BSODR ANNUAL MEETING 2017
6th – 8th SEPTEMBER
UNIVERSITY OF PLYMOUTH
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- **Superior** antibacterial protection for 12 hours**1,2**
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** Defined as teeth, tongue, cheeks and gums.
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With a rich marine and maritime heritage and a hand in some of Britain’s most famous events, a city as steeped in history as Plymouth has many stories to tell.

It is Britain’s Ocean City, a lively and authentic waterfront community with a distinctly European feel created by the many marinas, restaurants, alfresco pavement cafes and waterfront bars, historic buildings.

Nestling between the sea and rivers on three sides, the dramatic wild expanse of Dartmoor on the fourth, and a heritage that holds a powerful place in English and world maritime history.

A city with the sea at its heart, the major shopping centre is just a ten minute walk from the waterfront.

Take a walk along the cobbled streets of the Barbican and find yourself transported back in time, to history altering moments such as Sir Francis Drake victory over the Spanish Armada, the departure of the Mayflower carrying the Pilgrim Fathers in search of the New World, and explorers Scott of the Antarctic, Captain James Cook and Charles Darwin setting sail – all of which took place right here in Plymouth.

Plymouth has a strong bond with the armed forces and its naval history runs deep. There is no better example of that than the Royal William Yard, an impressive and imposing example of the city’s military prowess and the largest collection of listed naval buildings in Europe.

In addition to its impressive natural setting, Plymouth is the cultural capital of Devon and Cornwall with major events including the annual British Firework Championships and Flavour Fest, theatres, galleries and performing arts providing an eclectic cultural experience to add to the laid-back lifestyle.

With real character and personality and a scale which makes it really easy to get around, you can totally immerse yourself in Britain’s Ocean City.
Welcome to BSODR 2017

A warm West Country welcome to the 2017 British Society for Oral and Dental Research (BSODR) scientific meeting hosted by University of Plymouth.

The major aim of the scientific meeting is to facilitate the dissemination and application of research findings relating to oral health and the interactions between oral and systemic health and we have put in place an exciting scientific programme to deliver this aim. In addition, the BSODR has a clear mission to encourage our junior researchers. As for previous years, our junior researchers are encouraged to enter the research prizes held during the meeting. We are continuing the initiative started at the Cardiff meeting (2015), and followed up in the recent workshop in London (11th April 2017) by providing a sponsored Early Career Researcher (ECR) breakfast that aims to support the development of our ECRs who are a vital part of the future of the society and oral and dental research.

We hope you have a productive and enjoyable meeting.

On behalf of the Local Organising Committee

Conference Venue – Roland Levinsky Building
British Society for Oral and Dental Research

The BSODR was formed to advance research and increase knowledge for the improvement of oral health in the United Kingdom.

Our primary objectives are:
- To support and represent the oral health research community in the UK.
- To encourage junior workers to become involved in oral and dental research.
- To facilitate the dissemination and application of research findings relating to oral health and the interactions between oral and systemic health.

The Society is a Division of the International Association for Dental Research (IADR) and a member of a federation of European research societies - Pan European Region (PER). The members of the PER are the IADR divisions from Britain, Continental Europe, Ireland, Israel, Russia and Scandinavia.

Under various names, the BSODR has been meeting since 1953, but even before that, groups of British researchers had been meeting in London since 1931. The Society therefore has a long and rich heritage.


BSODR Management Committee

- Paul Anderson Assistant Honorary Secretary (QMUL)
- David Bartlett Honorary President (KCL)
- Chris Hope Councillor (Liverpool)
- Paul Hyde Councillor (Leeds)
- Katrin Jaedicke Councillor – ECR (Newcastle)
- Mike Lewis Immediate Past President (Cardiff)
- Richard Lynch Councillor (GSK)
- Rebecca Moazzez Honorary Treasurer (KCL)
- Marcello Riggio Honorary Secretary and Webmaster (Glasgow)
- Peter Robinson Honorary Editor/President Elect (Bristol)
- Vehid Salih Councillor (Plymouth)
- Alastair Salih Assistant Honorary Treasurer (Cardiff)
- Rachel Waddington Chair of Awards Committee (Cardiff)
- David Wood Councillor (Leeds)

For more information regarding BSODR and to sign up for our newsletter and tweets please visit our website: https://www.bsodr.org.uk/
# Sponsors

The BSODR gratefully acknowledges the generous support of all our sponsors.

