three adhesive removal methods around orthodontic brackets: A pilot study |
| Hassan Mohamed Ahmed | Prosthodontics | Prof Paul Brunton Dr Carolina Loch Santos da Silva Prof Karl Lyons Dr Nicholas Heng | Novel approach to treat root caries: A pilot study to investigate Chlorhexidine-modified glass ionomer cement applied using ART |
| Mohd Nor Hafizi Bin Mohd Ali | Periodontology | A/Prof Andrew Tawse-Smith A/Prof Jonathan Broadbent Prof Warwick Duncan | Quality evaluation of dental records and patient satisfaction following periodontal surgery |
| Divya Ramanan | Orthodontics | Prof Mauro Farella Dr Ajith Polonowita Prof Sandro Palla Mr John Hamilton | Oral behaviours and masseter activity in patients with masticatory muscle pain |

Abstracts of thesis research from doctoral graduands, 2017-18

Where available. Retrieved from University of Otago Library OUR Archive: ourarchive.otago.ac.nz

Nawal Radhiah Abdul Rahman

Abdul Rahman, N. R. (2017). Expression of the lysyl oxidase family in odontogenic lesions (Thesis, Doctor of Clinical Dentistry in Oral Pathology)

Advisors: Seo, Benedict Lloyd; Hussaini, Haizal; Rich, Alison Mary

Background: The lysyl oxidase family of enzymes consists of five members, namely lysyl oxidase (LOX) and lysyl oxidase-like (LOXL) 1-4. They are secreted enzymes whose function is to stabilise the extracellular matrix via crosslinking collagens and elastins. The enzymes are mostly known for their extracellular function but little is known about their intracellular function. Few studies have investigated LOX expression in the oral and maxillofacial region and those that exist are largely concerned with oral submucous fibrosis and oral squamous cell carcinoma. With regard to odontogenic lesions one study exists which showed increased expression of LOXL4 in the stromal tissue of odontogenic keratocyst (OKC).

Objective: To determine the expression of LOX family proteins and genes in locally aggressive odontogenic lesions (ameloblastoma and OKC) in comparison with non-aggressive odontogenic lesions (dentigerous cyst (DC) and hyperplastic dental follicle (DF)) using immunohistochemistry (IHC) and quantitative reverse transcriptase real-time polymerase chain reaction (qRT2-PCR).

Method: For IHC, formalin-fixed paraffin-embedded (FFPE) tissue samples of ameloblastoma (n = 10), OKC (n = 15), DC (n = 6) and DF (n = 9) were used with antibodies against LOX and LOXL1-4. Positive and negative controls were used for validation. Qualitative assessment of the pattern and distribution of staining was undertaken at varying magnifications. Automated quantitative assessment of digitised IHC images was performed using Fiji Software (ImageJ 1.51K). Specifically, the extent of positive reaction and intensity of staining were examined in three representative areas of the epithelium and connective tissue in each specimen at 400x magnification. One way ANOVA tests were performed using GraphPad Prism software (La Jolla California USA), and P values of <0.05 were considered to represent a statistically significant difference between the groups. For qRT2-PCR, RNA samples were isolated from FFPE tissue sections of ameloblastoma, OKC and DC, which were subsequently reverse transcribed into cDNA. The cDNA samples were preamplified prior to performing PCR reactions. A reference gene was used to normalise the results. The expression level of each gene and fold regulation (FR) between disease groups was determined using the method. Statistical significance was denoted when $FR > 2$ and $p < 0.05$ for each analysis.

Result: The LOX family proteins and genes showed differential patterns of expression in each lesion examined. Significant reduction of LOXL3 was observed in ameloblastoma at both protein and gene levels. LOXL4 protein was overexpressed in the epithelium, but underexpressed in the connective tissue of ameloblastoma and OKC. The expression of LOX family genes and proteins in DC showed a significant variation compared with ameloblastoma and OKC, whereas the protein expression patterns were similar between ameloblastoma and DF.

Conclusion: 1) LOX family expression was different in 'aggressive' odontogenic lesions compared with 'non-aggressive' odontogenic lesions, dentigerous cyst in particular. 2) Variable LOX family expression between ameloblastoma and OKC may reflect their

pathogenesis and biological behaviour. 3) The similarities of LOX family expression observed in ameloblastoma and hyperplastic dental follicle may reflect the embryonic dedifferentiation of ameloblastoma. 4) Dentigerous cyst serves as a proper 'control' tissue as opposed to hyperplastic dental follicle with regard to study of the LOX family.

Humza Ahmed

Ahmed, H. (2017). The effect of an additional application of sealer during continuous wave of condensation obturation (Thesis, Doctor of Clinical Dentistry in Endodontics)

Advisors: Chandler, Nick; Cathro, Peter

Background: Root canal fillings with a thin layer of sealer lining the dentine wall, a high percentage of core material that closely adapts to the dentine and sealer penetration into dentinal tubules is considered desirable. The continuous wave of condensation (CWC) is a warm obturation technique. It involves a down-pack of a master apical cone associated with the partial removal of the core material from the coronal segments of the root canal. Backfilling with a thermoplasticised core material is then carried out. It is unknown if a second application of sealer, following the down-pack, would be beneficial.

Aim: To assess the effect of an additional sealer application during the CWC technique by measuring the distance between gutta-percha (GP) and canal wall, percentage of sealer and sealer penetration into the dentinal tubules.

Materials and methods: Palatal roots of 105 extracted human maxillary molars were sectioned and prepared to a master apical file size 40, 0.06 taper with Vortex Blue® files. Roots were randomly assigned to seven groups (n = 15). Groups A (AH Plus™), B (Roth 801 Root Canal Cement) and C (Sealapex™) had a single application of sealer dyed with Sudan Black B before CWC obturation (Elements™ Free). Group D (negative control) was obturated without sealer. Groups E (AH Plus™), F (Roth 801 Root Canal Cement) and G (Sealapex™) received a second application of dyed sealer following the down-pack. Roots were sectioned at 2, 3, 4, 6, 7 and 8 mm from the root apex. The obturations were microphotographed (10 and 20x) and images measured with ImageJ. The distance from GP to canal wall, percentage of sealer and dentinal tubular penetration depth and direction was calculated at each level. The distance between the GP and canal wall were analysed using Mood's median test and the chi-squared test of independence ($p < 0.05$).

Results: At each ascending level, sealer percentage decreased for each experimental group while the number of outer third penetration depths increased when all groups were combined. Comparisons with Group D revealed all groups had significantly increased distance between the GP and canal wall at 2 - 4 levels ($p = 0.00 - 0.05$), increased sealer percentage at 4 - 6 levels ($p = 0.00 - 0.03$) and increased penetration depths. Comparison between a single and double application of sealer revealed Group E had increased distance between the GP and canal wall compared to Group A at the 4 and 6 mm levels ($p = 0.01 - 0.05$). Group F had increased distances compared with Group B at 6 mm ($p = 0.03$) and Group G was increased over Group C at 8 mm ($p = 0.03$). A double application of sealer increased the sealer percentage in Group A at

the 2 mm level compared with Group E. No significant difference in sealer percentages were noted when groups B and F were compared or Groups C and G. Analysis of Groups A and E revealed that additional sealer increased outer third penetration depths for Group E, which was also evident for Group G when compared to Group C.

Conclusions: An additional application of sealer slightly increased the distance between the GP and canal wall. It did not affect Roth's and Sealapex™ sealers but decreased the sealer percentage of AH Plus™ to a minor degree. It increased the outer third penetration depths for AH Plus™ and Sealapex™ but not Roth's sealer.

Adil Al Kharusi

Al Kharusi, A. (2017). Lymph nodes as a pre-metastatic niche for oral squamous cell carcinoma (Thesis, Doctor of Clinical Dentistry in Oral Medicine)

Advisors: Hussaini, Haizal; Rich, Alison

Pre-metastatic niche (PMN) is a new concept in the process of metastasis defined as tumour microenvironment at the future metastatic site which is established by the tumour as a preparation before the arrival of the disseminated tumour cells. Certain cells and cytokines have been reported to be a key factor in building these niches. To date, there is no single study that has investigated the PMN in the oral squamous carcinoma (OSCC). My hypothesis is that IL17, IL22, IL23 and STAT3 play part in the formation of PMN of metastatic OSCC.

Aim: To compare the expression of STAT3 and cytokines (IL22, IL23 and IL17) between positive and negative lymph nodes from OSCC.

Methods: A total of 36 formalin fixed paraffin embedded (FFPE) tissue specimens were obtained from the Malaysian Oral Cancer Database & Tissue Bank System (MOCDBTS). Sample were divided into two groups. Positive lymph nodes were those with histological evidence of metastatic OSCC while negative nodes were those with no sign of metastasis. The expression of IL17, IL22, IL23 and STAT3 was investigated using immunohistochemistry (IHC). Gene expression was done using Real time polymerase chain reaction (RT-PCR) to validate the results. Image J was used to count the number of positively staining cells. SPSS was used to analyze the data.

Results: IHC results shows that the expression of IL22, IL23 and STAT3 was significantly higher in the negative lymph nodes when compared with the positive group which proof our hypothesis. However, the difference in gene expression was not significant.

Conclusion: My results suggest that negative lymph nodes can be a PMN for the OSCC. In addition, IL22, IL23 and STAT3 can be responsible at least partially for the formation of this PMN.

Mohammad Alansary

Alansary, M. A. D. (2018). Primary tooth pulp as a source of progenitor cells for tissue regeneration (Thesis, Doctor of Philosophy).

Advisors: Drummond, Bernadette; Coates, Dawn; Friedlander, Lara

Primary tooth pulp cells have a unique character that can be attributed to their neural crest origin. The long-term aim of this research is to utilise these cells to regenerate dentine-pulp

complexes in damaged immature permanent teeth. In the first instance, it is necessary to successfully culture and characterise progenitor cells isolated from primary dental pulp and assess their ability to differentiate into cells of different origins. Future research can proceed to treatment-based clinical trials using 'progenitor cells' from primary teeth to treat future problems or diseases that may arise in the same patient by regenerating the pulp-dentine complex, leading to root maturation; and potentially regenerating damaged heart muscle or nerves.

Objectives: To characterise primary pulp cells from three defined stages of root resorption by in vitro immunocytochemistry and immunohistochemistry experiments. The expression of markers for embryonic, neural and mesenchymal stem cells were studied. The differentiation potential of primary pulp cells into the three germ layer lineages, specialised mesoderm (cardiomyocyte progenitor cells) and specialised ectoderm (neural progenitor cells) was assessed.

Methods: Caries-free primary canines at three defined stages of physiological root resorption were included in this study (n = 9). In vitro cultures were established in xeno-free, serum-free Essential 8 (E8) medium on a human truncated vitronectin matrix (VTN-N). An embryonic stem cell line (GENEA002) grown in stem cell media (M2) was used as a positive control in immunocytochemistry and multilineage differentiation experiments. The expression of embryonic stem cell proteins (Oct4A, Nanog and Sox2), neural stem cell proteins (nestin and distal-less homeobox 2 [Dlx2]) and mesenchymal stem cell surface markers (cluster of differentiation markers CD90, CD73 & CD105) was investigated. Flow cytometry analyses were also performed based on criteria proposed by the International Society for Cellular Therapy.

The differentiation potential of primary pulp cells into ectoderm, mesoderm and endoderm, as well as cardiomyocytes and neural progenitors, was determined.

Results: Most primary tooth pulp cells in culture and in tissue sections expressed the early neural progenitor markers nestin and Dlx2; a few isolated cells expressed the embryonic stem cell transcription factors Oct4A, Nanog and Sox2; and the majority expressed the mesenchymal stem cell markers CD90, CD105 and CD73. Flow cytometry for mesenchymal stem cell markers did not detect differences according to resorption stage.

Differentiated cells showed positive immunofluorescence for orthodenticle homeobox-2 (Otx2) (ectoderm), Brachyury (mesoderm) and Sox17 (endoderm) proteins of the three germ layers as well as expression of cardiomyocyte progenitor markers TNNT2 and Nkx2.5 and neural progenitor markers nestin, Sox1, Sox2 and Pax6.

Conclusions: The present study identified cells that variably express marker proteins belonging to embryonic stem cells, neural stem cells and mesenchymal stem cells. The in vitro ability of the cells to differentiate into the three germ layers cells, as well as cardiomyocyte and neural progenitor cells, was detected. The root resorption stage was not a significant factor in relation to mesenchymal stem cell marker expression.

This research provides an insight into the unique type of progenitor cells present in the dental pulp of primary teeth and their differentiation capabilities that can be utilised to regenerate the pulp-dentine complex in damaged permanent teeth following injury.

Abdullah Barazanchi

Barazanchi, A. (2018). Evaluation of 3D Printed and Soft Milled Cobalt Chromium Alloy for Prosthodontic Applications (Thesis, Doctor of Clinical Dentistry in Prosthodontics)

Advisors: Li, Kai Chun; Al-Amleh, Basil; Lyons, Karl; Waddell, J Neil

Background: The incorporation of digital dentistry into dental practices has greatly impacted the conventional dental workflow. This process has given clinicians access to additional treatment options, with more predictable outcomes for fabrications of prostheses by enabling a wider selection of dental materials and manufacturing techniques; one such material is cobalt chromium (CoCr). CoCr alloy is a favourable material choice due to its low cost and high physical strength, however, the outcome of traditional casting methods of CoCr alloy can be unpredictable and is heavily reliant on the skills of the technician. Computer-aided manufacturing can produce specimens with much more predictable properties, although, milling of fully sintered cobalt chromium has a high wear rate on milling components during the fabrication process due to the inherent hardness of the alloy. More recently, two techniques using CoCr powder have been developed. One involves milling of soft polymer bound CoCr (SM) which is then sintering to full density, the other is 3D printing/laser sintering (LS) of loose CoCr powder. Both of these manufacturing methods greatly reduce stress on the components of their respective machines. Published research on cobalt chromium fabricated using these two manufacturing methods, however, suffers from a lack of standardization making it difficult to draw clear conclusions on their in-vitro properties.

Aim: To compare the properties of additive manufacturing/laser sintered cobalt chromium alloy with subtractive manufacturing/ soft milling of cobalt chromium alloy in regards to mechanical properties, bonding to porcelain, and microstructural characteristics/behaviour.

Method: Chapter 2: Forty CoCr dumbbells were fabricated using the SM and LS manufacturing method with dimensions in accordance to the ASTM E8 standard. The dumbbells were fractured under uniaxial tensions and calculations performed to determine the ultimate tensile strength, proof stress and elastic modulus. The fracture surfaces were examined using scanning electron microscopy. Rectangular plate specimens were also fabricated and subjected to testing using nanoindentation method to further examine elastic modulus and hardness values.

Chapter 3: Thirty-two rectangular specimens with dimensions 8 x 30 x 1.5 mm were fabricated using the methods outlined in Chapter 2. Thirty specimens were layered with porcelain and tested using 4-point strain energy release rate approach in accordance with the method by Suansuwan and Swain (1999) to measure the adhesion strength. Fracture surfaces were then visually examined and under scanning electron microscopy to determine the mode of failure. Nanoindentation was carried out on the remaining two specimens to calculate the changes in elastic modulus and hardness post-porcelain firings. The effects of porcelain firings on microstructure and phase composition of specimens were also examined using electron microscopy.

Results: Chapter 2: The LS CoCr had a significantly higher ultimate tensile strength (1090 vs. 915.9 MPa) and proof stress (608.8 vs. 549.4 MPa) ($P < 0.05$) than SM, while the difference in the elastic modulus values was not statistically significant (196.2 vs. 180.4 GPa). The elastic modulus calculated using nanoindentation was similar to that found using tensile testing (LS CoCr 197.0 GPa and SM CoCr 181.8 GPa). The hardness was also lower for the SM than LS CoCr (3.3 vs. 4.4 GPa). Examination of the dumbbell fracture surfaces

showed uniform structure for the LS CoCr specimens whilst the SM CoCr specimens were perforated with porosities; neither the LS or SM specimens showed an obvious point of fracture.

Chapter 3: Adhesion energy of ceramic to LS CoCr was significantly higher than that of ceramic to SM CoCr (86.6 J/m² vs. 76.9 J/m²) ($P < 0.05$). The elastic modulus showed an increase in both specimens before and after the firing (LS 181.8 to SM 187.9 GPa vs. LS, 197 to SM 205.1 GPa). Lower hardness values of SM CoCr than LS CoCr were initially observed, however after ceramic firings, SM CoCr had a larger increase in hardness values at the interface than the LS CoCr (4.9 vs. 5.3 GPa). Electron backscatter diffraction (EBSD) mapping showed that both specimens had a regular grain structure, however SM CoCr had more localized changes in crystalline structure at the interface when compared to LS CoCr.

Conclusion: Despite the SM CoCr having voids that directly affected the overall mechanical properties, both LS CoCr and SM CoCr results had better mechanical properties when compared to cast CoCr. The LS CoCr had a dense fine grained structure while SM CoCr had a fine grained structure. For the adhesion test, both LS and SM CoCr had higher bond strength to ceramic than the cast CoCr. An interesting relationship was found between increased hardness of interface and lower bond strength. Overall although LS CoCr had superior properties to SM CoCr, both computer-aided manufacturing methods were superior to reported properties of conventionally cast of CoCr, suggesting that both would be a suitable choice for long-span PFM prostheses or metallic frameworks for use in the mouth. Further in-vivo research is required to examine the performance of such prostheses in the oral cavity.

Sy Yin Chai

Chai, S. Y. (2018). Effect of incisal preparation design on stress distribution and load-to-failure of ceramic veneers (Thesis, Doctor of Clinical Dentistry in Prosthodontics)

Advisors: Bennani, Vincent; Aarts, John; Lyons, Karl

Background: The incisal preparation designs for ceramic veneers have been widely discussed in the dental literature. Incisal preparation can be divided into two broad categories: overlap and non-overlap. The overlap group comprises the palatal chamfer (PC) and the butt joint (BJ) preparation designs, while the non-overlap group includes the window and the feathered edge (FE) preparation designs. A review of the literature shows there is no consensus on whether incisal reduction is necessary and how much of an incisal overlap should be provided when an increase in incisal length is not required. The two most common incisal preparation designs provided are the BJ and the FE.

Although ceramic veneers are highly successful, the majority of the clinical failures were related to veneer fracture. The most frequently reported complications include fracture or chipping, followed by debonding and marginal discoloration. The lack of randomised longitudinal controlled trials with large study samples has proven to be a challenge in most prosthodontic studies. The difficulty of standardising patients (age, health, diet), occlusion, the dynamicity of intraoral environment, quality of bonding, bonded tooth substrate (enamel versus dentine), tooth vitality, and conducting a long-term clinical trial are what made this area of research a challenge.

A meta-analysis of in vitro studies showed that the BJ incisal preparation design may be more favourable compared with the PC design in terms of ceramic fracture and frequency of tooth failure. One of the major difficulties of in vitro studies include

standardisation of tooth specimens and obtaining a large enough sample size for appropriate statistical power analysis. Other variables in the studies also include veneer preparation designs, amount of tooth preparation, veneer fabrication techniques, loading angulations and loading points. To date there are no studies that have investigated the stress distribution and the load-to-failure of ceramic veneers with the BJ and the FE preparation designs under various loading conditions.

Objectives: To evaluate the stress distribution and load-to-failure of ceramic veneers with BJ and FE incisal preparation designs under various loading conditions.

Methods: This thesis contains two parts:

Part I - Photoelastic analysis. Stress distribution of ceramic veneers with BJ and FE incisal preparation designs under different loading conditions was evaluated under a polariscope. Photoelastic models (control, BJ and FE) were loaded at i) 45°/at incisal edge, ii) 45°/1.5mm from incisal edge, iii) 20°/at incisal edge, and iv) 0°/at incisal edge. The development of the stress patterns was recorded using a digital camera.

Part II - Static load-to-failure test. One hundred and forty-eight typodont teeth (customised Nissin A25A-UL19B) (n=37) were divided into four groups: i) BJ 20°, ii) BJ 0°, iii) FE 20°, and iv) FE 0°. Lithium disilicate ceramic veneers (IPS e.max CAD, Ivoclar Vivadent) were milled using the computer-aided- design-and-computer-aided-manufacturing (CAD/CAM) techniques. Veneers were bonded to typodont teeth with resin cement (IPS Variolink Esthetic, Ivoclar Vivadent). Each group was loaded at 20° and 0° angulations at the incisal edge using an Instron Universal Testing Machine at a cross-head speed of 0.01 mm/s till failure.

Results: BJ photoelastic preparations had better stress distribution and lower stress concentration compared to FE photoelastic preparations under both axial and inclined loads. Stress concentration occurred at the incisal edge region and along the cement interface for all loading parameters. Pairwise comparison showed veneers from the BJ group had significantly higher load-to-failure value compared to the FE group. Veneers with FE preparation design loaded at 20° angulation (FE 20°) had the lowest load-to-failure value, with the failure mode being predominantly cohesive. None of the veneers in the four groups de-bonded during testing.

Conclusion: Within the limitations of the present study, the following conclusions can be made:

1. Both incisal preparation designs and loading angulations have significant effects on the stress distribution and the load-to-failure values of ceramic veneers.
2. The BJ group exhibits a significantly higher load-to-failure value compared to the FE group.
3. Of all the groups analysed, the FE group loaded at 20° angulation has the lowest load-to-failure value and the least favourable stress pattern.

Clinical significance: The BJ incisal preparation design is preferred to FE preparation design due to more favourable stress distribution and a higher load-to-failure value.

Maggie Chen

Chen, M. H.-M. (2018). Resonance frequency analysis in assessing implant stability: a retrospective analysis (Thesis, Doctor of Clinical Dentistry in Prosthodontics)

Advisors: Ma, Sunyoung; Tawse-Smith, Andrew; Lyons, Karl

Background: Resonance frequency analysis (RFA) has been proposed as a non-invasive tool for evaluating implant stability. It provides quantitative measurements (implant stability quotients, ISQs) supplementary to conventional clinical and radiographic assessments, but eliminates the subjectiveness that may be involved with other evaluations. Long-term clinical studies validating its association with other clinical parameters are limited, therefore, the aim of this study was to retrospectively assess ISQ values from patients that were followed up for 10 years, and evaluate any correlation between ISQs and clinical parameters such as change of marginal bone level (MBL).

Methods: One hundred and seventy-three participants (65 males and 108 females; age range 21 to 85 years), and 383 implants were followed up for 10 years. Implant locations, MBLs, and ISQs recorded at various recall times were entered for statistical analysis. Mixed model analysis was applied with the level of significance set at $P < 0.05$.

Results: Twenty out of 21 implants failed within 1 year of functional loading, resulting in a 10-year cumulative implant survival estimate of 95%. The failed implants had lower ISQs at surgery (52.3 ± 7.03) and baseline (52.5 ± 4.20) when compared to surviving implants, and the difference was statistically significant at surgery ($P < 0.05$). The mean ISQ values generally increased over time, with various patterns of change between implants when grouped according to patient sex and implant locations. There was no correlation between the changes in the ISQ values and the MBLs.

Conclusions: ISQ values may help to identify the implants at higher risk of failure. There may be various patterns of change over time in addition to an overall increase in ISQ values. Both similar and contradictory findings were found when compared with earlier literature, and a correlation between RFA and MBL change could not be identified. Despite limitations, the present study provides an overview of the clinical performance of RFA based on long-term clinical data.

Leonard Chia

Chia, L. Y. F. (2017). Clinicians' Perspectives on Special Care Dentistry in New Zealand (Thesis, Doctor of Clinical Dentistry in Special Needs Dentistry)

Advisors: Tong, Darryl C; Thomson, W Murray; Foster Page, Lyndie

Introduction: Special Care Dentistry in New Zealand is relatively underdeveloped. With its workforce persistently scarce, its training and career pathways remain unclear. Little is understood about the specialty's role within the New Zealand public oral health sector. With the ageing population and the increase in demand for public oral health services, it is perhaps timely to explore this specialty to understand its implications for the future of Special Care Dentistry in the context of New Zealand.

Aim: The aim of this research was to explore the perspectives of New Zealand clinicians who practise Special Care Dentistry on the current and future status of Special Care Dentistry in New Zealand.

Methods: A qualitative approach was used, and semi-structured interviews were conducted with nine registered Special Care Dentistry Specialists, a Dental Public Health Specialist, and a general dentist who predominantly practised Special Care Dentistry. Interview data were audio-recorded and transcribed. A general inductive approach was used to thematically analyse the data and emerging themes were identified.

Results: Three broad themes were identified: the profession, interprofessional interactions, and the issues in Special Care Dentistry. Under each of these themes, subcategories were further identified. This study revealed that the participants preferred 'Special Care Dentistry' to 'Special Needs Dentistry', which challenges the current term and definition used in New Zealand. In addition, the participants provided insights into career choices and their roles as Special Care Dentistry practitioners. Also highlighted were the career and training prospects of Special Care Dentistry and the associated limitations in New Zealand. Participants perceived that their professional interactions with their medical peers were better than their interactions with general dentists. Participants also indicated that there is a general reluctance of dentists to treat older people and patients who require special needs. The main barriers to provide Special Care in private practice were financial hurdles, time pressures, and limited medical knowledge. This study also identified critical issues such as older people's oral health and an increasing demand for Special Care Dentistry in public practice, suggesting a greater need for the development of Special Care Dentistry in primary health care. Recommendations were proposed for the improvement of career and training pathways, Special Care Dentistry education among undergraduates and general dentists, and the promotion of the specialty within the medical and dental professions.

Conclusion: Special Care Dentistry is a specialty of dentistry in its own right. However, Special Care Dentistry in New Zealand is still in its infancy and there is much room for improvement, particularly in the aspects of education and career pathways to provide a healthy self-sustaining workforce. There should be a focus to promote Special Care Dentistry by all levels of oral health care stakeholders including the Faculty of Dentistry, NZDA, and the Ministry of Health. With the findings in this study, Special Care Dentistry can be defined as a discipline that provides patient-centred oral health care for those within the spectrum of disabilities and activities restrictions that affect their oral health, within the personal and environmental context of the individual.

Joanne Choi

Choi, J. J. E. (2017). Continuous Measurement of Intraoral pH and Temperature (Thesis, Doctor of Philosophy).

Advisors: Waddell, Neil; Lyons, Karl

Dental erosion has been recognised as a major issue in dentistry - with epidemiological studies reporting an increasing prevalence of this condition. Salivary functions are the most significant factors in dental erosion; salivary pH in particular has an important role in the pathogenesis of these lesions and other problematic oral conditions. It has remained difficult to monitor salivary pH changes intraorally over time as most measurements are either done in vitro or in situ by saliva sampling. This limits the ability to fully understand the aetiology and changes in salivary pH. Intraoral temperature has a close relationship with pH but, to date, there has been no study that has reported simultaneous measurement of intraoral pH and intraoral temperature over a 24-hour period.

This thesis begins by reviewing the literature on tooth wear, especially dental erosion. By identifying the causal factors, saliva, in particular the salivary (intraoral) pH, plays the most significant role in the development of dental erosion. It was found that there is a large amount of research on the association of acidic food and drink consumption and the development of erosion, however, several risk groups such as individuals with xerostomia (dry mouth), and sleep and respiratory disorders, have not been well-studied. It was also found that there are few studies that have investigated normative intraoral pH variations over extended periods especially during sleep due to the limitation of intraoral pH measuring devices used. Intraoral pH and temperature are related, however, there is also a limited study available on the measurement of intraoral temperature for extended period.

Therefore, another literature review was conducted to investigate the paucity in the research to monitor the intraoral pH over an extended period. The literature review clearly identified the need for a novel device to be developed that measures simultaneously both intraoral pH and temperature.

A novel device to measure intraoral pH and temperature was developed and validated. It was found that intraoral pH and temperature can be measured successfully - continuously and simultaneously. Based on the studies conducted using this device, it was found that there is a decrease in intraoral pH during sleep and a noticeable difference in the pattern of variation of pH and temperature between day (7.3 ± 0.4 ; $33.9 \text{ }^{\circ}\text{C} \pm 0.9$) and night (6.6 ± 0.4 ; $35.9 \text{ }^{\circ}\text{C} \pm 0.5$).

Moreover, mouth breathing during sleep was found to be related to a decrease in intraoral pH compared with normal breathing during sleep, and this has been reported as a causal factor for dental diseases. The mean intraoral pH during sleep was $7.0 (\pm 0.5)$ and during sleep with mouth breathing was found to be $6.6 (\pm 0.5)$, which was found to be statistically significant ($p < 0.05$). No statistical significance was found in intraoral temperature between sleep with and without mouth breathing ($p = 0.38$). It was further found that there is a strong circadian rhythmic pattern in intraoral pH variation over a day. Lastly, from a pilot study conducted, it was found that there is an interarch difference in intraoral pH and a noticeable difference in the pattern of variation of pH and temperature between maxilla (7.32 ± 0.52 ; $33.12 \text{ }^{\circ}\text{C} \pm 5.51$) and mandible (7.07 ± 0.26 ; $36.18 \text{ }^{\circ}\text{C} \pm 0.96$) when measured over a 24 hour period.

The research described in this thesis showed that the development of a novel device to measure intraoral pH and temperature continuously over extended period can provide invaluable normative data for healthy individuals and help provide a better understanding of changes in intraoral pH related to the circadian rhythm of saliva in particular for investigating a relationship between dry mouth, mouth breathing and dental erosion, and other oral conditions related to intraoral pH, such as dental caries.

Abbey Corbett

Corbett, A. (2018). The Restorative Management of Dental Caries affecting Children and Adolescents in New Zealand (Thesis, Doctor of Clinical Dentistry in Paediatric Dentistry)

Advisors: Meldrum, Alison; Chandler, Nicholas; Drummond, Bernadette; Foster Page, Lyndie

With an increase in knowledge and understanding and alongside the development of materials, there has been a fundamental change in the management of dental caries. Contemporary

management is governed by minimal intervention principles. The application of these principles corresponds to personalised care focused on prevention, non-invasive and micro-invasive strategies to remineralise or limit progression of early lesions and where cavitation has occurred, the provision of conservative restorative treatment.

However, the translation of minimal intervention principles into clinical practice has been limited. This has been demonstrated in previous studies by the investigation of restorative treatment thresholds - the stage of progression of a carious lesion at which a practitioner would intervene operatively. Restorative treatment thresholds have been associated with a number of practitioner and practice factors. Previous studies have focused predominantly on restorative treatment thresholds held by dentists in the management of permanent teeth in adult patients. There is little known about restorative treatment thresholds in the management of primary teeth and in the provision of care for children and adolescents.

The study aims were:

1. To examine restorative treatment decisions made by New Zealand Oral Health Practitioners in their management of dental caries affecting children and adolescents.
2. To investigate what demographic characteristics are associated with restorative treatment decisions made by New Zealand Oral Health Practitioners in their management of dental caries affecting children and adolescents.

Methods: Two sampling frames were used to identify Oral Health Practitioners registered in: Dental Therapy Practice; General Dental Practice and Paediatric, Public Health and Special Needs Dentistry. A questionnaire was distributed to 2844 practitioners using REDCap software. The questionnaire initially collected practitioner and practice demographics for each participant. Subsequent sections asked participants to select proximal and occlusal lesions for which they would recommend restorative treatment in the management of primary and permanent teeth. They also selected the preparation technique and restorative material they would use to manage the lesion they had opted to restore.

Results: A total of 638 participants responded (22.4%). Participants who had not completed any of the clinical components of the questionnaire were excluded. The sample comprised 108 dental and oral health therapists (18.7%), 434 general dental practitioners (75.1%) and 36 specialists (6.2%). The sample represented the New Zealand oral health workforce well over a range of demographic characteristics.

In the management of proximal caries in primary teeth, 17.3% of the sample selected to restore a lesion within enamel. 15.6% of the sample would restore a lesion within enamel in a permanent tooth. The majority of participants selected to restore a lesion at the outer third of dentine in primary (50.3%) and permanent teeth (47.6%). Participants most frequently selected to restore proximal lesions with a slot preparation and resin composite as a restorative material. However, there was considerable variability in the materials selected for the management of primary teeth.

In the management of occlusal lesions, 21.8% of the sample selected to restore a lesion that did not involve dentine in the management of primary teeth. This increased to 37.3% in the management of permanent teeth. The majority of participants selected to restore an occlusal lesion described clinically as an underlying dark shadow from dentine and radiographically as having a carious lesion in the outer third of dentine. In preparing a cavity to treat an occlusal

lesion, 5% of the sample selected to open the whole fissure system in the management of a primary tooth. This increased to 9.6% in the management of permanent teeth. Conventional glass ionomer cement was the restorative material most commonly selected to restore occlusal lesions in primary teeth. In the management of occlusal lesions in permanent teeth, composite was selected by 64.3% of the sample. The selection of non-invasive and micro-invasive strategies to manage a questionable carious surface of a primary second molar was varied among groups.

Restorative treatment decisions demonstrated statistically significant associations with a number of practitioner and practice characteristics. A variation in judgement and a variation in perception are likely to contribute to the decisions made by the sample.

Conclusion: New Zealand Oral Health Practitioners appear to intervene early in the caries continuum when managing children and adolescents. Further regression analysis is required to eliminate confounding within the variables examined. Future research should focus on gaining a greater understanding of factors that influence restorative treatment decisions made by practitioners and the barriers they face in instituting caries management strategies based on minimal intervention principles.

Harsha De Silva

De Silva, H. L. (2018). Does *Candida albicans* influence oral carcinogenesis? (Thesis, Doctor of Clinical Dentistry in Oral Surgery)

Advisors: Hussaini, Haizal; Rich, Alison Mary

Oral squamous cell carcinoma (OSCC) has a multifactorial aetiology. The advanced disease is associated with significant morbidity and mortality. Many OSCC are preceded by clinically apparent oral potentially malignant disorders (OPMD) providing a potential window for early diagnosis and intervention to achieve better clinical outcomes. *Candida albicans* is a common oral commensal but may turn pathogenic under certain conditions. An association between *C. albicans* and OPMD/OSCC has been claimed since the 1960s. Yet, there is no convincing evidence to incriminate the organism with a causative role in oral carcinogenesis.

Aim of the study: To investigate the role of *C. albicans* colonization and infection in oral carcinogenesis using immunohistochemistry (IHC), histopathology and clinical information in patients with OPMD/OSCC.

Study hypothesis: Presence of *C. albicans* colonization and infection will show a positive correlation with severity of oral epithelial dysplasia (OED) and expression of specific molecular markers when compared with lesions without the presence of *C. albicans*.

Materials and methods: The study sample comprised formalin-fixed paraffin-embedded (FFPE) oral mucosal biopsy tissues of consecutive patients who presented for treatment of clinically suspicious OPMD/OSCC at a referral hospital in Sri Lanka. Clinical data collected included demographic, behavioural and health related information. The presence/absence of lesion surface colonization by *C. albicans* was determined by culturing material obtained from a scraping. Subsequently all lesions were biopsied and histopathologically examined to detect and record the presence/absence of *Candida* hyphae infiltration in the epithelium and for the presence/absence of low-risk OED, high-risk OED or OSCC. Clinical information was tabulated and statistically analysed

to investigate whether presence/absence of *C. albicans* colonization was an independent risk factor for presence/absence of high-risk OED/OSCC. Immunohistochemistry was performed to assess p53 and Ki67 protein expression in 62 selected samples with either, *C. albicans* colonization and infection or without *C. albicans* colonization/infection.

Results: The study sample (n=139) comprised 127 males (mean age 57.4 yrs.) and 12 females (mean age 63.6 yrs.). Betel-quad chewing was common (58.3%) followed by alcohol use (46.8%) and smoking tobacco (29.5%). Only 12.9% were denture wearers while 28.1% reported a medical condition indicative of potential immune compromise. Ninety-six (69.1%) patients had *C. albicans* colonization of which 28 (29.2%) showed Candida infection with hyphae invading the parakeratin layer of the epithelium. A highly significant independent association was observed between *C. albicans* colonization and OPMD having high-risk OED ($p=0.00$, RRR=4.92). Immunohistochemistry (n=62) showed marginally significant ($p=0.08$) increased mean immunoreactive score for anti-Ki67 in Candida-infected OPMD. There was significantly high immunopositivity for anti-Ki67 ($p<0.01$) and anti-p53 ($p=0.01$) evident in the maturation compartment of the epithelium in OPMD having Candida colonization and infection.

Conclusions: *C. albicans* colonization in oral mucosal lesions had a significant independent association with occurrence of high-risk OED and OSCC. The presence of *C. albicans* colonization and infection is associated with increased cell proliferation and a significantly increased immunopositivity for anti-Ki67 and anti-p53 in the maturation compartment of the epithelium on OPMD. Taken in context, these findings support a potential causative role for *C. albicans* in oral carcinogenesis which merits further investigation and validation.

Lisa Falland

Falland, L. R. (2018). Development of an Anatomical Head Model, using Simulant Materials, to measure Traumatic Brain Injury (Thesis, Doctor of Philosophy)

Advisors: Brunton, Paul; Waddell, Neil; Tong, Darryl

Head injury biomechanics is a complex area involving a combination of physical and biological principles. Blunt force head injury mechanisms remain poorly understood, especially repetitive short duration high impacts which may occur in both concussion and subconcussion. To understand forces and injury patterns involved with head injury and subsequent brain injury, head impacts must be simulated in such a way to accurately represent associated biodynamic responses of the scalp, skull and brain in vivo.

The phenomena of concussion and subconcussion, as well as the structural and mechanical properties of various head layers are outlined in the literature review of this thesis. It highlights that although various materials had previously been investigated, there is a lack of information regarding the mechanical properties of a suitable scalp, skull and brain simulant for blunt force impact experimental head models. To date, less than a handful of studies had reported the use of an anatomical model, which had limitations in the use of simulant materials. Therefore, this thesis attempted to find more suitable simulant materials for various head layers, as well as develop a more anatomically correct head model.

The study on skin/scalp simulant materials showed that dental silicones are a good alternative for studies that require a skin simulant. In this instance, the medium bodied polyvinyl siloxane

presented with adequate tear strength and hardness, thus chosen as the scalp simulant for the skin/skull/brain model. For the skull simulant, it was found that epoxy resin had an elastic modulus and flexural strength closest to that of the mean human skull values reported in the literature, with impact forces not exceeding the fracture stress. Consequently, it was used for the skin/skull/brain model. The search for a suitable brain simulant identified agar/glycerol/water conditioned to 22°C to be the most suitable material for high-speed imaging while measuring its elastic behaviour at ballistic strain rates. Although it had slightly higher apparent elastic moduli in the lower strain rate range it was chosen as the brain simulant material in the skin/skull/brain model.

To validate the use of the simulant materials (except for the brain) and an electronic data capture system (piezoelectric sensors) a basic spherical head model was developed. While the simulant materials performed in a satisfactory manner and were deemed suitable materials to be incorporated in an anatomical skin/skull/brain model, the use of piezoelectric sensors failed to accurately measure force transfer through the various head layers and therefore were not suitable.

In order to quantify the forces involved, in particular the degradation of these forces upon impact through the various head layers, accelerometers were embedded in the various simulant layers and used in the development of an anatomical skin/skull/brain model. This study identified that short duration, high intensity forces to the top of the head transfer through the various layers and undergo varying amounts of displacement. This suggests that the brain is subject to potentially traumatic forces upon repetitive short duration blunt force impact.

The novel research described in this thesis identified the suitability of various simulant materials for the use in an anatomically correct experimental skin/skull/brain model, as well as suitable electronic data capture system to measure force degradation and displacement highlighting the forces the brain is subjected to upon repetitive blunt force impacts.

Fiona Firth

Firth, F. A. (2017). A mechanical strain model for the assessment of periodontal ligament cell endoplasmic reticulum stress in three-dimensional culture (Thesis, Doctor of Clinical Dentistry in Orthodontics)

Advisors: Farella, Mauro; Seo, Benedict; Milne, Trudy

Introduction: The cellular basis of orthodontic tooth movement is complex, and is mediated by the biological responses of cells in the periodontal ligament (PDL) and alveolar bone. Appropriate homeostatic cytokine balance is essential for the safe and reliable induction of tooth movement. The endoplasmic reticulum (ER) plays a major role in maintaining homeostasis, with ER stress activating the unfolded protein response (UPR), potentially resulting in apoptotic cell death.