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<td>Anatomage</td>
<td>Located in Silicon Valley, Anatomage has thrived in a place where innovation is a part of the culture. Anatomage products are used in tens of thousands of clinics and hospitals internationally. We are proud that our products are copied by other companies; we take it as proof that our ideas are pushing the industry to set the new standard of the future.</td>
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<td>Colgate Oral Health Network</td>
<td>Colgate Oral Health Network incorporates all of Colgate’s professional education and development activities. Colgate Oral Health Network underpins Colgate’s long-term commitment in partnering with dental professionals including quality assured educational initiatives with academic partners, supporting research awards and partnerships with key dental associations.</td>
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<td>Johnson &amp; Johnson Ltd</td>
<td>Working in partnership with dental professionals to provide expert care, Johnson &amp; Johnson Ltd the makers of LISTERINE® are proud to be sponsors of BSODR. Visit the LISTERINE® stand to talk with the professional team about the latest evidence regarding the use of essential oils in the adjunctive management of oral biofilms. UK/LI/17-9423</td>
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<td>Microbiology Society</td>
<td>The Microbiology Society is a membership organisation for scientists who work in all areas of microbiology. It is the largest learned microbiological society in Europe with a worldwide membership based in universities, industry, hospitals, research institutes and schools. The Society publishes key academic journals, organises international scientific conferences and provides an international forum for communication among microbiologists and supports their professional development. The Society promotes the understanding of microbiology to a diverse range of stakeholders, including policy-makers, students, teachers, journalists and the wider public, through a comprehensive framework of communication activities and resources.</td>
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| Sponsor of the Ice-Breaker Event and Exhibitor | Main Conference Sponsor | Conference Exhibitor | Sponsor of a full page advert |
| **National Institute for Health Research** | The NIHR Clinical Research Network provides the infrastructure necessary to undertake high quality clinical research in the NHS. We help researchers set up clinical studies efficiently, support the life-sciences industry to deliver research, provide research training, and work with patients to ensure their needs are integral to all research activity. | Exhibitor |
| **PLYMOUTH UNIVERSITY PENINSULA** | Ranked third in the UK by the Guardian, our ethos is based on outstanding clinical education, world class research and exceptional social engagement. Early clinical contact for all our students is unique and we provide them with ultramodern facilities. We are committed to producing dental practitioners with excellent clinical skills and a strong sense of social awareness. | Sponsor of the Taste of the West Glass and Exhibitor |
| **Queen Mary University of London** | Dentistry at Barts and the London School of Medicine and Dentistry has been rated first in the UK in the Complete 2015 University Guide subject league tables and 2nd in the UK in 2015 Guardian University Guide. The results of the 2014 Research Excellence Framework (REF) has affirmed the Institute of Dentistry, QMUL, as the leading dental school for research in the UK. | Dental School Exhibitor |
| **UNIVERSITY OF LEEDS** | Leeds School of Dentistry has a world-class research profile and strong international partnerships, delivering for our partners a continuum from basic and clinical science through to translational research that in turn drive our innovative postgraduate programmes. We would like to welcome you to Leeds in 2019 for the next BSODR Annual Meeting. | Dental School Exhibitor |
| **WRIGLEY Oral Healthcare Programme** | It’s our mission to help patients to improve their oral healthcare routine between brushing, through one extra simple and enjoyable step: by chewing sugarfree gum after eating and drinking. Independent clinical research proves that chewing sugarfree gum for 20 minutes after eating or drinking helps neutralise the plaque acid attacks that can cause tooth decay. That’s the message we’re passionate about. And we’re working hand in hand with dental professionals to help spread the word. | Sponsor of a full page advert and bag insert |
| **ZIMMER BIOMET** | As an affiliate of one of the largest musculoskeletal companies in the world, Zimmer Biomet dental division has access to the latest technology, talent and resources to drive growth and accelerate the development of innovative solutions to address clinical needs. Robust portfolios of surgical, restorative, regenerative and digital dentistry solutions put the dental division in an even greater position to meet the growing demands of the industry | Exhibitor |
Conference Information

The University of Plymouth campus is situated in the centre of the City, just a 5 minute walk from the Train Station. The city centre is a 5 minute-walk from the campus and Plymouth Hoe and Barbican just a 10 – 15 minute walk.

All maps can be found in the maps section of the handbook.

Conference Venue
The BSODR Conference 2017 will be taking place in the Roland Levinsky Building which is situated on our main campus. All delegates will be required to register on the Ground Floor of the Roland Levinsky Building to collect their conference information on arrival. All conference sessions will take place in the Roland Levinsky Building.

Registration and Information Desk
Located on the Ground Floor of the Roland Levinsky Building, the Registration and Information Desk will be open throughout the conference from 08:00 – 17:00 daily. Members of the University of Plymouth Events Team will be on hand to assist with information about the conference and general information about Plymouth throughout the event.

Student helpers wearing red t-shirts will be available to help with directions, programme and poster questions, audio-visual, computer and room issues. Help will also be available in the speaker ready room for up-loading oral presentations.

Messages
Messages will be posted on the board near the registration/information desk. These message boards may also be used by delegates to advertise job vacancies and other conference meetings that may be of interest to conference delegates, subject to approval.

Free Wi-Fi
Visitors to the conference can enjoy FREE internet access across the campus. On arrival you will receive a username and password to enable you to access the internet across all of your devices whilst on the main University of Plymouth campus.

Scientific Session Protocol
It is strictly forbidden to photograph, audio or video any of the information presented during oral sessions or on posters. This is because it is a requirement that all results data presented are unpublished.

Oral Presentations
Please provide an electronic copy of your talk to a member of the audio-visual team in the slide preview room, the Jill Craigie Cinema, at least 60 minutes before the start of the session in which you are speaking. The slide ready room will be open from 08:00 to 16:00 throughout the meeting, and open from 11:00 on Wednesday 6th September for those participating in the prize presentations.
Speakers are expected to speak for 12 minutes and set aside 3 minutes for questions. Talks will be subject to strict timing as controlled by light boxes: Green to 9 minutes, Orange to 11 minutes and Red to 15 minutes. Only invited plenary speakers are permitted laptops, all other presenters must use the onsite equipment.

Poster Presentations

General posters will be displayed throughout the conference at Crosspoint zones 1-3 of the Roland Levinsky Building. Presenters should mount their posters preferably by Wednesday afternoon, but at the latest by Thursday 08:00 on their designated numbered board.

Presenters participating in the Unilever poster prize presentations must mount their posters by 13:45 Wednesday 5th September in room 206 of the Roland Levinsky Building. Following completion of the Unilever poster prize competition, these posters should be moved to their designated boards to join the general poster display at Crosspoint zones 1-3.

All posters should be A0 and must be in portrait orientation (NOT landscape). Presenters are required to stand by their posters at the times indicated in the scientific programme.

Conference Refreshments

To enhance networking opportunities, drinks, snacks and buffet lunches will be provided in the Crosspoint zones 1-3 of the Roland Levinsky Building on each day of the conference. Delegates attending group business lunches should obtain their lunch from this central location and take it with them into the assigned room. Trade stands are also located here, which all are encouraged to visit as our sponsors are vital to the success of BSODR meetings.

Access

There are toilets and disabled toilets located on each floor of the building. Lifts and staircases are available to all floors and Roland Levinsky Building Lecture Theatres all have wheelchair access.

Fire exits are through the main entrances/exits to the building. There are also a number of emergency exits on the ground floor, please follow the green and white signs to the nearest exit in the event of a fire alarm sounding.

The fire rendezvous points for the Roland Levinsky Building are as follows: for the WEST side of the building – congregate at Smeaton Building east end (facing Scott Building). For the EAST side of the building – congregate at LINK South West End. People with disabilities should, if possible, exit to the North side of the building in order to avoid the steps.

Smoking is prohibited in all common use areas such as classrooms, laboratories, offices and lecture theatres. Smoking areas are located outside all buildings. It is prohibited to smoke within 5 metres of a building.

All security personnel are trained first aiders; please contact the registration/information desk in the first instance if you require assistance.
Photography
There will be instances throughout the conference when the University of Plymouth official photographers will be taking pictures for PR and marketing purposes including the dental media and the BSODR and University websites. In some instances you may have been asked in advance for your permission, and in others you may be asked on the day. If you do not wish to appear in any photographs please make this known to the photographer or the conference organisers.

Cash Machine
There is a free to use ATM situated just outside the Roland Levinsky Building, which is available 24 hours a day. In addition there is a Santander Branch in the Smeaton Building.

Car Parking
At the University of Plymouth, we are serious about sustainability. In line with our green travel plan, we encourage people to find alternatives to using cars (unless it is essential due to mobility issues). Parking on campus is highly restricted.