Objectives: 1) To validate a 3D-hydrogel model in which to culture human PDL cells and 2) To examine cell viability, apoptosis, and the expression of ER stress- and UPR-related genes following the application of mechanical strain (mimicking orthodontic tooth movement) to PDL cells.

Materials and Methods: Primary cultures of PDL cells were obtained from premolar teeth that were extracted from three individuals for orthodontic reasons. Viability and apoptosis assays

were used to profile the time required by cultured PDL cells to establish themselves in hydrogel and assess their optimal seeding density. Non-strained PDL cells were used as controls. Optimal gel constitution and seeding density were determined and the cells were subjected to 24 hours of static mechanical strain (18% dimensional substrate elongation).

Results: A tendency for reduced cell viability was observed following the application of mechanical strain to both 2D and 3D cultures of PDL cells (cell viability of strained 2D and 3D cells was 83% and 73.1% respectively, of control values), while there was no difference in caspase activity. For monolayer samples, the gene LOX (involved in cross-linking of collagen and elastin) demonstrated a tendency to be upregulated following mechanical strain (mean fold-regulation = 9.22, $p = 0.25$). In 3D samples, a number of UPR-related genes were differentially upregulated; including CREB3L3 (mean fold-regulation = 1.91, $p = 0.063$), which plays a role in the acute inflammatory response, and DDIT3 (mean fold-regulation = 17.0, $p = 0.438$), a well-established pro-apoptotic factor in the UPR.

Conclusions: A model for the application of mechanical strain to 3D cultures of PDL cells has been validated. While a reduction in cell viability was observed following strain, an increase in caspase activity was not evident, thus the reduction in viability appears to be mediated via caspase-3/7-independent mechanisms. There is potential for the UPR to be involved in OTM, and future experiments could include increased strain periods and varying strain magnitudes.

William Fogarty

Fogarty, W. P. (2017). Adolescent oral health in New Zealand in 2009 (Thesis, Doctor of Clinical Dentistry in Paediatric Dentistry)

Advisors: Thomson, William Murray; Brosnan, Michael

Adolescence is an important developmental epoch, a dynamic period when the challenges of maturation from childhood to adulthood can have a substantial influence on both general and oral health. Among other things, behavioural factors can affect the state of oral health itself, or the ability of an individual to maintain it. There are several oral health-related domains that are of particular interest in the adolescent age group, including dental caries, periodontal disease, dental fluorosis, dental trauma, dental anxiety and oral hygiene.

In New Zealand, adolescents are eligible for publicly-funded dental care (up until their 18th birthday). Following that, individuals have to accept sole responsibility for the cost of their dental care. Thus, adolescence is an important period in which to promote and establish good oral health; however, there is a relative lack of information in the literature about adolescent oral health. As such, the aim of this study was to describe the oral health (and its associations) of New Zealand adolescents.

The study's objectives were:

1. To conduct a secondary analysis of the adolescent-age data from a previous national oral health survey;
2. To describe several (pertinent) oral health-related domains in the New Zealand adolescent population; and
3. To identify putative risk indicators/markers for each of the domains of interest.

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

The prevalence of dental caries in the 12- to 14-year-old and 15- to 17-year-old age groups was 45.2% (33.4, 57.5) and 65.7% (54.5, 75.3), respectively. Their respective mean DMFT scores were 1.4 (1.0, 1.9) and 2.5 (1.7, 3.3). The prevalence of gingivitis was 71.6% (60.0, 80.9); clinical attachment loss ≥ 4 mm was seen in 11.2% (4.5, 25.2) (gingivitis and periodontal attachment loss were recorded in the 15- to 17-year-old group only). Dental fluorosis was relatively uncommon, with respective prevalence estimates of 17.0% (10.3, 26.9) and 10.2% (4.8, 20.4), and dental trauma prevalence was 29.2% (19.8, 40.9) and 18.2% (10.5, 29.6), respectively. Only a few of the 15- to 17-year-olds were dentally anxious, and oral hygiene in the 12- to 14-year-olds was generally fair/good. Various putative risk indicators/markers were identified for each domain.

This study gave an insight into the state of adolescent oral health in New Zealand in 2009, by describing several (pertinent) oral health-related domains, and identifying several putative risk indicators/markers for each domain (and thereby gives some indication of the possible associations in the New Zealand adolescent population). More research is needed; however, the findings can be taken as starting points for further investigation.

Phillippa Greer

Greer, P. (2018). Effects of OTX008, a galectin-1 inhibitor, on oral squamous cell carcinoma cells in vitro (Thesis, Doctor of Clinical Dentistry in Oral Medicine)

Advisors: Coates, Dawn; Rich, Alison

Oral squamous cell carcinoma (OSCC) is a common cancer that is currently associated with significant morbidity and poor mortality, and for which targeted therapeutics have yet to be proved effective. Galectin-1 is a carbohydrate-binding protein that is commonly upregulated in cancers and is associated with increased risks of metastases, promotion of angiogenesis and escape of the immune response. Galectin-1 has been shown to be upregulated in OSCC, and this upregulation is associated with increased invasion and poor prognosis.

The aim of this study was to assess whether the small molecule galectin-1 inhibitor, OTX008, could inhibit OSCC cells in vitro, and to investigate how OTX008 affects the expression of a narrow array of genes in OSCC.

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

All four cell lines were cultured with three concentrations of galectin-1 (50, 100 and 150 ng/mL) and four concentrations of OTX008 (12.5, 25, 50 and 100 μ g/mL), and cell viability was assayed

at 24, 48, 72 and 96 hours. Galectin-1 decreased cell viability at 24 hours in two of the OSCC lines, had no effect on the third, and increased cell viability in the NOK cells at 72 hours. OTX008 reduced cell viability in a dose-dependent manner in all cell lines, and this effect increased at each time point during a 96 hour culture period. OTX008 had the greatest effect on cell viability of the OSCC line with the highest galectin-1 levels compared to the other cell lines.

Gene expression in OSCC cells following 48 hours of treatment with 25 µg of OTX008 was relatively unaffected, with the exception of expression of c-Fos which was significantly elevated in two of the OSCC cell lines.

The results of this study suggest that OTX008 may have therapeutic potential in the treatment of OSCC, possibly through induction of apoptosis via the AP-1 pathway.

Poppy Horne

Horne, P. (2018). Psychosocial aspects of periodontal disease diagnosis and treatment (Thesis, Doctor of Clinical Dentistry in Periodontology)

Advisors: Foster Page, Lyndie; Leichter, Jonathan; Knight, Ellie; Thomson, W. Murray

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

Fourteen adults with chronic periodontitis—who had been referred to a university clinic—kept diaries about their experiences. The diary information was then used as a framework for semi-structured qualitative interviews conducted at the completion of their non-surgical therapy. Inductive thematic content analysis with NVivo was employed. Data on clinical periodontal status, self-reported oral health and the condition's impact (the latter determined with the short-form Oral Health Impact Profile, or OHIP-14) were collected at baseline and follow-up to supplement the qualitative data. Finally, the findings were considered in the context of status passage, a sociological theory.

Three themes were identified which illustrated the detrimental impact of periodontal disease on the participants' psychosocial wellbeing: 'concealment', 'having a guilty conscience' and 'patient comfort as paramount'. These were related to a core underlying concept, 'progression to a more positive outlook', which described how the participants became more optimistic as they progressed through diagnosis and treatment. While most considered the treatment to be unpleasant, the participants not only perceived improvements in their symptoms, but described profound positive influences on their social wellbeing, self-esteem, mood, work, relationships and outlook. These findings were not reflected in the quantitative data, with a slight increase in the mean OHIP-14 score between baseline and follow-up (14.0 and 15.4 respectively). However, changes in self-reported periodontal status suggested greater periodontal awareness. Moreover, many of the findings were applicable to the notion of status passage, which indicated that this theory may be relevant to future studies investigating patients' experiences of periodontitis.

This study illustrated the broad psychosocial impact of periodontitis. The findings suggest that the benefits of periodontal treatment

extend beyond improvements in traditional biomedical indicators to those which are more relevant and desirable to patients. The findings may be reassuring for patients embarking upon periodontal treatment. In addition, this study gives clinicians valuable insights into the idiosyncratic experiences of our patients, to which we are not frequently exposed. This may improve our understanding of patients' perspectives and facilitate the delivery of periodontal care which is sensitive and responsive to patients' needs.

Jennifer Hughes

Hughes, J. (2018). Taphonomic alteration to juvenile porcine bone after exposure to a marine environment (Thesis, Doctor of Philosophy)

Advisors: Cannon, Richard; Black, Sue; Smith, Abby; Bell, Lynne

Research into the effects of different aquatic environments, particularly marine environments, on the taphonomic alteration of the skeleton, is an under-studied area of forensic research. Taphonomic alteration is environment-driven and, as such, geographically specific research is critical to develop a clear understanding of the range and degree of diagenetic processes to bone when exposed to a marine environment. Bone density is probably the most well studied intrinsic factor to bone survivability and differs greatly pre- and post-puberty, with bone thickness also fluctuating during growth. Because of these age-related differences in bone, it can be expected that juvenile remains would be modified at a different rate, and perhaps in a different way, to mature adult bone.

This work aimed to explore the impact of depositional marine environment on the taphonomic alteration to juvenile porcine skeletal remains. In particular, this research focused on the impact of time and seasonal variation based on initial exposure (summer and winter). Partial remains of 80 mixed breed white domestic piglets (*Sus scrofa domestica*) were exposed to two marine environments: submerged and intertidal. Remains were exposed for 6 to 24 weeks, in the Otago Harbour, Dunedin, New Zealand. The experiment involved deposition in summer (January) and winter (July). Long bones (74 femora and 68 tibiae) were recovered from the two environments and analysed using three different analytical techniques: morphological assessment, Fourier transform (FT)-Raman spectroscopy, and scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM-EDS). Exposed bones were also compared to 14 non-exposed controls (7 femora and 7 tibiae) macerated in laboratory conditions.

The presence of algae on newly recovered intertidal bones and possible iron sulphide (FeS₂) and hematite (Fe₂O₃) discolouration on submerged bones were characteristics that differentiated the two depositional environments. Permanent staining of various colours persisted on bones once dried from all submerged and intertidal samples after at least 12 weeks exposure. Whereas the pattern of increased scavenging and general bioerosion over time was similar between samples from the submerged and intertidal zones and matched the patterns of algal growth during the summer and winter experiments.

Using principal component analysis (PCA), sample-specific spectral indicators could be identified within the FT-Raman spectra of exposed bone samples. Intertidal samples had greater spectral variation than submerged and control samples and were generally defined by the presence of carotenoid peaks combined with amide degradation and a broadening of the phosphate peak, associated with increased carbonate substitution in the bioapatite. Quadratic

discriminant function analysis (QDA) of an independent test set achieved 84% overall correct classification for environment, and 42% total correct classification for environment and length of exposure. Importantly, using FT-Raman spectroscopy, exposed and non-exposed bones were not misclassified as each other.

Examination of the chemical composition of bone through SEM-EDS confirmed the presence of key marine sediment elements such as Al, Si, and Fe. The presence of these, or other, unique depositional elements may be of particular use in confirming the depositional environment if the sedimentology of the local marine environment is known. However, SEM-EDS offered little evidence for systematic depositional context-related diagenetic change over time.

While many aspects of marine taphonomy remain unknown, this research has shown that there is a need for more environment- and age-specific research into taphonomic alteration. In addition, this research has demonstrated the potential of three different methods that could be further developed to improve early exposure interval estimates. FT-Raman spectroscopy combined with PCA has shown its ability as a tool for defining taphonomic alteration in bones exposed to a marine environment and warrants further research.

Nurul Ruziantee Ibrahim

Ibrahim, N. (2017). Lymphangiogenesis in metastatic lymph nodes of oral squamous cell carcinoma (Thesis, Doctor of Clinical Dentistry in Oral Pathology)

Advisors: Hussaini, Haizal; Seo, Benedict; Rich, Alison

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

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

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

Result: IHC showed significantly greater VEGFC expression in Group A compared with Group B (p=0.0002). Significant positive correlation was found between VEGFC and TNM stage (p=0.004). No statistically significant differences were observed in the protein and gene expression level of the other tested markers.

Conclusion: This is the first study demonstrating significant overexpression of VEGFC in positive lymph nodes and suggests that

VEGFC is an important growth factor involved in OSCC lymph node metastasis.

Ghassan Idris

Idris, G. (2017). Efficacy of a Mandibular Advancement Appliance on Sleep Disordered Breathing in Children (Thesis, Doctor of Philosophy)

Advisors: Farella, Mauro; Galland, Barbara; Robertson, Christopher

Background: Sleep-Disordered Breathing (SDB) varies from habitual snoring to partial or complete obstruction of the upper airway, and can be found in up to 10% of children. SDB can significantly affect children's wellbeing, as it can cause growth disorders, educational and behavioural problems, and even life-threatening conditions, such as cardiorespiratory failure. Adenotonsillectomy represents the primary treatment for paediatric SDB where adeno-tonsillar hypertrophy is indicated. For those with craniofacial anomalies, for whom adenotonsillectomy or other treatment modalities have failed, or surgery is contra-indicated, mandibular advancement splints (MAS) may represent a viable treatment option. Whilst the efficacy of these appliances has been consistently demonstrated in adults, there is little information about their effectiveness in children.

Study objective: The aims of this research are first, to define the most accepted appliance from different designs of MAS to be used in the main study and second, to determine the efficacy of mandibular advancement appliances (MAS) for the management of Sleep-Disordered Breathing (SDB) and related health conditions in children.

Methods: The first part of this research was a pilot study designed as a randomized controlled study with crossover application of four different MAS designs. Questionnaires filled out by the patient and parent were used to gauge effectiveness of the different MAS designs regarding: the effects on speech, the initial acceptance, and the acceptance after wearing the appliance for a full night. A clinical examination then followed to test the appliance retention. One volunteer (11 year old male with class II dental and skeletal jaw relationships) participated in this pilot study and he was suitable for functional appliance treatment. Appliances tested were: 1) traditional Twin-Block with vertical elastics added to ensure the anteroposterior and vertical predetermined position of the mandible when wearing the appliance during sleep; 2) Twin-Block with a metallic fastener in the anterior area to test the function of mandibular advancement; 3) Clear elastic Twin-block which has the same traditional Twin-Block design with vertical elastics but uses vacuum formed retainers instead of the acrylic material; 4) a sham Twin-Block with upper and lower vacuum formed retainers without any mandibular repositioning. This pilot study showed that traditional Twin-Block was the best design to be used in the main study as it was highly accepted by the patient and showed the highest levels of retention in comparison to the other designs.

The main study was designed as a single-blind crossover randomised controlled trial with administration of both an 'Active MAS' (Twin-block) and a 'Sham MAS' (two Hawley retainers). Eligible participants were children aged 8 to 12 years, whose parents reported them snoring \geq 3 nights per week. Exclusion criteria included class III incisor and/or skeletal relationship, confirmed by lateral cephalometric radiograph. 18 children participated in the study. Each child was randomly assigned to a treatment sequence, starting with either the Active or the Sham MAS. Participants wore the appliances for three weeks, separated by a two-week washout

period. For each participant, home-based polysomnographic (PSG) data was collected four times, once before and once after each treatment period. The Apnoea Hypopnoea Index (AHI) represented the main outcome variable. Secondary outcomes, assessed at the same time with PSG recordings, included serum levels of Insulin-like Growth Factor 1 (IGF-1), obstructive sleep-related breathing symptoms, as assessed by the Paediatric Sleep Questionnaire (PSQ), quality of life, as assessed by the OSA-18 questionnaire, and childhood behaviour, as assessed by the Behavioural Assessment System for Children (BASC-2) Behavioural and Emotional Screening System (BESS), and nocturnal enuresis. In addition, blood samples were collected at the end of each treatment period to assess growth hormone changes by measuring blood levels of insulin-like growth factor-1 (IGF-1).

Results: Compared to a Sham MAS, wearing an Active MAS resulted in a significant reduction in AHI of 40% ($p=0.002$) with a decrease in AHI when using the Active MAS, and a tendency for an increase in AHI when using the Sham MAS. The separate assessment of AHI in supine and non-supine sleeping positions revealed that only the former was significantly influenced by treatment, with a reduction of 4.1 events per hour (95% CI=1.8-6.4; $p<0.001$). Snoring time was 46.3 minutes shorter with the Twin-Block than with the Sham appliance (95% CI=14.5-78.1; $p=0.004$). The lowest oxygen saturation showed significant improvement of 3.4% (95% CI=0.9-5.9; $p=0.007$) with the Twin-block in comparison to the Sham MAS. Compared to a Sham MAS, the Active MAS also reduced SDB symptoms. Subjective assessment by parents showed significant improvement, as represented by PSQ, OSA-18, and BASC-2 scores ($p\leq 0.028$). IGF-1 levels, however, did not differ between the two treatment periods ($p=0.172$). There were no reports of nocturnal enuresis incidents during the study periods.

Conclusion: The short-term use of mandibular advancement splints significantly reduced AHI, supine AHI. The decrease in the overall AHI resulted from a combination of a decrease in AHI when using the Active MAS, and a tendency towards an increase in AHI when using the Sham MAS. Snoring time decreased significantly when using MAS in children with SDB, and participants showed improvement in subjectively assessed SDB symptoms and quality of life. In addition, significant improvement was detected in parent-reported child behaviour.

Austin Kang

Kang, A. (2017). Digital assessment of three-dimensional tooth movement during orthodontic activation using an optimised typodont system (Thesis, Doctor of Clinical Dentistry in Orthodontics)

Advisors: Antoun, Joseph; Mei, Li (Peter); Ali, Azam; Farella, Mauro

CAD/CAM technology was used to develop an optimised typodont system, which allows three-dimensional simulation and quantification of orthodontic tooth movements.

The system was then used to quantify movements associated with a number of orthodontic archwire reshaping activations (tapering, squaring, expanding, asymmetrical, and reversing the curve of Spee).

The optimised typodont system was successfully developed and could reliably be used to quantify tooth movements in 3D. Reshaping of the archwire have implications in all three dimensions which should be taken into account when planning tooth movements.

Victoria Kashchuk

Kashchuk, V. (2017). Effect of Manuka Honey with CycloPower™ on dental plaque activity and gingival health in young adults (Thesis, Doctor of Clinical Dentistry in Paediatric Dentistry)

Advisors: Tompkins, Geoffrey; Boyd, Dorothy; Drummond, Bernadette

Introduction Manuka Honey with CycloPower™ (MMHC) is a low glycaemic index chewable tablet which offers sustained-release delivery of high grade New Zealand Manuka honey. It is marketed as a 'tooth-friendly' dietary supplement, containing high strength methylglyoxal, xylitol and CycloPower™. Methylglyoxal is found in Manuka honey and is responsible for much of the honey's antibacterial properties. CycloPower™ is an alpha-cyclodextrin: a cyclic oligosaccharide molecule derived from plants. Xylitol, a naturally occurring sugar alcohol, has been shown to effectively decrease caries risk.

Aim To compare the effects of MMHC with a xylitol tablet on dental plaque pH, salivary characteristics, gingival health and dental plaque accumulation.

Methodology The project was undertaken in two parts.

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

Part II. A randomised control, single blind, parallel group trial involving 31 healthy participants over 56 days. Participants chewed either a MMHC or a xylitol tablet three times daily for 28 days. Oral health and dental plaque pH changes (following 10% sucrose), were measured at Day 1, 14, 28 and 56. The minimum pH reached, area under the pH curve (AUC_{5.7}) and maximum decrease in pH were recorded. Linear mixed models were used to compare treatment groups for both parts.