If you are a blue badge holder we will endeavour to offer parking at all times, please let the Registration and Information Desk know on arrival.

There are plenty of car parks in the city centre within walking distance of the University. A full list and maps are available from the Plymouth City Council website. The nearest are Plymouth Train Station, Mayflower House Court, Mayflower Street East and Regent Street. Your hotel may offer parking at a reduced rate, please ask your individual accommodation provider for further information.

Local Transport
Plymouth is a compact city and therefore easy to walk to various destinations during your stay. Hackney Carriage Taxis are available at the Train Station and around the City Centre and local buses are frequent. Please ask at the Registration and Information Desk if you require further information about buses, taxis or the Plymouth Park & Ride service.

Plymouth Taxis 01752 606060
Taxi First 01752 222222
Towercabs 01752 252525
Social Programme

Welcome Reception – A Taste of the West, National Marine Aquarium
Taking place at the National Marine Aquarium, guests will have the opportunity to taste and sample a range of food and drink local to the South West.
The NMA is the largest public aquarium in the UK. The awe-inspiring exhibits, featuring marine animals from near and far, provide an environment that intrigues, inspires and motivates visitors to engage with their conservation messages.
Pick up your glass and meander your way through Plymouth Sound, the Atlantic Ocean and the Great Barrier Reef exhibits and enjoy the delights of local West Country beers, ciders, wines and food. Coach transport will be available between North Hill and the NMA and back again – departing North Hill at 19:00 and 19:30 from outside the Museum.

Conference Dinner, Royal Marine Barracks Stonehouse
RMB Stonehouse dates back to 1783. Guests will be hosted in the most historic part of the barracks, The Commando Forces Officers’ Mess which boasts a grand dining room and displays many rare and valuable regimental paintings and pieces of silver. Guests will enjoy a three-course dinner with wine and some military entertainment. Dress code: smart/business. Coach transport will be available between North Hill and RMB Stonehouse and back again – departing North Hill at 18:45 and 19:15 from outside the Museum.
Plymouth: Britain’s Ocean City
Directions to the National Marine Aquarium

This is the suggested walking route from the Roland Levinsky Building to the National Marine Aquarium. Please note, the footbridge from the Barbican towards the National Marine Aquarium is temporarily closed and therefore there is no direct access to the Barbican.

The Museum based on North Hill is where the coach transport will pick up on both nights for transfer to the social events.
Highlight sessions

**TC White lecture**

09:30 Thursday 7th September in Lecture Theatre 1 of the Roland Levinsky Building

Dr Anwen Louise Cope BDS, PhD

**Summary:** Antibiotics are frequently used in the management of acute dental conditions in primary dental care, however there is evidence that the majority are prescribed either in situations which do not warrant their use, or as a substitute to definitive operative treatment. What are the reasons for this, and why do some dentists prescribe far more antibiotics than their peers? This lecture will describe studies undertaken to try to understand decision making around antibiotic use in primary dental care and to explore the reasons why dentists may not follow clinical guidelines regarding prescribing. It will also consider how greater understanding of the drivers of inappropriate antibiotic use can be utilised in the design of interventions to optimise antibiotic prescribing in dentistry.

**About Anwen:** Anwen Cope is a Specialty Trainee in Dental Public Health at Cardiff and Vale University Health Board in Wales. She graduated from Cardiff University in 2009 and worked in primary and secondary care dental services in South Wales before returning to Cardiff University in 2011 to undertake postgraduate research. She was awarded her PhD in 2015. Her research seeks to understand how antibiotics are used in the management of acute dental problems in primary care. She started specialty training in the NHS in September 2015 and currently holds a Clinical Research Time Award from Health and Care Research Wales.

**Keynote lecture**

14:00 Thursday 7th September in Lecture Theatre 1 of the Roland Levinsky Building

Professor Jonathan Grant BSc (Econ), PhD

The Keynote Lecture at the BSODR 2017 Annual Meeting in Plymouth is to be delivered by Professor Jonathan Grant, Director of the Policy Institute at King’s College London. His lecture – *Assessing the impact of biomedical and health research* – will look at why it is important to be able to assess the impact of biomedical and health research, and the different approaches for doing so. It will examine case studies from the UK Research Excellence Framework, including a sub analysis of those relating to dentistry, as well as reviewing other quantitative approaches. In conclusion, it will be argued that while research funding is effective in improving health, that same is not true for its efficiency in light of concerns about research waste.
Jonathan Grant is Assistant Principal for Strategic Initiatives & Public Policy at King’s College London, and Professor of Public Policy in the Policy Institute at King’s. Jonathan was Director of the Policy Institute between February 2014 and 2017, and under his leadership it acquired a national and international reputation as a centre of excellence for facilitating the translation of research into policy and practice. The Policy Institute was profiled in the Times Higher Education Supplement and is seen as a ‘model’ by other universities worldwide. He was appointed Assistant Principal for Strategy in October 2015, tasked with leading the development a new Strategic Vision for King’s, which was published in January 2017. Subsequently, Jonathan was invited to oversee the implementation of the Strategic Vision, as Assistant Principal for Strategic Initiatives & Public Policy. Jonathan is a member of the Senior Leadership Team for the university.

Jonathan’s main research interests are on biomedical and health R&D policy, research impact assessment and the use of research and evidence in policy and decision making. Jonathan has significant international experience providing analytical support on the formulation and implementation of R&D strategies in, for example, the UK, Greece, Norway, Qatar, Oman, Australia, Canada and the USA. Recent studies that Jonathan has led include: an assessment of the impact case studies from the UK Research Excellence Framework; a project estimating the economic returns from cancer-related research in the UK and a study looking at the economic spillovers from public funded biomedical and health research.

Jonathan co-founded the International School on Research Impact Assessment, is an advisor to Giving Evidence, an organisation that aims to ensure charitable giving is based on sound evidence, and a Trustee and Chair of the Grants Committee for Fight for Sight, a UK-based medical research charity that dedicated to pioneering eye research. In 2013, he co-authored a book, ‘The Drugs Don’t Work’, on the global threat of antimicrobial resistance. The book, written in collaboration with the Chief Medical Office of England, Professor Dame Sally Davies, and an expert in infectious diseases, Prof Mike Catchpole, was serialised by The Sunday Times and featured in the New Statesman and The Scotsman.

Jonathan was President of RAND Europe between June 2006 and October 2012, where he oversaw the doubling of RAND Europe’s activity in Europe, the founding of a vibrant and successful office in Brussels, and the establishment of the Cambridge Centre for Health Services Research, a joint venture with the University of Cambridge. Prior to joining RAND in 2002, Jonathan was Head of Policy at the Wellcome Trust. Jonathan received his Ph.D. from the Faculty of Medicine, University of London and his B.Sc. (Econ) from the London School of Economics.
Official launch of the James Lind Alliance research priority setting exercise for Oral and Dental health
15:00 Thursday 7th September in Lecture Theatre 1 of the Roland Levinsky Building
Professor Peter Robinson

Oral and Dental research in the UK is world-leading. Never-the-less, it is fragmented and does not receive the funds it deserves, resulting in a small National Institute of Health Research (NIHR) portfolio of research, and a possible shortage of evidence to inform clinical decision making. One solution to this would be to identify the research priorities in relation to oral health. Priority Setting Partnerships (PSPs) involve patients and clinicians working together to identify uncertainties about healthcare interventions to prioritise research. PSPs are facilitated by the James Lind Alliance (JLA) and focus on clinical research problems. The NIHR Oral and Dental Specialty Group has joined with Dental Schools’ Council and Public Health England to create a PSP for oral and dental health. The PSP will first invite contributions from any organisation or individual to an initial survey to identify possible priorities. Responses to this initial survey will be content-analysed into themes and to remove duplicates. The existing evidence-base for the remaining questions will be searched formally. The unanswered questions will then be shortlisted so that a ‘Top Ten’ can be selected by patients and clinicians. The Top Ten research questions in oral and dental health will then be passed on to research funders to generate calls in these priority areas. The priorities should also bring researchers together to focus on these questions.

BDA President’s Address
16:00 Thursday 7th September in Lecture Theatre 1 of the Roland Levinsky Building
Mr Peter Dyer & Mr Stephen Skelton

This will be a joint presentation given by Peter Dyer (BDA President) and Stephen Skelton (BDA Senior Policy Advisor)

Peter and Stephen will update delegates on some of the strategic issues currently affecting dentistry. Included in this will be an update on reforms to hospital employment contracts and the future of some of the smaller specialties.