Results Part I. Minimum pH (mean \pm SD): MMHC (5.3 ± 0.3) vs sucrose (4.9 ± 0.2 ; $p<0.001$); vs xylitol (6.3 ± 0.4 ; $p<0.001$); and vs Manuka honey (5.0 ± 0.4 ; $p<0.001$). The AUC_{5.7} (mean \pm SD) was larger for sucrose (13.3 ± 11.6) than xylitol (0.1 ± 0.2 ; $p<0.05$), but did not differ between sucrose and either Manuka honey (16.5 ± 15.6 ; $p=0.506$) or MMHC (4.9 ± 9.6 ; $p=0.124$).

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

Conclusion MMHC consumption resulted in a plaque pH decrease below critical pH 5.7. Therefore, the MMHC tablet should be used with caution in individuals at high caries-risk.

This project was funded by Manuka Health New Zealand Ltd.

Caleb Lawrence

Lawrence, C. (2018). Dental caries, tooth wear and dietary sugar intake in a sample of Northland Māori. (Thesis, Doctor of Clinical Dentistry in Orthodontics)

Advisors: Farella, Mauro; Mainvil, Louise; Antoun, Joseph; Mei, Li

In New Zealand, there are well known disparities in oral health between different ethnicities and groups with different socioeconomic status.

It has been recently shown that Māori are 1.8 times more likely to be higher daily consumers of sugar-sweetened beverages and food (SSB and SSF) in comparison to their European counterparts. Excessive intake of dietary sugar as well as carbonated drinks can have consequences on oral health, such as caries and tooth wear, but also broader implication for overall health.

The aims of this study were: 1) to describe self-reported oral hygiene, caries experience, tooth wear and dietary sugar intake in a Northland Māori sample; and 2) to investigate for possible associations between dental health and consumption of SSB/SSF. As whanau ora is an important aspect of Māori health, families were investigated as a unit.

A pilot study was designed as cross-sectional, family aggregation study. Forty-three Māori families (41 parents and 90 children) residing in Northland, New Zealand were recruited from three primary health care services. The study participants were firstly asked to fill in a questionnaire on self-reported oral hygiene, dental health, jaw habits, dental care service utilisation, and sweet beverages and food frequency consumption. Participants underwent a clinical dental examination, received an intraoral scan, and finally provided a hair sample for an objective measure of dietary sugar consumption (13C). Oral hygiene was measured using Greene's simplified oral hygiene index (OHI-S). Dental caries experience was assessed using the Decayed Missing Filled Teeth Index (DMFT/dmft), while tooth wear was assessed by the Basic Erosive Wear Examination (BEWE). Data were analysed by a mixed model with DMFT/dmft and BEWE as response variables, adjusted for gender, OHI-S, and family member (parent versus child), and family cluster as random effect. Family pattern were investigated using intraclass correlation coefficients and scattergrams, as appropriate.

Some 95% of study participants lived in an area with high deprivation scores (NZDep=8-10), and about half of the parent sample reported an inability to see a dentist. Self-reported caries experience was high in parents, as the vast majority of them received dental restorations (90.2%) and tooth extractions (65.9%). Children reported brushing their teeth and having greater access to dental care services more often than parents. Tooth clenching/grinding were self-reported by over 30% of the parents and children samples, while almost 90% of them reported snacking between meals (i.e. grazing). Oral hygiene was fair in both parents and children (Mean OHI-S levels \pm 1.3). The mean DMFT/dmft (\pm SD) for parents and children were 9.8 (\pm 5.6) and 2.3 (\pm 2.1), respectively. Tooth wear levels were mostly confined to enamel in both parents (BEWE=6.3 \pm 2.3) and children (4.3 \pm 2.7). Oral hygiene, as represented by OHI-S, was significantly associated with both DMFT/dmft (IRR=1.39; P=0.006) and BEWE scores (P=0.028). Sugar intake, as represented by SSB, SSF, and 13C hair content, was not significantly associated with DMFT/dmft and BEWE scores. Weak family patterns were identified for both caries experience and erosion (ICC \pm 0.23).

Conclusion: The small investigated sample had high deprivation scores and modest-to-low oral health. Caries experience and tooth wear were significantly associated with oral hygiene, but not with dietary sugar intake. A larger sample is needed to confirm this result. It is evident that oral health disparities still exist in New Zealand, and also affect Māori.

Ana Low

Low, A. (2018). Development of an in vivo model to investigate the effects of three adhesive removal methods around orthodontic brackets: A pilot study (Thesis, Doctor of Clinical Dentistry in Orthodontics)

Advisors: Antoun, Joseph; Mei, Lei; Farella, Mauro; Tompkins, Geoffrey

Orthodontic treatment has increased significantly over the last two decades, however the prevalence of biofilm related complications in the form of white spot lesions (WSLs) is still unquestionably prevalent. Orthodontic adhesives have been shown to be a critical factor for bacterial attachment and proliferation. With the increasing use of indirect bonding systems, advances in adhesive technology and lack of well-designed clinical trials, there is uncertainty regarding clinical guidelines for the management of excess adhesive around orthodontic brackets.

This study's primary objectives were to develop a protocol to compare the effects of three removal methods of excess adhesive around enamel-bonded orthodontic brackets on the acidogenicity of the formed biofilm following 96 hours in vivo.

A prospective study involving participants wearing customised intraoral appliances containing six randomised bovine enamel discs (three on each side) with bonded orthodontic brackets to facilitate intraoral biofilm development.

Validation of pH acidogenicity was initially performed with a *Streptococcus mutans* UA159 biofilm formed in vitro on bovine enamel discs containing orthodontic brackets and compared to stainless steel brackets on their own, following a glucose (10% w/v) challenge. The ion dissociation of sterile enamel discs was also tested on the pH assay.

To test the validity of a maxillary double vacuum-formed appliance, a volunteer wore the appliance continuously for four days containing enamel-bonded orthodontic brackets. Ninety-six hours was established as the optimum time for mature biofilm formation.

Eight healthy adult volunteers (age range = 25-39) wore customised maxillary double vacuum-formed appliances containing six bovine enamel discs (three on each side) with bonded orthodontic brackets for 96 hours. The three adhesive removal interventions (bur, no-removal and scaler) were randomised into canine, premolar or molar positions. The appliances were immersed in a sucrose solution (10% w/v) five times a day to facilitate biofilm growth.

pH measurements were done ex vivo on all biofilm bearing discs and control discs (absence of bacteria) following a glucose challenge (10% w/v). Cross sectional microhardness and elastic modulus measurements were obtained at the composite enamel interface and at the internal control (underneath the bracket).

Six volunteers completed the study. There was no difference between adhesive removal methods on final pH after glucose challenge. There was a significantly lower final pH for the discs located at the premolar position (5.3 \pm 0.1; p=0.006) and right side of the mouth (5.3 \pm 0.1; p=0.009) compared to control discs (7.3 \pm 0.2; p<0.001).

There was no significant difference between the interventions for the microhardness and elastic modulus at the enamel-composite interface. There was a significant difference for the microhardness and elastic modulus at the internal control (underneath the bracket) between the scaler, bur and no removal interventions (p \le 0.05) and canine, premolar and molar positions (p<0.05).

Conclusion: There is no significant difference between adhesive removal method around orthodontic brackets on the formation of an acidogenic biofilm in low risk individuals. The location in the mouth is highly correlated with creation of a cariogenic biofilm.

Hassan Mohamed Ahmed

Mohamed Ahmed, H. I. H. (2018). Novel approach to treat root caries: A pilot study to investigate Chlorhexidine-modified Glass Ionomer Cement applied using ART (Thesis, Doctor of Clinical Dentistry in Prosthodontics)

Advisors: Brunton, Paul; Lyons, Karl; Loch, Carolina; Jithendra, Ratnayake; Nicholas, Heng

Background: Root caries is common amongst the older population. The risk of caries increases with irregular attenders and special need groups. A simple, reliable and cost-effective therapeutic method is required to deal with this issue.

Objectives: To investigate the clinical effectiveness, patient acceptability and potential to reduce cariogenic microorganisms of a novel restorative material to treat root caries placed using the atraumatic restorative treatment (ART).

Methods: Two clinically-visible root surface carious lesions per patient (n=9) were restored using ART. One root carious lesion was restored with a conventional glass ionomer cement (GIC) and the other with a GIC cement modified with 5% chlorhexidine digluconate (GIC-CHX). Patient acceptability and survival rates of the restorations were evaluated using questionnaires and the modified Ryge criteria (Ryge 1980) at baseline, and after 1, 3 and 6 months. Plaque and saliva samples were collected around both restorations and microbiological analysis for bacterial viability were completed at baseline, 1, 3 and 6 months.

Results: Eighteen restorations were placed using GIC and GIC-CHX in nine patients. After reviewing the restorations at 1, 3 and 6 months following placement, most of the participants (n=8, 88.9%) indicated that they were satisfied with the appearance of the ART restorations, felt no pain during the procedure and experienced no change in taste over time. The set time for GIC-CHX was quicker or the same as GIC (77.8%). At the 6-month examination, 77.8% (n=7) of the GIC-CHX restorations were continuous with the tooth anatomy, whereas 44.4% (n=4) of the GIC restorations were discontinuous. The survival rates of GIC-CHX and control GIC restorations were 88.9% and 66.7% respectively, the main reason for failure was gross marginal defects; however, this result was not statistically significant using the Chi square test ($p>0.05$). There was no statistically significant reduction in the mean count of the tested microorganisms in plaque samples for both types of restorations at 1, 3 and 6 months although the mean count of *Candida* and *Streptococcus mutans* in saliva suspension tended to be lower.

Conclusion: Restoration of carious root surfaces using the ART with GIC-CHX resulted in higher survival rates compared to a control GIC, however, a larger number of patients is needed to confirm the validity of this finding. GIC-CHX restorations applied using ART may be a viable approach for use in outreach dental services to restore root surface carious lesions in the older adults and other special needs groups.

Mohd Nor Hafizi Mohd Ali

Mohd Ali, M. N. H. (2018). Quality Evaluation of Dental Records and Patient Satisfaction following Periodontal Surgery (Thesis, Doctor of Clinical Dentistry in Periodontics)

Advisors: Tawse-Smith, Andrew; Duncan, Warwick; Broadbent, Jonathan

Background and aim: Accurate record keeping is essential in daily clinical practice. An audit of clinical records over a specific period helps practitioners to evaluate and improve their performance and deliver a better care to the patient. Recently, studies have shown that record keeping in dentistry may be inadequate. An audit of record keeping following periodontal surgical procedure/ crown lengthening surgery or for patient-reported outcomes after such procedures has yet to be published. Patient's satisfaction survey is one of study on patient-reported outcomes, where the patient informed their satisfaction towards the treatment. This study investigated the quality of record keeping in periodontal surgery and patient satisfaction following Crown Lengthening Surgery (CLS) at the Faculty of Dentistry, University of Otago.

Method: One hundred and three clinical records from the period 2012 to 2016 were retrospectively evaluated against the developed audit criteria. Data was collected using an audit form and examined for adherence to the developed criteria. Patients' satisfaction survey used a set of questionnaires which consisted 15 questions. Eleven questions had a 5-point Likert response format (strongly agree, agree, neutral, disagree, strongly disagree), two with numerical pain scale and two were open-ended questions.

Result: A total 103 records were audited during the five-year period of investigation. Only one record satisfied 100% of the proposed standards. The most correctly reported items were referral reason (99%), suturing material (98.1%) and post-operative instruction (92%). In contrast, the most often absent criteria in the records were post-operative medication (16%) and use of post-operative mouthwash (14%). Regarding the patient satisfaction survey, 33 patients answered the survey and able to recall the surgical experience. From that, 82% of them were satisfied with the surgery.

Conclusion: The audit found that the recordkeeping after crown lengthening procedure was inadequate and the development of a departmental guideline can improve record keeping in the future. Regarding satisfaction survey, most participants were satisfied with their crown lengthening surgery.

Hitesh Navani

Navani, H. (2017). Angiogenesis in the apical papilla of immature permanent teeth (Thesis, Doctor of Clinical Dentistry in Endodontics)

Advisors: Friedlander, Lara; Milne, Trudy; Hussaini, Haizal; Rich, Alison

Dental trauma, caries or developmental anomalies may result in reversible or irreversible injury to the dental pulp in immature permanent teeth and this presents a clinical conundrum. Immature teeth possess a more favourable healing potential, and this is partly contingent on the vascularity, and angiogenic potential of the resident cells and growth factors. Moreover, the apical papilla is a tissue unique to these teeth and plays an important role in root development and healing. Angiogenesis is a fundamental process in development and disease and is incumbent upon an intricate interplay of angiogenic genes, growth factors and their cognate

receptors. The dental pulp is not a “doomed organ” (Rebel 1922) and is capable of healing. Hence, current therapies are aimed at preservation of pulp vitality and facilitating apexogenesis, but treatment outcomes are not always predictable. An increased understanding of angiogenic signalling in the apical region at a molecular level may improve this. This research explored the angiogenic potential of the apical papilla in healthy immature permanent human teeth and serves as a baseline for understanding potential responses to disease. As well as examining protein expression in the apical papilla tissue, the distribution and relative mRNA levels of angiogenic growth factors (VEGF, Ang-1, Ang-2), receptor proteins (VEGFR2 and Tie-2), and cell-surface markers (CD34 and CD45) were investigated.

Immunohistochemistry and gene expression experiments conducted on the apical papilla showed that this tissue was comprised of angiogenic growth factors and receptors and few resident cells and blood vessels, demonstrating evidence that it is capable of partaking in and promoting angiogenic signalling. Endothelial cells were the predominant cells expressing these markers but expression on other cell types including fibroblasts and immature mesenchymal cells suggests they play contributory roles. VEGF, Ang-1, and Tie-2 exhibited greater immunopositivity and higher cell counts than Ang2 in the apical papilla, while CD34 and CD45 were sparsely distributed. Real-time polymerase chain reaction corroborated these results and revealed differences in gene expression between the apical and coronal regions. The differential expression of VEGF and angiopoietins and their receptor mRNA and protein in the apical papilla suggests the potential for these growth factors to contribute to physiological root development and pulp healing following injury. This study has enhanced our understanding of angiogenesis in healthy dental pulps, and contributes to the body of knowledge related to potential use of angiogenic-modulatory factors in vital pulp therapies.

Norhasnida Nordin

Nordin, N. (2017). Parental perceptions of the impact of early childhood caries in Malaysia and New Zealand (Thesis, Doctor of Philosophy)

Advisors: Thomson, Murray; Foster Page, Lyndie; Morgaine, Kate

The impact of Early Childhood Caries (ECC) and its treatment on the quality of life (QoL) of family members (especially the parents) has not been explored comprehensively. ECC is highly prevalent in NZ and especially in Malaysia, and the study offers an unprecedented opportunity to study the impact of the disease on children and their families in two quite distinct cultures and settings.

The Likert response format is the most frequently used method in QoL studies because it is easy to complete and has a minimal burden for respondents. However, the meaning of words in the response options may remain somewhat unclear. Inexact and ill-defined words might confused respondents, and the validity of the data collected could be affected. This study intended to explore definitive meaning of response options in the two scales (short-form P-CPQ and FIS) used in the study.

This study used a mixed-methods sequential explanatory design. The design utilized the quantitative method as the primary approach supported by qualitative method to assist in interpreting the quantitative findings.

A longitudinal study was conducted using short-form P-CPQ-16 and FIS-8 (along with the collection of socio-demographic and

clinical data) for 310 parents with a child aged 2-5 years old; they were recruited from two distinct settings (hospital-based and community-based) in Malaysia and New Zealand. The translated version of the questionnaires was utilised for participants in Malaysia. The questionnaires were self-administered, and were collected immediately after participants had completed them. An intensity sampling method was applied to identify information-rich participants for the interview stage. In-depth interviews were carried out face-to-face and audio-recorded. Scoring and analysis of the data used both quantitative and qualitative approaches. The quantitative analysis used SPSS version 21, and the qualitative analyses were carried out using content and thematic analysis, both manually and computer-assisted using NVivo 10.

The construct validity of the P-CPQ-16 and FIS-8 was confirmed in the Malaysia and New Zealand samples. There was a similar pattern in both countries, in which the highest score was the Hospital ECC group followed by the Community ECC and then the Caries-free group. The mean overall P-CPQ-16 score of the Hospital ECC and Community ECC group was three times than that the Caries-free group in both countries. This pattern was apparent for the subscales too, with the exception of the Emotional well-being subscale, where the two ECC groups did not differ. The mean overall FIS-8 score of the Hospital ECC group in Malaysia was higher than that for their New Zealand counterparts. The score of the Community ECC group was similar in both countries. However, for the Caries-free group, the score in Malaysia was lower than that seen in New Zealand.

The prevalence of impacts decreased with treatment. Large reduction in impact was recorded with large effect sizes across groups in the two settings (hospital-based and community-based) in Malaysia and New Zealand. A small effect size was measured in the Caries-free group in Malaysia, but it was large in their counterparts in New Zealand.

Participants' responses on the meaning of the options were general and not specific. Most of them used information on specific ECC-related events in their strategy (recall-and-extrapolate) to select the appropriate response option. Participants used the frequency of events and severity of the ECC-related experiences as their frame of reference in the decision-making process for selecting the appropriate response option. There was evidence of differences in respondents' interpretation of the response options. Use of the MID in interpreting the data helped in providing a benchmark for the analysis process.

The mixed-methods design used is a strength of the study. The design provided an opportunity to explore the subject in-depth from another perspective, to enhance understanding of the impacts of ECC on parents, and to explore the definite meaning of the option from participants' perspective. This study had some unique features. The samples were taken from two different settings (hospital-based and community-based) and from two different countries. The sampling approach provided an unprecedented opportunity to study the impact of the disease (ECC) on children and their families in two quite distinct cultures and settings, and at the same time allowed a comparison between them.

Conclusions: ECC has a pervasive impact on the QoL of the affected children's families, and especially on the parents. The treatment carried out for the children's ECC, successfully improved their OHRQoL and reduced the negative impacts on their parents' QoL. There is evidence of an association between ECC and parents' QoL. Emphasise should be given to parents' psychosocial aspects in designing oral ill-health prevention programmes.

Researchers and clinicians using the P-CPQ-16 and FIS-8 scales

need to view the scale scores cautiously because of possible differences in respondents' interpretation of the response options. This underlines the necessity to know and use the minimally important difference (MID).

Soo-Wee Ong

Ong, S.-W. (2017). Third molar surgery outcomes: a comparison between intravenous sedation and general anaesthesia (Thesis, Doctor of Clinical Dentistry in Oral Surgery)

Advisors: Tong, Darryl; Thomson, Murray; De Silva, Rohana; De Silva, Harsha

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

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

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

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

Aravind Parachuru Venkata

Parachuru Venkata, A. (2017). Children's oral health-related quality of life five to seven years after comprehensive care under general anaesthesia for early childhood caries (Thesis, Doctor of Clinical Dentistry in Paediatric Dentistry)

Advisors: Drummond, Bernadette; Meldrum, Alison; Heng, Nicholas

Early childhood caries (ECC) is one of the most common childhood diseases in preschool children. Untreated ECC can lead to pain, sepsis, periapical infection, malnutrition and may result in poor Oral Health Related Quality of Life (OHRQoL) and general health. Many children are treated successfully in the dental clinic with local anaesthesia. Children with ECC who cannot cooperate well for traditional restorative care require comprehensive dental care under general anaesthesia (GA). Many early studies suggest an improved OHRQoL immediately after the dental care under GA. However, none of these studies have looked at the OHRQoL in the mixed dentition period. While it has been reported that caries in preschool years is a significant indicator of caries risk in adolescence, it is unknown whether this risk is also evident in the mixed dentition. The significance of the current research is that this is the first study

to investigate the OHRQoL during mixed dentition of the children five to seven years after they received comprehensive dental care under general anaesthesia for ECC. Furthermore, this study has compared the OHRQoL of children who had dental care under GA with children who had dental care without GA, and children who did not have caries.

The aim of the study was to compare the OHRQoL in children in the mixed dentition period following comprehensive dental treatment and/or extractions for early childhood caries under GA with that of children who had received dental restorations in the chair or children of the same age who were caries-free. This was done by using the 16-item Short-Form Child Perceptions Questionnaire (CPQ11-14). The findings of this research will help with development of appropriate preventive strategies and recommendations to improve quality of life and dental outcomes.