Peter graduated in dentistry from the Royal Dental Hospital in 1979 during which time he was the president of the British Dental Students’ Association and in medicine from University College Hospital, London in 1988. He completed his training as a senior registrar at the Royal London Hospital and was appointed consultant in oral and maxillofacial surgery to the University Hospital of Morecambe Bay NHS Foundation Trust in 1998 with a special
Interest in trauma and orthognathics. He is now the Responsible Officer for the Trust. He is Chair of the Central Committee for Hospital Dental Services and President of the BDA for 2017/18.

After gaining undergraduate and postgraduate degrees in politics Stephen took up a post at the BDA. He was initially involved with the CDS and dental academics and later his role was expanded to also encompass hospital dentists and wider BDA governance.

Peter Dyer (BDA President)  
Stephen Skelton (BDA Senior Policy Advisor)

Graham Embery Lecture
16:20 Thursday 7th September in Lecture Theatre 1 of the Roland Levinsky Building
Professor Mike A. O. Lewis PhD, FDSRCPs, FDSRCS (Eng), FRCPath, FFGP (UK), FHEA

The Graham Embery Lecture at the BSODR 2017 Annual Meeting in Plymouth will be delivered by Professor Mike Lewis, Professor of Oral Medicine at the School of Dentistry, College of Biological Sciences, Cardiff University. His lecture – My war against the oral microbiome – will describe his clinical and laboratory based research targeted against bacterial, viral and candidal infections of the orofacial tissues over a period of 35 years.

Mike undertook his undergraduate clinical training in Dundee and his specialist training in Glasgow. Mike received his PhD from the University of Glasgow in 1987. He holds Fellowships of Royal College of Physicians and Surgeons of Glasgow, Royal College of Surgeons of England, Royal College of Pathologists, Faculty of General Dental Practice and Higher Education Authority.

Mike stood down as Dean of School of Dentistry at Cardiff University on July 31st 2017, having served in that role since 1st August 2010, to return fully to his substantive post as
Professor of Oral Medicine. He is also Director of the Dental Clinical Board of Cardiff & Vale University Health Board.

Mike has a long association and involvement with BSODR, attending his first meeting in 1984 in London and has attended regularly since that time. He was Chair of the Oral Medicine and Pathology Group (2004 - 2007) and a Council Member of the Oral Microbiology and Immunology Group (1994-1997). Mike has served a member of the BSODR Management Committee (1997 - 2001) and was President of BSODR (2014 - 2016).

In 2002, Mike was the Chairman of the Organising Committee for the Inaugural Meeting of the Pan-European Federation of the IADR 2002, which was held in Cardiff. With regard to International Association for Dental Research, Mike served as a Member of the Hatton Awards Committee (2001-2004), Chairman of the Pre-doctoral Hatton Award Committee (2004), Member of the William J Geis Award Committee (2007-2010) and President of the Oral Medicine and Pathology Group (2012).

Mike has published over 200 scientific articles and co-authored six medical textbooks. He has delivered more than 500 postgraduate lectures worldwide. In addition, he has served as President of the British Society for Oral Medicine, Dental Member of the Advisory Council for Misuse of Drugs (Home Office) and Dental Member of the Scientific Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infection (Department of Health). Mike is also a past Dean of the Dental Faculty of the Royal College of Physicians & Surgeons of Glasgow.

Annual Business Meeting
Please join your colleagues in attending the ABM which will take place after the Graham Embery Lecture in Lecture Theatre 1 of the Roland Levinsky Building.

Early Career Researcher Breakfast
08:00 on Thursday 7th September in room 206 of the Roland Levinsky Building.
This breakfast session is provided free of charge for all ECRs. The session aims to provide a relaxed atmosphere for ECRs to network and provides a chance to learn more about BSODR and the benefits it can bring for career progression along with details of funding opportunities that are available for junior researchers.

Business meetings and group lunches

Group Lunches

Oral Medicine & Pathology (Professor Paula Farthing)
13:00 on Thursday 7th September in room 206 of the Roland Levinsky Building.

MINTIG (Professor Paul Cooper & Dr Maisoon Al-Jawad)
13:00 on Thursday 7th September in room 207 of the Roland Levinsky Building.

NIHR CRN (Professor Sue Pavitt and Professor Francesco D’Auito)
13:00 on Thursday 7th September in Lecture Theatre 1 of the Roland Levinsky Building Closed meeting by invitation only.