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

Children who had comprehensive care under GA reported poorer OHRQoL mainly in the oral symptoms/functional limitation domains, whereas children who reported poorer OHRQoL also reported that their overall health was affected by their oral condition. There were no statistically significant differences in OHRQoL reported between children who had comprehensive dental care under GA and children who had teeth extractions only under GA. While all the children who had high caries in the primary dentition reported poorer OHRQoL, children who had dental care under GA had more caries currently than children in the other groups. Approximately 45% of these children had two or more carious lesions in the permanent dentition at the time of the study.

The present study determined that the children who had dental care under general anaesthesia have a poorer OHRQoL in the mixed dentition period. Further research is needed to understand the factors that are contributing to the ongoing poorer OHRQoL.

Andrew Quick

Quick, A. (2017). The influence of orthodontic and orthopaedic therapy on mandibular motion (Thesis, Doctor of Philosophy)

Advisors: Farella, Mauro; Johnson, Gill

Orthodontic functional appliances for the correction of Class II malocclusions work by both dental and orthopaedic effects on the mandible. In asymmetrical Class II malocclusions, unilateral appliances can be used to effect correction on the affected side. Very little is known about the effect of functional appliances on mandibular kinematics in general, and to date, no data has been found on the effect of a unilateral functional appliance on mandible movement.

Ten subjects were recruited for the study, five in a group with a bilateral fixed FORSUS® fatigue resistant appliance, and five with a unilateral FORSUS appliance. Three participants in the bilateral group

were lost to the study, leaving seven participants in total. Where possible, jaw movement recordings were taken pre-treatment, pre-FORSUS appliance placement (ie, after fixed appliances had been placed), pos-FORSUS removal, and post-treatment. Recordings were done using a 12-camera opto-electric Eagle system that monitored movement of the lower jaw relative to the cranium by tracking reflective markers. The mandible markers were mounted on a splint that rigidly fixed to the lower jaw. Participants were requested to do two open-close movements, protrusion movement and both left and right lateral excursion movements. Data were processed using a Butterworth filter and standardized to 100 data points. The data were exported to a spreadsheet, where maximum opening, protrusion and for the unilateral group, rotation around the vertical axis was assessed. Descriptive statistical analysis was used to assess the recordings.

There was individual variation in the recordings, but results showed that the use of a unilateral FORSUS appliance does not appear to alter either open-close, protrusion or rotation. Assessment of bilateral FORSUS was made difficult with only two participants completing the study, with both showing individual variation on both measures of open-close and protrusion. In this group particularly, treatment effects may have confounded the recordings. The placement of fixed appliances did not influence mandibular kinematics, and there appeared to be little difference between repeat open-close recordings within any particular recording session.

In conclusion, the results indicate that a unilateral fixed FORSUS appliance does not alter jaw function either during or post-orthodontic treatment. Further research is indicated with both unilateral and bilateral FORSUS appliances, especially with regards to mandibular kinematic with the appliance in situ.

Divya Ramanan

Ramanan, D. (2018). Oral Behaviours and Masseter Activity in Patients with Masticatory Muscle Pain (Thesis, Doctor of Clinical Dentistry in Orthodontics)

Advisors: Farella, Mauro; Palla, Sandro; Polonowita, Ajith

Background: Myogenous pain of the chewing muscles is a subgroup of temporomandibular disorder (TMD). It is a complex condition not fully understood at this time. One possible causal factor of myogenous TMD may be overloading of the jaw joint and muscles as a result of prolonged low-level clenching. This includes behaviours such as clenching and grinding, which may be observed during awake hours. The use of wireless surface electromyography (EMG) allows for the collection of objective data regarding jaw muscle activity in the habitual environment.

Methods: Female patients (N = 27, mean age 27.0 ± 6.3 years) diagnosed with myalgia or myofascial pain with referral were age matched with TMD-free controls (N = 26, mean age 28.0yrs ± 6.5 years). A single examiner completed a standardised TMD examination on all participants to confirm eligibility for the study. Participants were fitted with a minimally invasive wireless EMG sensor on the skin surface overlying the masseter muscle on their preferred chewing side. Participants wore the EMG sensors while awake, over two consecutive days. Maximum voluntary contraction (MVC) was identified as peak bite force. Contraction episodes were detected at four thresholds: 3 x minimum root mean square (RMS) at rest, 3% MVC, 5% MVC, 10% MVC.

Results: The vast majority of the participants in the patient group had myofascial pain affecting the masseter muscles. Maximum

opening was decreased in the patients compared to controls. The Oral Behaviour Checklist (OBC) summary score was higher in patients than controls (p < 0.01). MVC was 1124.7 ± 550.8 μV in the patient group and 1202.5 ± 424.5 μV in the control group (p = 0.559). The frequency, duration and amplitude of masseter contraction episodes were calculated. Most masseter contraction episodes of both patients and controls were of relatively low amplitude (< 10% MVC) and short duration (< 10 seconds). There was no significant difference in the number of episodes per hour between groups. A significant difference in total contraction time % was found between groups (p = 0.039) with a tendency to longer contractions in the patient group. No significant association was found between self-reported parafunction and masticatory muscle activity.

Conclusion: Patients with myogenous TMD reported a higher level of parafunction. Patients and controls have a similar level of number of contractions during waking hours but the contractions are longer. The OBC may not be a reliable tool for assessing wake-time parafunction.

Arunjith Ramawarrier

Ramawarrier, A. (2017). A novel keratin-chitosan-tricalcium phosphate biocomposite as a potential scaffold for regenerative endodontics : an in vitro study (Thesis, Doctor of Philosophy)

Advisors: Love, Robert; Dias, George; Ali, Azam

The present study is the 'first look' at a novel biocomposite which may be used as a 3D implantable intracanal scaffold for regenerating dental pulp and periapical tissues. The main ingredient of the biocomposite was low molecular weight keratin protein extracted from sheep wool. Merino sheep wool offers a grand storehouse of keratin proteins which can be extracted by many methods. This study used a novel chemical-free method using high temperature and pressure. The extracted proteins were of low molecular weight (3.5-15 kDa) and were water soluble. These proteins were used for the fabrication of the biocomposite along with other ingredients namely chitosan, tricalcium phosphate, barium sulphate and glycerol. This is, perhaps the first study that has explored the use of low molecular weight keratin in biomedical applications. Other constituents of the biocomposite were selected in order to provide specific properties to the composite. Keratin-chitosan formed a mechanically stable homogenous matrix. Chitosan also imparted an antimicrobial potential to the scaffold. Tricalcium phosphate acted as the filler and also a supplier of calcium ions. Barium sulphate provided radiopacity to the scaffold while glycerol was the plasticizer. The scaffold demonstrated many key characteristics relevant to tissue regeneration applications such as adequate porosity and degradation, as well as to endodontic applications such as moderate swelling and radiopacity.

Assessment of cytocompatibility yielded promising results. The scaffold promoted proliferation of MDPC 23 (odontoblast like cells) and OCCM 30 cells (cementoblast like cells). The cells were able to grow and achieve functional differentiation when cultured after exposure to scaffold extracts as evidenced by ALP assay which detected elevated ALP levels in culture. AR-S staining detected calcium deposits which further confirmed cell differentiation. Furthermore, immunocytochemical analysis revealed expression of DSPP by MDPC 23 cells which was indicative of odontogenic differentiation. These cell reactions demonstrated the regenerative potential of the biocomposite scaffold.

The population density of viable stem cells and their successful differentiation is an absolute prerequisite for successful regenerative pulp therapy, so is the effective disinfection of the root canal system. The antimicrobial potential of the scaffold was tested against *S.mutans* which was a representative organism for primary infection and *E faecalis* which represented secondary or re-infection of the root canal system. The scaffold was able to successfully inhibit growth of both the species. This potent antibacterial action of the scaffold eliminated the need for using highly potent antibiotics and other antimicrobials detrimental to host cell survival during endodontic regenerative procedures.

Frances Ruddiman

Ruddiman, F. E. (2017). Microbial Leakage at the Implant-Abutment Interface: Comparing Original and Aftermarket Abutments in an Ovine Model (Thesis, Doctor of Clinical Dentistry in Periodontology)

Advisors: Duncan, Warwick; Schmidlin, Patrick; Leichter, Jonathan

Introduction: Prior in vitro work has shown that implants restored with aftermarket (AM) abutments are more prone to leakage at the implant-abutment interface (IAI) than implants seated with their original equipment manufacturer (OEM) abutments. The goal of the current study was to examine the relationship between bacterial colonisation at the IAI and implant parameters using OEM or AM abutments on identical implants. It was hypothesised that microbial colonisation at the IAI may increase peri-implant inflammatory cell accumulation and lead to increased bone and soft tissue loss around the AM abutments.

Method: Sixty \varnothing 4/3 mm x 10 mm implants were placed into healed mandibular post-extraction ridges in ten mature ewes. Abutments were placed immediately or at 2nd stage surgery after 2 months. Six groups (n=10) were evaluated as follows: Delayed aftermarket abutment (A), delayed OEM abutment (B), immediate aftermarket abutment (C and D), immediate OEM abutment (E and F). Radiographs and microbial sampling were taken at baseline, 2 months, and 4 months. Identification and relative quantification of DNA for oral microbial species was performed using Polymerisation Chain Reaction (PCR) (IAI Padotest, Switzerland). Mean percent bone- to-implant contact (%BIC) and distance to first bone contact were calculated from two images per implant using Image J software. Linear mixed models were used to look for between group differences and mixed logistic regression models used for the binary outcomes. Analyses were conducted using Stata 14.1 and $p < 0.05$ was considered statistically significant.

Results: While there were more failures of the implants restored with aftermarket abutments (14 vs. 8) this difference failed to reach statistical significance ($p=0.17$). There was no statistical difference between OEM vs. aftermarket for %BIC, first bone contact, radiographic bone changes, height of soft tissue, bone density, or microbial colonisation. There was no correlation between microbial leakage and implant outcomes.

Conclusion: This animal study found no difference in microbial leakage between OEM and AM abutments. There was no apparent relationship between increased microbial leakage and implant outcomes. Statistical analysis was complicated by the higher-than-expected number of implant failures. While some intriguing trends were noticed, a larger human study is now recommended to further explore this relationship.

Nina Scott

Scott, N. (2017). Dental trauma in New Zealand adults: a secondary analysis of national survey and ACC data (Thesis, Doctor of Clinical Dentistry in Endodontics)

Advisors: Thomson, W. Murray; Cathro, Peter

Dental trauma is described by the World Health Organization as a worldwide major public health problem. However, little is known in New Zealand (NZ) and worldwide about the dental trauma experience of adults. Most studies of dental trauma prevalence, incidence and aetiology in NZ and overseas have been carried out using convenience samples, such as people attending a hospital dental clinic. The literature shows that a considerable amount of trauma to permanent teeth occurs at a young age. Since most damage to permanent teeth is not self-healing, injuries to permanent teeth and sequelae of the trauma can be carried into adulthood. Dental trauma is therefore a life-long burden for the individual adult and society. While there have been three National Oral Health Surveys in NZ, the 2009 survey was the first to collect information about dental trauma in the interview and examination. In NZ, visits to a dentist for dental trauma and subsequent treatment is recorded with the Accident Compensation Corporation (ACC), a compulsory social insurance scheme. To date, dental injury data recorded with the ACC have not been analysed with respect to outcomes.

The objective of this study was to assess the prevalence, risk associations and impact of dental trauma of New Zealanders over 18 years old.

Information about dental trauma in a representative sample of NZ adults was collected as part of the 2009 NZOHS. This included self-reported information and a clinical examination of the six maxillary anterior teeth. Data were weighted and analysed using Stata.

Data from a separate sample of NZ adults who had sustained dental trauma in 2008 and had the injury registered with the ACC were analysed using SPSS.

Analysis of the 2009 NZOHS data showed that of the approximately 40% who reported previous orofacial trauma, 70% (that is, 28% overall) reported that this included a dental injury. More males than females had experienced orofacial trauma (51% and 31% respectively; $P < 0.05$) but there was no sex difference in self-reported dental trauma. The most common injury was a "chipped or broken tooth" (67%). Almost three-quarters had sought treatment for their dental injury. Clinical examination revealed an overall trauma prevalence of 23%, with more males than females affected (27% and 20% respectively). Almost 15% had one injured tooth; 7% had two injured teeth and 2% had three or more. The central incisors were the most frequently affected. The most common clinical dental trauma observation was evidence of "treatment" or an "untreated enamel fracture", more common among males and those aged 35-44.

Analysis of dental information from the ACC revealed that 32,110 adults and children sought treatment for orofacial trauma during 2008. Dental injuries to permanent teeth most commonly involved the central and lateral maxillary incisors. Some 1,325 adults who sustained dental trauma during June 2008 were followed for the subsequent 5 years. Generally, more severe injuries required more treatment.

Conclusion: Prevalence estimates for and characteristics of dental trauma in NZ adults are similar to international findings. There were socio-demographic disparities in the occurrence and treatment of

dental trauma in the NZ adult population. The findings confirmed that traumatic dental injuries in the New Zealand adult population constitute an important public health issue, given that many will need life-long follow-up and treatment.

William Sew Hoy

Sew Hoy, W. H. (2017). Genetic factors associated with orthodontic pain in children and adolescents: a pilot study (Thesis, Doctor of Clinical Dentistry in Orthodontics)

Advisors: Farella, Mauro; Antoun, Joseph; Chandler, Nick; Merriman, Tony

Introduction: Pain is often reported as being the worst aspect of orthodontic treatment. Nearly all patients experience pain and discomfort at their teeth at some point during orthodontic treatment. Little information exists on the severity of pain in the latter stages of orthodontic treatment. In addition, no studies have investigated the role of genetic factors on pain caused by fixed appliances.

Objectives: To investigate whether demographic, clinical or genetic factors are associated with the severity of pain experienced following adjustment of fixed orthodontic appliances.

Methods: Eighty-two participants undergoing fixed orthodontic treatment were recruited. Baseline DNA was collected via blood or saliva samples. Immediately after bond-up or an adjustment of the fixed appliances, the participants used a smartphone app to record regular pain scores at their teeth over the following three days.

Results: Pain peaked approximately 19 hours after the orthodontic adjustment, then gradually returned toward baseline levels by day three. Pain on chewing was significantly greater than the resting pain at the teeth at all time points concerned. There was a significant difference in the total amount of pain at the teeth over the three days when comparing bond-ups to no arch wire changes (with or without bends placed). Gender, age, and time in treatment were not associated with the severity of pain experienced after an orthodontic adjustment. The rs931233 SNP of the HTR2A and the rs4646310 SNP of the COMT genes were significantly associated with pain severity. Haplotypes of the COMT gene also showed promising, although non-significant associations with pain severity.

Conclusions: Pain on chewing is significantly more painful compared to resting pain at the teeth after adjustment of fixed appliances. SNPs of the HTR2A and COMT gene were associated with the severity of pain following adjustment of fixed appliances. Therefore, it seems that genetic factors have a modifying effect on orthodontic pain (as is the case with many other pain conditions such as TMD, fibromyalgia, and experimental pain). Larger samples are required to investigate these associations further.

Yevgeny Sheftel

Sheftel, Y. (2017). Novel grafting materials for sinus floor elevation in the sheep model (Thesis, Doctor of Clinical Dentistry in Periodontology)

Advisors: Duncan, Warwick; Schmidlin, Patrick; Leichter, Jonathan

Sinus floor elevation (SFE) may be required for implant placement in the severely resorbed posterior maxilla. Although often successful, autologous bone grafting requires a donor site and may lose substantial volume while remodelling. Bone replacement grafting

(BRG) materials were developed to overcome these limitations. This study investigated three novel grafting materials: 1) equine collagen cone (CN), 2) equine collagen cone filled with biphasic calcium phosphate particles (CO), 3) deproteinized bovine bone particles coated with polylactic acid and poly ϵ -caprolactone copolymer (SB). These were compared with the most commonly-used bovine bone BRG, Geistlich Bio-Oss® (BO).

Methods: The extra-oral access sinus grafting model from Haas et al. (1998) was used in 11 cross-bred female sheep. Two experimental sites on each side of the animal were prepared. CN, CO, SB, BO were each placed through separate 10 mm access window in the antral wall, under the elevated Schneiderian membrane. BO sites were covered with a porcine collagen membrane (Geistlich Bio-Gide®), while for CO, SB, BO sites the equine collagen membrane (RESORBA PARASORB®) from the manufacturer of these experimental materials was used.

The animals were euthanised after 16 weeks. New bone, residual graft particles and connective tissue areas were measured on undemineralised resin-embedded sections.

Results: One sheep did not survive the surgery. All sites in remaining ten sheep healed uneventfully. The CN and SB grafting materials resorbed completely and failed to form new bone. BO and CO particles were bridged by the new bone, the new bone fraction was 10% ($\pm 9\%$) for BO and 4% ($\pm 5\%$) for CO. The differences were not statistically significant.

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

Adlin Suhaimi

Suhaimi, A. (2017). Awareness of pre-radiation dental assessment of head and neck cancer patients among dentists in Malaysia and New Zealand (Thesis, Doctor of Clinical Dentistry in Special Needs Dentistry)

Advisors: Rich, Alison; Broadbent, Jonathan

Aims: The aim of this study was to investigate the approaches taken for dental assessment of patients with head and neck cancer (HNcCa) by hospital dentists in New Zealand and Malaysia, in order to assist with the development of contemporary uniform guidelines for pre-radiation oral health management.

Methods: A review of national guidelines was conducted from United Kingdom, United States, Australia, and New Zealand. A questionnaire-based survey of specialists and hospital dentists working in a hospital setting within New Zealand and Malaysia was undertaken. Information was collected about knowledge of the effects of radiotherapy on the oral environment, current practice regarding the dental management of HNcCa patients prior to radiotherapy, guidelines practitioners were currently using and problems that they faced treating HNcCa patients.

Results: One hundred questionnaires were distributed; 50 for each country and the response rate was 75%. The respondents were consultants/specialist (34.7%), specialist registrars (8.0%), general dentists/ dental officers (38.7%), house surgeons/ first year dental officers (17.3%) and other (1.3%). The majority of respondents stated that multidisciplinary meetings (MDM) were held at their centre (New Zealand- 51.4%; Malaysia - 52.5%) but the health practitioners attending the MDM varied. Only 48.6% New Zealand and 2.5% Malaysian respondents followed formal guidelines or

protocols for dental assessment of HNCa patients. Problems that were highlighted included late referral from the medical team, lack of radiation information and inadequate knowledge among the dentists themselves in managing these patients.

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

Andrew Tawse-Smith

Tawse-Smith Alturo, A. (2018). Presence and Origin of Titanium Particles in Peri-implant Tissues (Thesis, Doctor of Philosophy)

Advisors: Duncan, Warwick; Tompkins, Geoffrey

Implant prostheses have complications that compromise peri-implant health and marginal bone. In addition to pathogenic bacterial biofilm, other determinants, such as implant surface deterioration, Ti particulates in peri-implant tissues, and functional stress have been reported as influencing peri-implant tissue stability.

Aim: This thesis investigated the origin and presence of Ti particles in healthy and diseased peri-implant human tissues. Three trials evaluated the effect of acid-forming bacteria and mechanical instrumentation on Ti discs, and the effect of loading on implant surfaces on human participants.

Methods: Four experiments involving a combination of in vitro and in vivo trials were performed. The first identified Ti particles in peri-implantitis tissues. Tissue specimens were analyzed under polarized light-microscopy (LM), scanning-electron-microscopy (SEM) and energy-dispersive X-ray spectrometry (EDS) analysis. In the second, a microbiological protocol incubated Ti discs achieving viable biofilm, which were investigated in-vitro for microbial-induced-corrosion. The third was an in-vitro trial evaluating topographic and composition changes by ultrasonic instrumentation on Ti discs. Surface changes were evaluated using SEM, confocal-laser-scanning-microscopy (CLSM), and EDS. Rinsing solutions were evaluated using induced-coupled-plasma-mass-spectroscopy (ICPMS). The fourth experiment was a human trial on single implant crowns after five years. Exfoliative cytology samples from peri-implant mucosa and junctional epithelial, and control tooth mucosa sites were evaluated using LM, SEM and EDS. ICPMS was carried out on the exfoliative cytology microbrushes. Clinical peri-implant parameters were determined.