Delegates attending group business lunches should obtain their lunch from Crosspoint zones 1-3 and take it with them into the assigned room.
Sponsored Symposia

OMIG
14:00 Wednesday 6\textsuperscript{th} September in Lecture Theatre 1 of the Roland Levinsky Building

Title: Life at the host-pathogen interface

Overview:
The relationship that exists between the host and the associated commensal microbiota at any specific body site is complex and subtle shifts in either or both can lead to disease initiation and progression. The aim of this symposium is to bring together both strands of this complex relationship and highlight the research currently underway in several distinct areas that are underpinning our understanding of life at the host-pathogen interface.

List of speakers and individual presentation titles for each speaker:

Dr Angela Nobbs (University of Bristol), \textit{Streptococcus gordonii and endocarditis: from plaque to platelets}

Prof Iain Chapple (University of Birmingham), Neutrophil dysfunction and neutrophil extracellular traps (NETs)

Dr Andrew Smith (UCL), Orofacial granulomatosis: host microbe interactions

NIHR CRN Methods Symposium
11:30 Thursday 7\textsuperscript{th} September in Lecture Theatre 1 of the Roland Levinsky Building

Title: Periodontal research and systemic health – the methodological challenges of designing an intervention trial to tackle co-morbidity

Overview:
Periodontal health is now widely accepted as having a major role in systemic health such as cardiovascular disease, diabetes, and rheumatoid arthritis. Could it be as simple as cleaning up the oral cavity to improve these co-morbidity conditions? But can the dental community agree how to do a trial? This symposium is for those that want to understand the difficulties and contribute to generating pragmatic solutions for getting a national collaboration, multicentre trial designed by the UK dental community to maximise patient benefit and their general health.

Sponsored by the National Institute of Health Research Clinical Research Network

Symposium Presenters

11:30-11:45 Professor Francesco D’Aiuto (Periodontologist) – Periodontal disease and Diabetes (highlighting the results from his Phase 2 trial and the selection of clinical outcomes – diabetes or cardio outcomes)

11:45-11:55 Professor Azfar Zaman (Cardiologist) – Periodontal disease treatment in patients with type 2 diabetes mellitus after acute coronary syndrome (high lighting a cardiologist’s perspective of the selection of clinical outcomes)
11:55-12:10  **Professor Thomas Dietrich** (Oral Surgeon) – Perio and RA (highlighting the challenges of referral from RA clinics to dentistry and patient attrition)

12:10 – 12:25 **Professor Deirdre Devine** (Oral microbiologist) – Perio and early RA (highlighting the selection of an agreed periodontal protocol and sampling for translational research)

12:25 – 12:35 **Dr Jianhua Wu** (Statistical Lead Dental Translational and Clinical Research Unit DenTCRU, Leeds) - Implications of the control arm in intervention trials in periodontal research – routine care (no treatment) versus active monitoring delayed treatment – managing the ethical dilemma of ‘no treatment’ - how long is acceptable and sample size implications.

12:35-13:00 **Panel Q&A and Discussion** All Speakers

**NIHR CRN** (Professor Sue Pavitt and Professor Francesco D’Auito)  
13:00 on Thursday 7th September in Lecture Theatre 1 of the Roland Levinsky Building  
Closed meeting by invitation only

**MINTIG**  
11:30 Friday 8th September in Lecture Theatre 1 of the Roland Levinsky Building

**Title:** Approaches for hard tissue craniofacial imaging

**Overview:**  
Recent advances in imaging from the laboratory to the chairside are enabling us to understand the physiochemistry and biology of hard tissue structures better than ever before. The symposium will highlight recent research in hard tissue imaging for understanding function and for clinical diagnostics and therapeutics. It aims to showcase national and international research from in vitro to clinical translation across a range of clinical, scientific and engineering disciplines. The symposium will be of interest to basic, applied and clinical scientists giving a platform for discussion of new ideas and expanding continual professional development.

**Symposium chair** – Prof Paul Cooper

**Speakers:**

11:30 **Professor Richard Lynch** (GlaxoSmithKline)  
The enamel lesion, what are we trying to measure and why?

11:50 **Prof Paul Anderson** (Queen Mary University of London)  
The role of salivary proteins on enamel demineralization and remineralization with scanning microradiography

12:10 **Dr Samera Siddiqui** (Aarhus University, Denmark)  
Diffraction Scattered Computed Tomography as it relates to dental hard tissues

12:30 **Dr Laurent Bozec and Dr Susan Parekh** (Eastman Dental Institute, UCL)  
Translating Optical Coherence Tomography from bench to patients

12:50 Closing remarks
Prizes

All oral prize presentation sessions are open for all to attend. Judging of poster prizes will be a closed session, but posters will be presented again later in the scientific programme.