Results: Firstly, the presence of Ti particles in peri-implantitis tissues was confirmed in 88% of the samples. Granular foreign material was scattered within the connective tissue and the epithelium layer. In most cases the inflammatory infiltrate contained a mixture of acute and chronic inflammatory cells. In the second experiment acid-forming bacterial colonisation of the disc surface was evident after 24 hours and maintained throughout the 7-day observation period. Although Ti isotopes should show some variation in the inoculated growth media, ICPMS measurements were hindered due to the high concentrations of sodium (Na) and phosphorus (P) in the broth, this created backscattering during the analyses. The third experiment ultrasonic instrumentation of Ti discs demonstrated significant surface topographical alterations. ICPMS analysis of the rinsing solutions identified Ti and other metal traces. In the fourth experiment, the exfoliative internal and external cytology smears showed black scattered foreign material, which were also noted

with SEM and EDS. More particles were identified at the level of the implant-abutment interface when compared to the external mucosal smears. The presence of these particles did not influence peri-implant health.

Conclusions: Peri-implantitis biopsies exhibited Ti and other metal particles. The origin of these particles could be related to biomaterials used in oral implantology. Although a consistent viable acid-forming biofilm on Ti specimens has been devised, the measurement of Ti dissolution in the surrounding environment needs further investigation. Ultrasonic instrumentation of Ti surfaces caused topographic and compositional changes, which created Ti particulate. The effect of functional loading between implant components, created wear of Ti implant surfaces. Functional wear of implant components resulted in release of metal particles into the peri-implant milieu. The presence of these particles did not affect the peri-implant health.

Masters degree completions

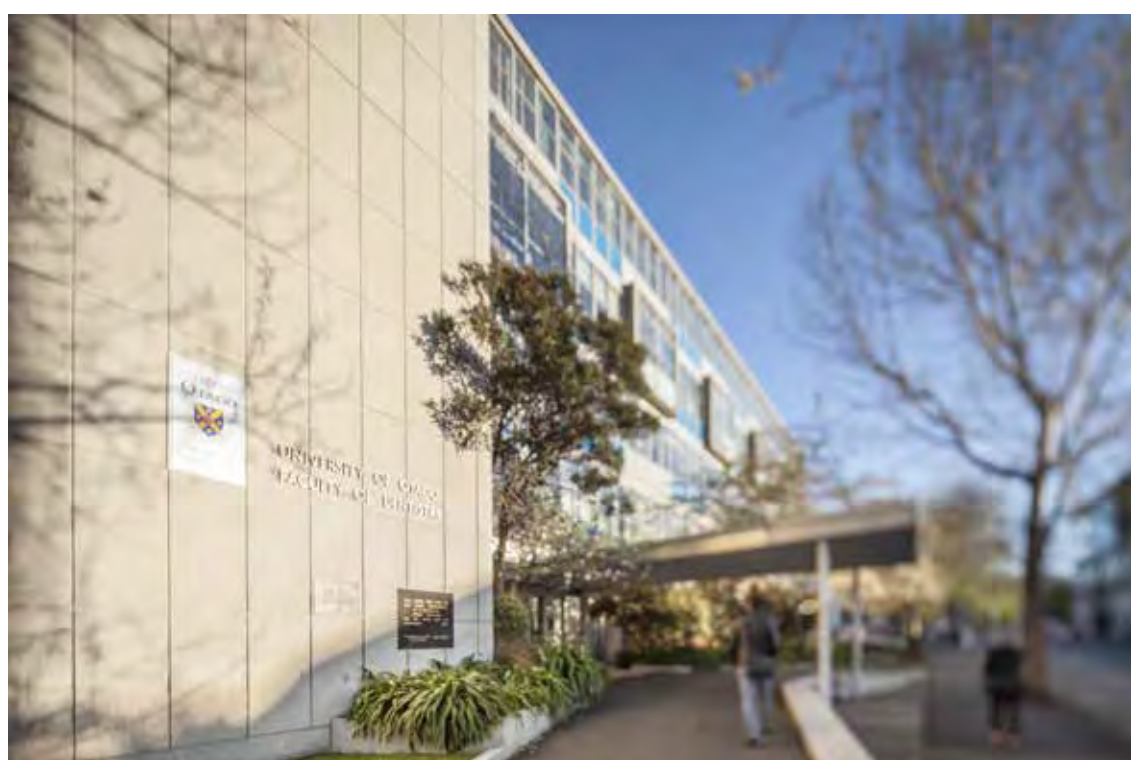
Listed by degree, then by year of graduation.

Master of Community Dentistry (MComDent)

| Student | Thesis title | Advisors | Year |
|-----------------------|---|--|------|
| Ellen Clark | Supervised tooth brushing in Northland | A/Prof Lyndie Foster Page, Prof Murray Thomson | 2017 |
| Sunitha Gowda | The natural history, antecedents, and impact of xerostomia among adults in their thirties | Prof Murray Thomson | 2017 |
| Geoffrey Hunt | Dental Treatment of Children under GA: a situational analysis | Prof Murray Thomson | 2017 |
| Donna Kennedy-Langley | The role of primary oral healthcare clinicians in the detection and diagnosis of oral and oropharyngeal cancer in New Zealand | Prof Murray Thomson, Prof Alison Rich, Prof Brian Cox, A/Prof Lyndie Foster Page | 2017 |

Other Masters degree completions, 2017-18

| Student | Degree | Year |
|------------------|--|------|
| Arti Naidu | Master of Dentistry (MDent) | 2017 |
| Marwan Wadea | Master of Dentistry (MDent) | 2017 |
| Ritu Ganjigatti | Master of Dentistry (MDent) in Aesthetic Dentistry | 2018 |
| Rishi Ramani | Master of Dentistry (MDent) in Aesthetic Dentistry | 2018 |
| Osvaldo Gonzalez | Master of Dental Surgery (MDS) in General Practice | 2018 |
| Rafiah Abdullah | Master of Oral Health (MOH) | 2018 |



Postgraduate diploma completions

Listed by degree, then by year of graduation.

| Student | Degree | Speciality (if applicable) | Year |
|------------------|--|--------------------------------|------|
| Yasmen Alfaisal | Postgraduate Diploma in Clinical Dentistry (PGDipClinDent) | | 2017 |
| Osvaldo Gonzalez | PGDipClinDent | General Practice for Dentistry | 2017 |
| Dema Waleed | PGDipClinDent | Special Needs Dentistry | 2017 |
| Zeina Al Naasan | PGDipClinDent | Periodontology | 2018 |
| Sangeeta Mankal | PGDipClinDent | Paediatric Dentistry | 2018 |
| Laura Petroff | PGDipClinDent | Paediatric Dentistry | 2018 |
| Bhavya Rajan | PGDipClinDent | General Practice for Dentistry | 2018 |
| Mi Ra Yang | PGDipClinDent | Paediatric Dentistry | 2018 |
| Hannah Clark | Postgraduate Diploma in Dental Therapy (PGDipDentTher) | | 2017 |

Postgraduate Diploma in Clinical Dental Technology

| Student | Year | Student | Year |
|------------------------------|------|----------------------|------|
| Omar Abdel Ghany | 2017 | Akruti Tataria | 2017 |
| Marco Anastasopoulos | 2017 | Michiel Van Den Berg | 2017 |
| Khaled Bibi | 2017 | Kate Withy | 2017 |
| Faizel Ebrahim | 2017 | Chen Xu | 2017 |
| Nicolene Griebelaar | 2017 | Audrey Yee | 2017 |
| Frederik Jansen van Rensburg | 2017 | Wenhao Zheng | 2017 |
| Bessie Kay | 2017 | Mustafa Ali | 2018 |
| Abdulrahman Kayed | 2017 | Aliullah Aman | 2018 |
| Jean-Francois Le Goff | 2017 | Gi Hun Hyun | 2018 |
| Chun Lee | 2017 | Justin Jordaan | 2018 |
| Joanna Lee | 2017 | Angela Ko | 2018 |
| Jody Lucas | 2017 | Ji Hang Lee | 2018 |
| Pengcheng Ma | 2017 | Kaichuan Li | 2018 |
| Emily Munn | 2017 | Jeevan Sapkota | 2018 |
| Ly Samban Sok | 2017 | Jinkyu Shin | 2018 |

Undergraduate research projects

Final year Bachelor of Dental Surgery elective research projects

Titles of research projects presented at DENT552 Elective Colloquia, November 2017 and 2018.

November 2017

| Students | Supervisors | Project title |
|-----------------------------------|--|---|
| Al-Khaburi, Z; Chua, M.L | Mrs A. Meldrum, Mr M. Brosnan | A survey of members of the Australasian Academy of Paediatric Dentistry on their use of behaviour management techniques. |
| Al-Nabhani, A., Chen, A | A/Prof J. Broadbent, Dr A. Barazanchi | Oral Health Care Needs Among Former Refugees. |
| Au, J. | Mrs F. Bennani, Prof M. Farella, Mr A. Kang, Dr L. Mei | 3-Dimensional Lip Change in Response to Simulated Maxillary Incisor Advancement |
| Bartlett, S. R., Lindsay, T. A. | Dr K. Newsham-West | Investigation of Children Referred for Dental Treatment Under General Anaesthetic at The Faculty of Dentistry in 2016. |
| Bell S.M.K., Raikuna A.F.V. | A/Prof L.A. Foster Page, Prof W.M. Thomson | Explorative study of Pacific Island families' experience of and access to oral health care services for their children in Auckland |
| Bhatia, S.B. | A/Prof R. Kumara De Silva, Prof D. Tong, Dr H De Silva | Efficacy of local therapeutics in the prevention of alveolar osteitis: a systematic review of the literature |
| Chen, N.T., Yeh, R.T. | Dr E.T. Knight, Dr M.M. Smith | Analysis of Dental Implant Preferences at School of Dentistry (Otago) since 1995 |
| Chen, W.T., Chen, Y.E., Cheong D. | Dr L. Adam, A/Prof G. Tompkins, Prof R.D. Cannon | Comparing the Microbiology Syllabi between the University of Otago and the World's Top Dental Schools |
| Chew, C. K., Ting, K. H. | Dr. S. Ma | The available internet-based information regarding dental implant and the accuracy of data |
| Chew, M. | Dr. S. Ma, A/Prof A. Tawse-Smith, A/Prof G. Tompkins | Quantification and comparison of methods for decontaminating used implant healing abutments for possible reuse. |
| Chin, B.J. Neynens, C. | Dr S. Ma | Are we dressed to impress? The perceived importance of attire among patients, staff and students in a University Dental School setting: a cross-sectional study. |
| Clarke, S.M., Dempster, K.M. | Dr K Newsham-West, Prof B.K. Drummond | Identification of Children and Adolescents with Dental Enamel Defects being treated in the Departments of Oral Sciences and Oral Rehabilitation: A Clinical Audit |
| Fan, W., Tiang, N.M.K. | Prof W.M. Thomson | The occurrence, associations and impact of temporomandibular disorders in 38-year- olds |
| Graham, D.O. | A/Prof B.C. Monk | The Molecular Basis of Azole Inhibition of an Antifungal Target |
| Guan, S. Takawi, S. | Prof W.M. Thomson | University of Otago Dental Students' Perceptions of Gerodontology in the BDS Curriculum: A Mixed-Methods Study |
| Heran R.S., Yeang HW.. | Mrs. D.H. Boyd, Dr. L. Adam | Students' experiences and perceptions of, and barriers to undergraduate research |
| Hiku, N. | Mrs D.H. Boyd, Prof K Lyons | What is the expected survival of a Cobalt-Chrome Removable Partial Denture? |
| Horsley, A., Laqekoro, Z. | Prof J.R. Broughton | Oranga niho Māori: Māori oral health |
| Huang, Z., Lee, E. | Dr Mrs L. Mei, F. Bennani, A/Prof G. Tompkins | Air polishing: a review on recent literature. |
| King, T., Jiang, Y. | Dr M Lee, Dr P Fowler, Prof M. Farella | A follow-up of orthodontic referrals made by the Community Dental Service |
| Lee, Jhc. | A/Prof JN Waddell, Prof N Hammer, Prof D Tong | A Biomechanical Comparison between Human Calvarial Bone and a Skull Simulant |

| Students | Supervisors | Project title |
|---|--|---|
| Li, L | Dr L. Mei, Mrs F. Bennani, Prof M. Farella | Oral hygiene behaviours and awareness in orthodontic patients treated at the Faculty of Dentistry, University of Otago |
| Liao, A. Lim, M.Y. | Dr S. Ma | Patients' Perception of Dental Healthcare Services in a University Dental Clinic Setting |
| Low K.W., Chong F. | Dr S. Hanlin | Investigation of Perception of Smile Attractiveness between Asian Dental and Non- Dental Students |
| Mohamed, M, M, Hasmali, N.H. | Prof W. Duncan | Are Dental Restorations Truly Individualised? |
| Mooney, K.O., Joshi, L.M | Prof N.P. Chandler, A/Prof J.N Waddell | Improved Teaching Models For Endodontic Surgery |
| Nanayakkara, T.D., Puwakdandawa, D.T.M. | A/Prof R.K. De Silva, Prof M. Farella, Mr. H.L. De Silva | Facial Attractiveness of Skeletal Class III patients before and after Maxillary Advancement and Mandibular Set-back Surgery as perceived by people with different backgrounds |
| Newbould, R.E | A/Prof J. Broadbent | Tooth shade and self-perceived dental appearance. |
| Ng, J.Y. Oh, G. | R. Butson, Dr. P. Cathro | Exploring the merits of physiological, psychological and environmental data in determining factors associated with stress in oral surgery tutors. |
| Pang, Jk. Lian, K. Wong, S. | Dr M. Atieh | Predicting peri-implant disease: chi-squared automatic interaction detection (CHAID) decision tree analysis of risk indicators |
| Roa, A., Yao, S. | Prof J.R. Broughton | Oranga Niho; Māori Oral Health Strategies- A Review |
| Saha, S., Fitzgerald, F., Martin, H. | Prof K. Lyons, Dr H. Osborne | The reported lumbar, thoracic and cervical spine pain in undergraduate dental students enrolled at the University of Otago Faculty of Dentistry in 2017. |
| Searle, Jr | A/Prof J.M. Broadbent | Development of Operative Dentistry Abilities Among Dental Students |
| Shenoy, M., Tee, A., Tiang, T. | Dr K. Newsham-West | A Pilot Project to Assess a Dental Aid Initiative in Cambodia |
| Stephenson, M.H.G., Sweetapple, K.M. | Prof W.M. Thomson | Oral Health Knowledge and Attitudes Among Care Facility Staff Caring for Older People |
| Tee, A. | Dr H. Hussaini, Mrs F. Bennani, Dr. L. Mei | Estimation of Greenhouse Gas Emission at Faculty of Dentistry, University of Otago |
| Tiong, M., Lee, H.M. | Prof J. Broadbent | Possible Future Applications of MRI in Dentistry |
| Wockner R, Maher H | Mrs A. Meldrum, Mr M. Brosnan | An exploratory investigation of the views of oral health of adolescents accessing the Bachelor of Oral Health Dental Clinics at the Otago University Faculty of Dentistry. |
| Won, J.Y., Ma, T.Z. | Prof W.M. Thomson | Evaluation and comparison of Dental Curricula in Otago and Hong Kong |
| Wong, L; Phemister, R. | A/Prof L. Foster Page; Dr J. Antoun | A Retrospective Audit of Young People Treated by the WFAST from 2012-2015 |
| Yeung, B., Yew, Y.T. | A/Prof G. Tompkins, M. McLean, L.K. Ng | Disinfection of Dental Loupes with UV-B Trans-illuminator |
| Zhang, S., Choo, P.L. | Dr L. Adams, Dr C. Loch Santos Da Silva | Investigation of the learning experiences of 4th year Bachelor of Dental Surgery students in relation to perceived clinical tutor teaching approach. |
| Zhang, Y | Dr H. Hussaini, Dr B. Seo, Prof A. Rich | Are myofibroblasts and associated cytokines important in the development of oral cancer? |

November 2018

| Students | Supervisors | Project title |
|--|--|---|
| Al Lawati, E.A., Al Maskari, H.A. | Dr S Ma | "I am a Lefty in a Right-handed World": Qualitative Analysis of Clinical Learning Experience of Left-handed Undergraduate Dental Students |
| Barnes, T.S., Kim, K., Lu, S., Sia, A. | Prof K.M. Lyons, A/Prof L.A. Foster Page | Oral Health Professional Students' Perceptions towards Volunteering to Prevent Oral Disease and Promote Oral Health for the Elderly |
| Berryman, Z.M., Bridger, L.E. | A/Prof A.Tawse-Smith, Dr H. Hussaini, Prof A.M. Rich | Can Titanium Particles Influence Bone Loss in Tissues with Peri-Implantitis? |
| Butler, B.M., Leov, F.R., Van Den Heever, R. | A/Prof L.A. Foster Page | A 24-month Primary Care Randomised Control Trial of Hall and Non-Hall Techniques - How Effective are our Radiographic Diagnostic Skills? |
| Brown, K., Lacey K., Woodmass, J. | Prof J.R. Broughton | Whānau Ora: A Literature Review |
| Bryant, J.N. | Dr S. Ma, A/Prof G.R. Tompkins, A/Prof A. Tawse-Smith, A/Prof J.N. Waddell | Using Sodium Hypochlorite and a Steam Cleaner to Decontaminate Used Implant Healing Abutments: an In Vitro Study |
| Cai, C. | A/Prof J.M. Broadbent, Dr L. Mei | The Dental Aesthetic Index – Digital Measurement and Longitudinal Application |
| Campbell, A.J., Davies, M.K. J. | Dr H.L. De Silva, Prof W.M. Thomson, Dr L. Mei, A/Prof V. Bennani | The Impact of Third Molars on Anterior Crowding: a Survey of Opinions of Registered New Zealand Dentists |
| Chen, D., Sim, C. | Dr S. Ma | Patient Satisfaction and Aesthetic Outcome of Single Implant Crowns Performed in a University Teaching Setting: 5-year Clinical Retrospective Study |
| Desai, H.N., Chamberlain, R.T. | A/Prof A.Tawse-Smith, Dr M.A.H. Atieh | Dental Implant Surface Decontamination in Patients with Peri-implantitis: A Systematic Review of Randomized Controlled Trials |
| Ding, Y.W., Lim, S.Y. | Prof K.M. Lyons | Longevity of Posterior Tooth Coloured Restorations – a Literature Review |
| Eaddy, C., Engelbrecht, M., Waters, H. | Mrs D.H. Boyd, Ms M. Smith | Too Much or Just Enough? The Nature of Toothpaste Marketing in New Zealand |
| Ghose, A., Latchoumanane, M. | A/Prof J.M Broadbent | Dental Student Productivity |
| Hermans, G., Mckenzie, J., Shaw, H. | Prof W. M. Thomson | The Oral Health Knowledge, Attitudes and Practices of Nurses Treating Older People in a Hospital Setting |
| Ho, K.K.G., Tham, M.L. | Dr H.L. De Silva, Dr P.P. Konthasingha, Mr F. Gilroy | How Confident are Undergraduate Dental Students and Oral Health Students in Managing Medical Emergencies in a Dental Setting? |
| Hohaia, S.A., Linn, J.J.C., Martin, J.J. | Prof W.J. Duncan | Dental Loupes: Attitudes and Behaviours of Dental Surgery Students During their Clinical Training |
| Jin, Y. | Mrs D.H. Boyd | An Evaluation of Waste Produced in Undergraduate Dental Practice |
| Karnail, S.M., Lee, W.T., Tan, X.W. | Prof D.C. Tong, Prof W.M. Thomson | Level of Confidence and Knowledge of Drug Prescription Among Dental Students |
| Kenny, C., Oldfield, L. | Prof D.C. Tong | Common Medications Among Dental Outpatients – A Five-year Update |
| Khaw, Z.H.R., Tan, J.W., Kwan, Y.Q. | A/Prof J.N. Waddell, A/Prof J.M. Broadbent, Dr K.C. Li | The Accuracy of 3D Printed Study Model |

| Students | Supervisors | Project title |
|-------------------------------------|--|---|
| Kuan, I., Ng, Y., Sun, T. | Mrs D.H. Boyd, A/Prof G.R. Tompkins | Feasibility of Safely Reusing Dental Floss |
| Kuan, S., Abd Aziz, S., Jin, E. | Dr C. Loch Santos da Silva, Prof W.M. Thomson | Do as I Say and not as I Do? New Zealand Dentists' Oral Health Practices and Advice to Patients |
| Kumar, M.A., Joshi, D. | Mrs. D.H. Boyd, A/Prof G.R. Tompkins | Intraoral Topical Anaesthesia – an Estimate of Dose |
| Kwek, S.D., Noh, J.P. | Dr L.T. Friedlander | Attitudes and Perceptions of BDS4 Students to an Advanced Rotary Endodontic Module |
| Lay, C.A. | Prof K.M. Lyons | The Success of Hybrid Ceramics in Dentistry: A Review of the Literature |
| Lee M.J., Lee P. | Dr A. Barazanchi, Dr K.C. Li | Light Cure Resin Cement and Ceramic Thickness: How Thick is Too Thick? |
| Liaw, Y., Pg Metussin, A. | Dr C. Loch Santos da Silva, Prof P.A. Brunton | The Teaching of Posterior Composites: a Survey of Dental Schools in Oceania |
| Lim, C., Singh, A., Tu, J., Yeo, J. | Dr P.R. Cathro, Dr D.R. Schwass, A/Prof L.A. Foster Page | A Retrospective Audit of the Documentation of Treatment Cost Estimates by BDS5 Students in Dental School Clinics |
| Martin-Hendrie, R.M. | A/Prof J.N. Waddell, Dr K.C. Li, A/Prof N. Hammer | The Bond Strength of Dental Adhesives to Bovine Cortical Bone |
| Masters, E.H.L., Mcleay, J.H. | Prof J.R. Broughton | Travelling for Treatment: A Qualitative Study |
| Parry, M., Chang, V. | A/Prof G.R. Tompkins | A literature Review of Siderophores and their Potential Applications |
| Petterson, C.R., Van Wichen, A.E. | Prof M. Farella, Dr J.S. Antoun, A/Prof V. Bennani | Facts and Myths About Sports Mouthguards: Are They Worth It? |
| Phua, R.L.W. | Dr H.M. Hussaini, Dr B.L. Seo, Prof A.M. Rich | Does the Presence of Myofibroblasts Play a Role in The Pathogenesis of Odontogenic Cysts and Tumour? |
| Seto, T.H. | Dr J.E. Choi, Dr K.C. Li, A/Prof J.N. Waddell | Adhesion of Ceramics to Bleached Enamel |
| Stanescu, I.A. | Dr P.R. Cathro, A/Prof G.R. Tompkins | The use of UV-B Light to Predictably Disinfect the External Root Surface for Ex-Vivo Endodontic Studies |
| Stratford, K.M | Dr A. Barazanchi | Dental Wear of Olympic Weightlifters |
| Ting, X.Y., Soh, M.L. | A/Prof J.N. Waddell, Dr K.C. Li | In Vitro Study of the Effect of Mouthwashes on Solubility Behaviour of Different Luting Cements |
| Wang, S., Wang, E., Wu, A. | Dr H.L. De Silva, Dr P.P. Konthasingha | Assess Basic Knowledge and Self-Perceived Confidence in Administering Local Anaesthetic Injections Among Dental and Oral Health Students in the Faculty of Dentistry, New Zealand |
| Yu, W.W., Goh, R., Cheong, E. | Dr L. Mei | Prevalence of Halitosis Among Young Adults in New Zealand |

Summer studentships and BDS (Honours) projects, 2017-18

With thanks to Dr Nicholas Heng, BDS (Honours) and SJWRI Summer Studentship Coordinator.

Summer studentships, 2016/17

Danni Chen

Identifying essential amino acids in an antifungal target

Supervisors: Dr Mikhail Keniya, A/Prof Brian Monk

Funder: Otago Medical Research Foundation

Invasive fungal infections are a major global health issue, causing 1.5 million deaths annually. New drugs are urgently needed due to the increasing number of immunocompromised patients and resistance to existing antifungal medication. This project analysed sites that potentially affect drug interactions within the essential fungal enzyme lanosterol 14 α -demethylase. This enzyme is the target of azole drugs and is required for the production of ergosterol, an essential component of the fungal cell membrane. Mutations introduced in amino acid residues around the active site of the protein were used to assess their potential as drug targeting features. It was found that these mutations increased susceptibility to certain antifungal drugs, and may aid in the development of next-generation antifungals.

Michelle Chew

Identification and complete elimination of contaminants from used implant healing abutments.

Supervisors: Dr Sunyoung Ma, Dr Geoff Tompkins, A/Prof Andrew Tawse-Smith, A/Prof Neil Waddell

Funder: Sir John Walsh Research Institute

Healing abutments (HAs) are titanium caps placed on top of dental implants during the healing period. They have the potential to be reused but it is essential to completely remove all bacteria, bacterial components and tissue debris. This study examined used HAs after three different treatments to assess the most effective cleaning method (a) autoclave sterilisation, (b) autoclaving followed by air-polishing with erythritol powder, and (c) autoclaving followed by sodium hypochlorite (bleach). After the indicated procedures, HAs were stained, photographed and analysed to measure the proportion of contaminated surface area. HAs were significantly cleaner after additional treatment, but complete debris removal was only achieved with bleach. The results support the reuse of HAs, but the effect of bleach on titanium alloy warrants further investigation.

Yinglu Jiang

Tooth surface texture analysis following air polishing and rubber-cup cleaning

Supervisors: Dr Li Mei, Prof Richard Cannon, Prof Mauro Farella

Funder: Division of Health Sciences

Tooth brushing is challenging for patients with braces and therefore frequent professional cleaning is required. Traditionally, 'rubber cups' are used to remove debris and stains but air polishing is

more effective and efficient at cleaning around braces. In order to determine the better method, the surface roughness created by the cleaning procedures was studied as it may promote plaque accumulation. In this study, ten human teeth with braces brackets attached were randomly allocated to two groups and each group was subjected to a different treatment time (5s or 60s). Both cleaning methods were applied at two separate locations on the same tooth. The polished enamel was removed for surface texture scanning. There was no increase in enamel surface roughness after rubber cup polishing. Air polishing, on the other hand, caused an increase in enamel roughness.

Manish Kumar

How is the Candida albicans drug efflux pump Cdr1p arranged in the cell membrane?

Supervisors: Dr Hee Ji Lee, Prof Richard Cannon, Dr Erwin Lamping

Funder: EK Crow Trust Fund

Candida albicans is usually a harmless yeast for humans but can sometimes cause infections in the mouth and elsewhere in the body. These infections can become invasive and life-threatening in the immunocompromised. The azole class of drugs is most commonly used to treat Candida infections however an increasing prevalence of resistance complicates treatment. Azole resistance is most often due to the increased production of a membrane-associated drug efflux pump called Cdr1p. Despite its importance, the structure of Cdr1p has yet to be established. It is predicted that on the outer surface of the pump, there are six cysteine amino acids. In this study we developed and validated a method to detect the location of these cysteine residues and showed that some form disulfide bonds on the outer surface of Cdr1p.

Kali Stratford

Dental wear and calculus in Orcinus orca: What can we learn from marine mammals?

Supervisor: Dr Carolina Loch

Funder: New Zealand Dental Association

A stranding of Orcinus orca (orca or killer whale) in Southland, New Zealand, provided the opportunity to investigate dental wear and calculus in a pod of nine animals. 429 teeth were analysed to determine location, intensity and type of dental wear present, with over 1600 surfaces analysed for calculus. Calculus deposits were also analysed using energy-dispersive x-ray spectroscopy (EDX). All orca showed dental wear, with 90% of teeth affected in 89% of the animals and 89% of orca also had calculus. There was no difference in wear and calculus occurrence between males and females. Larger animals presented with a higher frequency of tooth wear and calculus. EDX analyses showed sodium, magnesium, phosphorus, calcium and strontium as common elements in calculus. Knowledge of wear patterns and dental disease in wild animals could be used to inform studies with orca in captivity and to improve their quality of life.

Ashley The

Dental students' and staff perceptions of the impact of learning environment disruption on their learning and teaching experiences

Supervisors: Prof Paul Brunton, Dr Lee Adam, Dr Alison Meldrum, Faculty of Dentistry

Funder: R.C. Tonkin Summer Scholarship, New Zealand Dental Association Research Foundation

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

BDS (Honours) projects, 2017

Danyan Graham

The molecular basis of azole inhibition of an antifungal target: Investigating the effect of a second-site mutation on the antifungal target lanosterol 14 α -demethylase in the model yeast *Saccharomyces cerevisiae*

Supervisors: A/Prof Brian Monk

Funding: NZ Dental Association (Sir John Walsh Honours Scholarship)

Background: The widely-used and well-tolerated azole antifungals prevent synthesis of the essential and fungal-specific sterol ergosterol by inhibiting lanosterol 14 α -demethylase (Erg11p). Azole prophylaxis in immunocompromised patients has selected for the emergence of more difficult to treat Erg11p mutants of fungal pathogens, limiting therapeutic options.

Objective: This study investigated the structural and functional effect of two common, clinically-relevant mutations (Y140H and I471T) in recombinant Erg11p expressed in the model yeast *Saccharomyces cerevisiae* (ScErg11p).

Methods: Liquid minimum inhibitory concentrations for 80% growth inhibition (MIC80) of control wild-type and mutant cells were measured for short-tailed (fluconazole [FLC] and voriconazole [VCZ]), long-tailed (itraconazole [ITC] and posaconazole [PCZ]) azoles and the novel medium-tailed tetrazole VT-1161. ScErg11p expression levels in mutant cells were probed using SDS-PAGE and western blotting experiments. Mutant enzymes in complex with either VCZ or ITC were crystallised and X-ray diffraction data was collected on the MX1 beamline at the Australian Synchrotron. The structures were solved using the molecular replacement method.

Results: The MIC80s of Y140H mutated strains for FLC, VCZ and VT-

1161 were two-fold high than wild-type cells ($P < 0.001$, ANOVA). Addition of the I471T second-site mutation further increased the MIC80s for FLC and VCZ three-fold ($P < 0.0001$, ANOVA), but not to VT-1161 which retained wild-type susceptibility. Cells expressing the Y140H and I471T mutations both individually and collectively were sensitised to treatment with ITC and PCZ. Expression of ScErg11p containing the Y140H and/or the I471T mutation was 36% of the wild-type control indicating that the resistance observed was not due to overexpression. Crystals of ScErg11p Y140H + I471T in complex with VCZ diffracted X-rays at a resolution of 2.9 Å and revealed the loss of a key water-mediated hydrogen bond between the tertiary hydroxyl of VCZ and the residue at position 140.

Conclusion: The results suggest that incorporating a tail substituent in the design of next-generation azoles may take advantage of increased hydrophobic interaction with the walls of the substrate entry channel, stabilising the drug within the binding cavity thereby diminishing the effect of the Y140H and I471T double-mutation which occurs in the active site.

Jik Hang Clifford Lee

A biomechanical comparison between human calvarial bone and a skull simulant

Supervisors: A/Prof Neil Waddell, A/Prof Niels Hammer, Prof Darryl Tong

Funding: NZ Dental Association (Sir John Walsh Honours Scholarship)

Background: Current forensic analysis of blunt force trauma is reliant upon the use of cadaveric or animal tissues, posing ethical and reproducibility concerns. Use of artificial surrogates does not require ethical approval or suffer from limited supply, and improves repeatability and validity of tests. However, existing surrogates exhibit poor anatomic and mechanical biofidelity, especially in the choice of skull simulant material. Progress has been made in identifying certain materials that have similar mechanical properties to human skull bone, with the potential to behave similarly in dynamic loading.

Aims: To compare the biomechanical properties of human calvarial bone with an epoxy resin simulant (MasterFlow 622, BASF, Ludwigshafen, Germany). Data collected was also used to analyse the effect of morphology, microstructure, water content, and periosteal attachment on the mechanical properties of skull bone.

Methods: Fifty-six skull bone specimens were prepared from two embalmed human cadavers post rinsing in isotonic saline. Specimens from the left half of both skulls were stripped of periosteum and dura mater as the bare bone control group, whereas the periosteum was left intact on the right side. Bone specimens were analysed with micro-computer tomography (μ -CT) scans to assess trabecular connectivity, volume density, and total bone surface area. Duplicates of the bone specimens were fabricated out of an epoxy resin. The specimens were loaded under three-point bend tests until fracture, while a digital image correlation system analysed deformation. The bone fragments were then lyophilised to measure their water content.

Results: Skull specimens had lower bending modulus and higher bending strength than resin specimens, displaying greater flexibility and force absorbance under load. The presence of periosteum and dura mater increased rigidity and strength in both skull samples.

Conclusion: The mechanical properties of epoxy resin measured in this study fall within the reference ranges for skull tissues in literature, but skull tissues had slightly lower values. Attached

periosteum on skull specimens increased rigidity and bending strength, bringing the bending modulus nearer to that of the resin duplicates, suggesting that the proposed resin responds to load more similarly to the bone-periosteum complex than bare bone.

Yinan Zhang

Are myofibroblasts and associated cytokines important in the development of oral cancer?

Supervisors: Dr Haizal Hussaini, Dr Benedict Seo, Prof Alison Rich

Funding: NZ Dental Association (R.C. Tonkin Scholarship)

Background: Oral squamous cell carcinoma (OSCC) is an aggressive cancer with a high mortality rate. Myofibroblasts (MF) are mesenchymal cells that express alpha smooth muscle actin (α -SMA). There are more MF in the stroma of OSCC than in the connective associated with normal oral mucosa (NOM) and potentially malignant oral disorders (PMOD; histologically presenting with dysplastic oral mucosa (DOM)). Studies have shown that the abundance of MF in OSCC stroma is associated with faster proliferation of tumour cells, increased likelihood of metastasis and poor prognosis. Malignant keratinocytes in OSCC have been shown to be in close contact with fibroblasts and to stimulate their trans-differentiation by secreting Transforming Growth Factor Beta-1 (TGF β -1). In turn, MF secrete hepatocyte growth factor (HGF) that stimulates the proliferation and invasion of OSCC.

Objective: To investigate the role of MF (as detected by α -SMA) and related cytokines TGF β -1 and HGF in the development of PMOD and OSCC by examining their protein expressions using immunohistochemistry (IHC).

Methods: IHC (using antibodies against human TGF β -1, HGF and α -SMA) was performed on formalin-fixed paraffin-embedded (archival OSCC (n = 27) and PMOD (n = 24) tissues, with non-specifically inflamed NOM as controls (n = 30). Qualitative and quantitative analyses of positively stained cells were undertaken and compared between the groups.

Results: OSCC group had a higher proportion of α -SMA+ cells compared with DOM and NOM groups (p < 0.0001). Interestingly, NOM had a higher proportion of α -SMA+ cells compared with DOM. The expression of TGF β -1 was significantly higher in the OSCC group, in comparison with both the NOM (p < 0.0001) and DOM (p < 0.0001) groups. There was no significant difference between NOM and DOM tissues.

Conclusion: Increased presence of MF and greater expression of TGF β -1 correlated with the presence of OSCC. A decrease in the number of α -SMA+ cells in the stroma may indicate a progression of NOM to PMOD with histological evidence of epithelial dysplasia.

Joanne Au

Three-dimensional analysis of lip changes in response to simulated maxillary incisor advancement

Supervisors: Dr Austin Kang, Prof Mauro Farella, Mrs Florence Bennani, Dr Li Mei

Funding: NZ Dental Association (R.C. Tonkin Scholarship)

Background: Upper lip change in response to orthodontic movement of the maxillary incisors varies largely across individuals. Research on this topic has been predominantly conducted at the

midline of the lip using lateral cephalograms, hence lip changes in three dimensions remain poorly understood.

Objective: To assess three-dimensional (3D) lip changes in response to simulated maxillary incisor advancement.

Methods and materials: A convenience sample of 20 orthodontics patients without brackets bonded (not in active treatment) was recruited from the Faculty of Dentistry, University of Otago. Incremental maxillary incisor advancement was simulated by placing wax of increasing thickness on the participants' incisors (+2 mm, +4 mm and +6 mm) and the induced lip changes were recorded using 3D digital stereo-photogrammetry. The induced displacement of lip landmarks was quantified using 3D image analysis software. Averages and standard deviations of all measurements were calculated and a repeated-measures analysis of variance (ANOVA) was performed.

Results: A large inter-individual variation in lip response to simulated incisor advancement was observed. A significant overall effect on 3D lip changes was found for increasing values of simulated maxillary incisor advancement (F=14.1; p<0.05). Significant overall differences in response to simulated maxillary incisor advancement were found between anatomical landmarks of the lip (F=12.5; p<0.05). Most points moved outwards and antero-superiorly, except the midpoint and corners of the lip. Greatest movement was observed in the sagittal plane, followed by vertical and transverse planes.

Conclusion: Maxillary incisor advancement significantly influences upper lip change in three planes of space. Further investigation is needed to correlate findings with soft tissue characteristics to better understand the large inter-individual variability observed in this study.

Summer studentships, 2017/18

Lauren Allen

Comparison of F₁F₀-ATPase amino acid sequences between oral streptococci

Supervisors: A/Prof Geoffrey Tompkins, Dr Nicholas Heng

Funder: Division of Health Sciences

Comparison of the membrane proteins conferring acid tolerance in bacteria associated with tooth decay. Acids produced by oral bacteria gradually cause tooth decay. Decay-causing bacteria have a membrane pump (F₁F₀-ATPase) which removes internal protons, allowing the bacteria to survive acidic conditions while continuing acid production. This advances tooth decay. This project developed an acid tolerance testing protocol which categorized a range of non-mutans Streptococcus type strains and isolates from carious lesions by relative acid tolerance. Tolerance was found to vary between these bacteria. Further work will sequence F₁F₀-ATPase genes from these microbes to generate amino acid sequences for comparison. Motifs which relate to acid-tolerance (if found) may have future use in risk assessment, detection and treatment of decay.

Zoe Berryman

The role of titanium particles in dental implant disease

Supervisors: A/Prof Andrew Tawse-Smith, Dr Haizal Hussaini, Prof

Alison Rich

Peri-implantitis results in the loss of bone and soft tissue around dental implants, and is the main cause of dental implant failure. Recent research has investigated the inflammatory responses that occur when titanium particles from the implant enter the soft tissues, and whether these contribute to bone and soft tissue loss. This project aimed to investigate the presence of titanium particles in tissue samples adjacent to dental implants, and the levels of inflammatory markers in the areas with titanium compared to areas without. The majority of samples studied contained titanium particles. Two of three inflammatory markers were increased in the areas with titanium, suggesting that bone remodelling may have occurred. The remaining inflammatory marker showed little difference but we can infer that there were increased levels of wound healing occurring in the sample tissues. In conclusion, more research needs to be conducted to confirm the inflammatory response to titanium particles in peri-implantitis.

Cylan Cai

A digital method for measuring the Dental Aesthetic Index

Supervisors: Simon Olliver, Dr Li Mei, A/Prof Jonathan Broadbent

Funder: Auckland Dental Association

Background: The Dental Aesthetic Index (DAI) is a multifunctional occlusal index used to estimate malocclusion severity and orthodontic treatment need. It can be used as an eligibility criterion for publicly-funded care or as an index of dentofacial anomalies in epidemiological research. No studies have reported on changes in DAI scores from childhood to adulthood in a population sample. Objective: (1) To determine whether a digital imaging technique allows reliable estimation of DAI and (2) to evaluate long-term stability of DAI scores and association with dental appearance, using Dunedin Multidisciplinary Health & Development Study data. Method: World Health Organisation criteria were used for estimating clinical DAI scores and were adapted to our digital method, where necessary. After examiner calibration was complete, DAI was then collected for DMHDS participants. Results: The digital method did not show bias relative to the original clinical method and intra- and inter-examiner reliability were high. Greater DAI scores at age 18 were associated with poorer self-rated dental appearance at age 45. The DAI at age 18 and caries-associated deciduous tooth loss by age 5 years were associated with worse DAI scores at age 45 years. Improvement in DAI score from 15 to 18 and the presence of an orthodontic retainer wire were associated with better scores. Sex and history of orthodontic treatment were not associated with any differences. Conclusion: DAI score during adolescence is associated with self-rated dental appearance 30 years later. DAI scores in mid adulthood are also associated with DAI scores during adolescence, as well as early loss of deciduous teeth.

Anne Jude

Nanosilver as an antimicrobial for dental implants.

Dr Dawn Coates, Dr Gemma Cotton, Professor Warwick Duncan, Mrs Syarida Safi

Funder: Otago Medical Research Foundation

Everybody loses teeth eventually. When this happens, dental implants can be screwed in, supporting an artificial tooth. If jaw

bone healing fails, implants fail. Moa Bone® (MB) is a product from cattle found to increase human jaw healing, securing implants. However, there is a high chance of infections. To solve this, we turn to nanotechnology. Silver nanoparticles destroy bacteria but may also be harmful to human cells. Our aim was to find concentrations of nanosilver, where human gum cells are still alive. We found such concentrations do exist, revealing silver nanoparticles to be no more harmful than Chlorhexidine, a dental mouthwash. We now know that nanosilver can be both harmful to bacteria and safe for human cells. The next step is to combine the silver nanoparticles with MB, creating a product that allows people to retain the implants that replace their missing teeth – safe healing without infection.

Manish Kumar

Studying the extracellular domains of the *Candida albicans* multidrug efflux pump Cdr1

Supervisors: Dr Erwin Lamping, Dr Hee Ji Lee and Prof Richard D Cannon

Funder: Weribee Trust Fund

The human commensal yeast *Candida albicans* can cause superficial skin infections that can become life-threatening invasive fungal infections in the immunocompromised. Azole antifungals are widely used to treat invasive *Candida* infections, but treatment can become difficult for azole resistant isolates overexpressing the multidrug efflux pump, Cdr1. Cdr1 is an integral membrane protein with six extracellular cysteines that are conserved among all plant and fungal efflux pump homologs. We investigated whether these six cysteines form disulphide bonds and whether they stabilize the three dimensional structure of Cdr1. We took a previously created, fully functional Cdr1 protein that had all six cysteines mutated to serines and created five additional Cdr1 mutants with predicted disulphide bonds re-introduced either individually or in various combinations. The five newly created Cdr1 mutants were fully functional, which means that we are now in a position to confirm the three predicted disulphide bonds by mass spectrometry.

Eden Ross

The provision of oral health care by New Zealand nurses: can we do more?

Supervisor: Professor Murray Thomson

Many groups of people in New Zealand are known to suffer worse oral health. Nurses have a unique opportunity to work with these groups. This study aimed to: (1) gauge the perceptions of nursing staff about oral health care and identify any barriers to the provision of this care; and (2) gain an understanding of nurses' feelings towards future oral health screening of patients. This study surveyed nursing staff working at Dunedin Hospital in order to elicit their appraisal of current oral health care practices. Data were analysed using Chi-squared tests. 182 nursing staff members responded to the questionnaire. Only 35% of respondents felt that oral health care was provided as often as it should be, and the greatest barriers to providing oral health care to dependent patients included the patient declining, time constraints, greater medical concerns, and lack of staff. Nurses' workloads need to be improved to allow for improved oral health care provision and the introduction of oral health screening.

Hetal Shukla

The Study of a Potential Drug Target for Cholesterol Lowering Medications

Supervisors: Dr Alia Sagatova and Dr Mikhail Keniya

Funder: Division of Health Sciences

Squalene monooxygenase (Erg1) is an enzyme involved in regulation of cholesterol biosynthesis in the human body. An analogue of this enzyme is seen in fungi and antifungal medications target fungal Erg1. Knowledge on human Erg1 (HsErg1) is limited but has clinical relevance particularly for patients with high blood cholesterol and breast and liver cancers. This study aimed to: 1) co-express HsErg1 with a co-factor enzyme (CaNCP1) needed for Erg1 function, 2) determine the sensitivity of HsErg1-expressing strains to allylamine antifungals, and 3) isolate HsErg1 for structural studies. Functional expression of HsErg1 was evident due to an increase in drug resistance by all HsErg1-expressing strains, however no difference in drug resistance was seen between the HsErg1 and the HsErg1-CaNCP1 co-expressing strains. Co-expressing strains had a reduced amount of HsErg1 compared to strains that expressed HsErg1 alone. Purification of HsErg1 gave small amounts of product, suggesting the need for further investigation.

BDS (Honours) projects, 2018

Jodie Bryant

Comparison of two decontamination methods on used implant healing abutments: an in vitro study

Supervisors: Dr Sunyoung Ma, A/Prof Geoffrey Tompkins, A/Prof Andrew Tawse-Smith, A/Prof Neil Waddell

Funding: NZ Dental Association (Sir John Walsh Honours Scholarship)

Aims: To assess the effectiveness of using sodium hypochlorite and a steam-cleaner to eliminate contaminants remaining on used healing abutments after autoclaving.

Methods: One hundred and thirty-two used titanium implant healing abutments which were previously autoclaved at 132°C for seven minutes were divided randomly into one control group (Group 1) and two test groups (Group 2 and 3). All healing abutments were photographed using a light microscope and capture system (Nikon SMZ800) at 2x magnification after which they were stained with Phloxine B (400 µg/mL). The used healing abutments were subsequently imaged again to assess the baseline amount of contamination after autoclaving. Group 1 underwent no further treatment. Group 2 underwent decontamination by immersion in sonicated sodium hypochlorite (25 g/L) for 25 minutes. Group 3 underwent the same treatment as Group 2 but with the addition of a two-minute steam-cleaning of the top surface of the healing abutments. After each stage, the healing abutments were rinsed twice in 80 mL of distilled water and dried at 50°C overnight. The healing abutments were then stained, imaged and digitally analysed to assess residual contamination and therefore the comparative effectiveness of the decontamination protocols.

Results: Submersion in sonicated NaOCl resulted in a significant reduction in residual contaminants present on healing abutments in both Group 2 and Group 3 ($p=0.00$). The addition of a two-minute steam cleaning protocol improved the reduction of residual contaminants present on the top of healing abutments, although

the difference between this protocol and the NaOCl protocol alone was not statistically significant ($p=0.271$).

Conclusion: Immersing used healing abutments in sonicated sodium hypochlorite solution is an effective and technically feasible decontamination method. Future studies will assess the effect of NaOCl and steam-cleaning on the characteristics and surface topography of used implant healing abutments.

Reuben Martin-Hendrie

The bond strength of dental adhesives to bovine cortical bone

Supervisors: A/Prof Neil Waddell, Dr KC Li, A/Prof Niels Hammer

Funding: NZ Dental Association (Sir John Walsh Honours Scholarship)

Polymethyl-methacrylate (PMMA) cements have long been used to bond orthopaedic implants to bone, despite multiple inherent drawbacks that can result in debonding and failure of the implant. Dental adhesives are able to reliably bond to various substrates while resisting degradation and cyclic loading forces, and may provide a more efficacious alternative.

Objective: to determine if dental adhesive systems can provide a higher bond strength to bone than that of traditional PMMA cements.

Methods: 120 bovine cortical bone specimens were shaped and cemented in a lap shear configuration using glass ionomer cement (GIC) (Fuji IX GP, GC America Inc., USA), resin-modified glass ionomer cement (RM-GIC) (Fuji PLUS, GC America Inc., USA), resin cement (RelyXTM Universal, 3M ESPE Company, USA), and PMMA bone cement (SimplexTM P with Tobramycin, Stryker Corp., USA) for a total of 15 bonded specimens in each sample. Specimens were tested in tension at 1.0 mm/min in a universal testing machine (Instron 3369, Instron Corporation, USA) until failure occurred. Peak force at failure and modulus of elasticity was measured and shear stress calculated. Samples were examined under a scanning electron microscope (Sigma FEG SEM, Zeiss, Germany) to analyse mode of failure.

Results: there was a statistically significant difference in shear stress values between the four samples as determined by one-way ANOVA ($F = 61.07, p < 0.001$). A Dunnett's post hoc test was performed using PMMA bone cement as the control group. The mean shear stress values for GIC, RM-GIC, and resin cement were 8.58, 15.82, and 35.21 times greater than that of PMMA bone cement, respectively ($p < 0.001$). A statistically significant difference exists in the modulus of elasticity between the four cements as determined by one-way ANOVA ($F = 21.11, p < 0.001$). Electron microscopy revealed that all three dental adhesives demonstrated a higher proportion of cohesive failure than PMMA cement.

Conclusion: The shear bond strengths of all three dental adhesives were significantly greater than that of PMMA bone cement. Further research is required regarding solubility and biocompatibility prior to commencement of animal/clinical research.

2019

New Clinical Services Building

Official opening of the Clinical Services Building, which includes new facilities for teaching clinics, primary care, multi-disciplinary specialist services and clinical research.



Research seminars

Sir John Walsh Research Institute seminars

| Date | Presenter | Affiliation | Presentation title |
|-------------|-------------------------------------|--|---|
| 8 Feb 2017 | A/Prof Mario Brondani | Faculty of Dentistry University of British Columbia, Canada | Aging – Research, services and teaching in dental geriatrics |
| 15 Mar 2017 | Dr Rhiannon O'Connor | School of Dental Sciences Newcastle University, UK | The Newcastle Thousand Families Birth Cohort: A study overview, with a focus on the Oral Health Component |
| 5 May 2017 | Prof Huang Li | Department of Orthodontics Nanjing University, China | Biology and pathology of the temporomandibular joint |
| 14 Jun 2017 | Dr Ken Hemmings Dr Lloyd Searson | Eastman Dental Institute University College London, UK | What have we learnt from 30 years of restorative clinical practice? |
| 5 Oct 2017 | A/Prof Donald Chi | Department of Health Services and Department of Paediatrics University of Washington, USA | Interdisciplinary approaches to solving paediatric oral health inequalities |
| 1 Feb 2018 | Dr Charles Carlson | Department of Psychology University of Kentucky, USA | Chronic temporomandibular pain: Psychosocial issues and the role of self-regulation strategies for long-term management |
| 10 Sep 2019 | Prof Paul Cooper | School of Dentistry University of Birmingham, UK | Stick 'em up, we've got you surrounded! – The role of the oral epithelium and neutrophils in periodontitis pathogenesis |
| 27 Nov 2018 | A/Prof Ioannis Koutlas | Department of Diagnostic and Biological Sciences, School of Dentistry University of Minnesota, USA | Syndromes of the head and neck |
| 3 Dec 2018 | Dr Jan D'haese | Department of Periodontology and Oral Implantology Ghent University, Belgium | Recent developments in Computer-Guided Implant Surgery |
| 12 Dec 2018 | Dr May Lei | Faculty of Dentistry University of Hong Kong | The success of silver diamine fluoride in caries management: what's behind it? |

Faculty of Dentistry Get-Together research seminars

| Month | Presenter | Position | Presentation title |
|------------|------------------------|----------------------------------|--|
| April 2017 | Dr Carolina Loch | Lecturer, Oral Sciences | Science outreach: what do we have to do with it? |
| | Dr Joanne Choi | Lecturer, Oral Rehabilitation | Development of tooth coloured shell crowns for the Hall Technique |
| May 2017 | Dr Gemma Cotton | Postdoctoral Fellow | Silver nanoparticles in dentistry |
| | Dr Jithendra Ratnayake | Postdoctoral Fellow | Development of a novel xenograft material from New Zealand sourced bovine bone |
| June 2017 | Ana Low | DClinDent student (Orthodontics) | Effects of different adhesive removal methods on bacterial colonisation on in vivo orthodontic bracket model |
| | Soo-Wee Ong | DClinDent student (Oral Surgery) | Third molar surgery: a comparison between two anaesthesia methods |

| Month | Presenter | Position | Presentation title |
|----------------|-------------------------|------------------------------------|--|
| July 2017 | Lisa Falland | PhD student | Anatomical head model to measure impact force transfer and displacement |
| | Golnoush Madani | PhD student | Biochemical and structural analysis of fungal ABC membrane protein Cdr1p |
| August 2017 | Humza Ahmed | DClinDent student (Endodontics) | Sealer application during the continuous wave of condensation root canal filling technique |
| | Hassan Mohamed Ahmed | DClinDent student (Prosthodontics) | Novel approach to treat root caries |
| September 2017 | Dr Nicholas Heng | Senior Lecturer, Oral Sciences | A Dog's Breakfast: antibacterial-producing bacteria of canine origin |
| | Dr Carolina Loch | Lecturer, Oral Sciences | On the evolution (and devolution) of whale and dolphin enamel |
| October 2017 | Dr Alia Sagatova | Postdoctoral Fellow | Fungal drug resistance |
| | Dr Erwin Lamping | Senior Research Fellow | Studying multidrug efflux pumps from fungal pathogens |
| November 2017 | Danyon Graham | BDS(Hons) student | The molecular basis of azole inhibition of an antifungal target |
| | Danni Chen | BDS5 student | Identifying essential amino acid residues in the fungal Erg11p enzyme |
| February 2018 | Dr Lee Smith | Research Fellow | Pasifika adolescents' understandings and experiences of oral health care |
| March 2018 | Prof Richard Cannon | Director, SJWRI | Adhesion of Candida albicans in the oral cavity |
| April 2018 | Prof Murray Thomson | HoD, Oral Sciences | An overview of our current research on the oral health of older New Zealanders |
| June 2018 | Simon Olliver | DClinDent student (Orthodontics) | Is posterior cross-bite a risk factor for temporomandibular joint clicking? |
| | Ghassan Idris | DClinDent student (Orthodontics) | Do overweight adolescents chew differently? |
| July 2018 | Zhen Dong | PhD student | Stem cell models of tissue regeneration |
| | Sabarinath Prasad | PhD student | Jaw Activity Wearable Systems |
| September 2018 | Dr Tanmoy Bhattacharjee | Postdoctoral Fellow | Tissue elasticity measurements using the UltraD3 device - an update |
| October 2018 | Maggie Chen | DClinDent student (Prosthodontics) | Reliability of RFA in assessing implant stability: a retrospective analysis |
| | Yasmeen Ruma | PhD student | Development of Cryptococcus neoformans and Candida parapsilosis as drug targets |

Research Day presentations

SJWRI Research Day 2017

Keynote presentations

Prof Alan Brook

UNIVERSITY OF ADELAIDE AND QUEEN MARY UNIVERSITY OF LONDON

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

Prof Peter Hunter

AUCKLAND BIOENGINEERING INSTITUTE & MEDICAL TECHNOLOGIES CoRE

Overview of the Physiome Project

Prof Mike Morgan

HEAD, MELBOURNE DENTAL SCHOOL

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

Invited speakers

A/Prof Roslyn Kemp

DEPARTMENT OF MICROBIOLOGY & IMMUNOLOGY, UNIVERSITY OF OTAGO

Immunology in cancer – using big data to improve outcomes

Prof Stephen Robertson

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

Bones under pressure – Understanding mechanosensing in bone

Programmes/Themes (Staff presentations listed first)

ORAL MOLECULAR AND IMMUNOPATHOLOGY

FEATURED PROGRAMME

Nawal Abdul Rahman

Expression of the Lysyl Oxidase family in odontogenic lesions

Adil Alkharusi

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

Nurul Ruziantee Ibrahim

Lymphangiogenesis in metastatic lymph nodes of oral squamous cell carcinoma

Hitesh Navani

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

BIOMATERIALS

Dr Carolina Loch

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

Dr Joanne Choi

Bond strength between modern denture base acrylics and relin materials

Adeline Chai

Effect of incisal preparation design on porcelain laminate veneers

Lisa Falland

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

Arun Ramawarrier

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

CLINICAL AND TRANSLATIONAL RESEARCH

Prof Warwick Duncan

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

Victoria Kashchuk

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

Soo-Wee Ong

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

Assil Russell

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

Eugene Sheftel

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

Adlin Suhaimi

Pre-radiation dental assessment of head and neck cancer patients

CRANIOFACIAL RESEARCH

Joanne Au

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

Fiona Firth

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

Will Sew Hoy

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

Austin Kang

Assessing tooth movements in three dimensions

DENTAL EPIDEMIOLOGY AND PUBLIC HEALTH

Dr Lee Smith

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

A/Prof Abhishek Mehta

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

Leonard Chia

Clinicians' perspective of special care dentistry in New Zealand

Nina Scott

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

MOLECULAR MICROBIOLOGY

Dr Nick Heng

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

Dr Alia Sagatova

Expression and purification of a drug target squalene monooxygenase

Dr Hee Ji Lee

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

Golnoush Madani

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

PAEDIATRIC DENTAL RESEARCH

Dorothy Boyd

Clinical outcomes in New Zealand primary oral healthcare

William Fogarty

Adolescent oral health in New Zealand in 2009

Aravind Parachuru

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

SJWRI Research Day 2018

Keynote presentations

Prof Marco Peres

DIRECTOR, ARCPOH, ADELAIDE DENTAL SCHOOL, UNIVERSITY OF ADELAIDE

Population-based oral health studies in Australia: from surveillance to hypothesis-driven research

Prof Paul Cooper

DIRECTOR OF RESEARCH, SCHOOL OF DENTISTRY, UNIVERSITY OF BIRMINGHAM

Dental tissue regeneration: What are the modifying factors and how could a conducive environment for healing be generated?

Programmes/Themes (Staff presentations listed first)

UNDERSTANDING THE ORAL HEALTH OF NEW ZEALANDERS

FEATURED PROGRAMME: DENTAL EPIDEMIOLOGY AND PUBLIC HEALTH

Prof Murray Thomson

Medication use and xerostomia among dependent older New Zealanders: findings from a national survey

A/Prof Jonathan Broadbent

Antecedents of trajectories in untreated dental caries experience to age 45

Shaikha Al Samahi

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

Abbey Corbett

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

Chuen Lin Hong

Personality, dental neglect, and oral health: a longitudinal study

Poppy Horne

Psychosocial aspects of periodontal disease diagnosis and treatment

Caleb Lawrence

Dental caries, tooth wear and dietary sugar intake in a sample of Northland Māori

Divya Ramanan

Jaw muscle overload as a possible cause of orofacial pain

Elizabeth Williams

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

NEW TECHNOLOGIES AND THERAPEUTICS

Dr Tanmoy Bhattacharjee

Tissue elasticity measurements using UltraD3 device

A/Prof Dawn Coates

Regulation and control of stem cells

Dr Nick Heng

Dysgalactacin and Sanguinicin K11, two novel antimicrobial proteins (Bacteriocins) targeting important pathogens

Dr Jithendra Ratnayake

Ionic substituted bovine-derived hydroxyapatite bone grafts for dental surgery applications

Zhen Dong

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

Pip Greer

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

Golnoush Madani

Expression and purification of Candida albicans multidrug efflux pump Cdr1 for structural studies

EVALUATING OUR TEACHING, LEARNING AND PRACTICE

Dr Carolina Loch Santos da Silva

When whales had teeth: dental morphology and ultrastructure in ancestral cetaceans from Antarctica

Dr Li Mei

Efficacy of oral probiotics in managing biofilm formation in patients wearing fixed orthodontic appliances

Dr Arthi Senthilkumar

Challenges in clinical teaching investigated: towards sustainable staff recruitment and retention in dentistry

Imad Al Lawati and Hind Al Maskari

I am a lefty in a right-handed world – Qualitative analysis of clinical learning experience of left-handed undergraduate dental students

Jodie Bryant

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

Danni Chen

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

Ana Low

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



Completion of our Redevelopment

The completion of the full interior refurbishment of the Walsh Building and New Zealand's National Centre for Dentistry, providing quality dental care, research informed teaching and internationally recognised research.