Senior Colgate Prize
- Heat Th2.1, 14:00 Wednesday 6th September, Lecture Theatre 2, Roland Levinsky Building
- Heat 303.1, 14:00 Wednesday 6th September, Room 303, Roland Levinsky Building
- Heat Th2.2, 15:30 Wednesday 6th September, Lecture Theatre 2, Roland Levinsky Building
- Heat 303.2, 15:30 Wednesday 6th September, Room 303, Roland Levinsky Building
- Final, 09:30 Thursday 7th September, Lecture Theatre 2, Roland Levinsky Building

Junior Colgate Prize
- 14:00 Wednesday 6th September, Room 207, Roland Levinsky Building

Unilever Poster prize
- 14:00 Wednesday 6th September, Room 206, Roland Levinsky Building

VOCO (Materials 1) Prize
- 11:30 Thursday 7th September, Room 206, Roland Levinsky Building

PER GSK MINTIG Award
- 11:30 Thursday 7th September, Room 303, Roland Levinsky Building
Overview Programme

[Diagram showing a timetable with various sessions, rooms, and time slots.]
## BSODR 2017 – Oral Session Chairs

<table>
<thead>
<tr>
<th>Topic</th>
<th>Date</th>
<th>Time</th>
<th>Chair</th>
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<tbody>
<tr>
<td>Stem Cell &amp; Neuroscience</td>
<td>7th Sept</td>
<td>9.30am</td>
<td>Dr. Ryan Moseley</td>
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<tr>
<td>Dental Education Research</td>
<td>7th Sept</td>
<td>9.30am</td>
<td>Prof. Liz Kay</td>
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<tr>
<td>Oral Medicine and Pathology</td>
<td>7th Sept</td>
<td>9.30am</td>
<td>Dr. Craig Murdoch</td>
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<tr>
<td>Caries Prevention</td>
<td>8th Sept</td>
<td>9.30am</td>
<td>Prof. Ivor Chestnutt</td>
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<tr>
<td>Dental Materials</td>
<td>8th Sept</td>
<td>9.30am</td>
<td>TBC Robert Hill</td>
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<tr>
<td>Pathogenesis of Periodontitis</td>
<td>8th Sept</td>
<td>9.30am</td>
<td>Dr. Louise Belfield</td>
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<tr>
<td>Health Promotion</td>
<td>8th Sept</td>
<td>11.30am</td>
<td>Prof. Peter Robinson</td>
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<tr>
<td>&amp; Health Services Research</td>
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<tr>
<td>Oral Microbiology</td>
<td>8th Sept</td>
<td>11.30am</td>
<td>Prof. Dave Spratt</td>
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<tr>
<td>Periodontology</td>
<td>8th Sept</td>
<td>11.30am</td>
<td>Prof. Francis Hughes</td>
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## BSODR – Prize Session Chairs

<table>
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<tr>
<th>Topic</th>
<th>Date</th>
<th>Time</th>
<th>Chair</th>
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<tbody>
<tr>
<td>Jr. Colgate</td>
<td>6th Sept</td>
<td>pm</td>
<td>Prof. Alastair Sloan</td>
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<tr>
<td>Sr. Colgate Heats 1.1/1.2</td>
<td>6th Sept</td>
<td>am</td>
<td>Dr. Marcello Riggio</td>
</tr>
<tr>
<td>Sr. Colgate Heats 2.1/2.2</td>
<td>6th Sept</td>
<td>am</td>
<td>Dr. Fionnuala Lundy</td>
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<tr>
<td>Unilever Poster</td>
<td>6th Sept</td>
<td>pm</td>
<td>Closed Session for Judges</td>
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<tr>
<td>Senior Colgate Final</td>
<td>7th Sept</td>
<td>am</td>
<td>Prof. Rachel Waddington</td>
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<tr>
<td>PER GSK MINTIG</td>
<td>7th Sept</td>
<td>am</td>
<td>Prof. Paul Cooper</td>
</tr>
<tr>
<td>VOCO</td>
<td>7th Sept</td>
<td>am</td>
<td>Prof. Dave Wood</td>
</tr>
</tbody>
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Detailed Programme

Poster abstracts are numbered 041 - 094

Wednesday, September 6, 2017  14:00 - 15:30  Lecture Theatre 2
Senior Colgate Heat Th2.1

001 Periodontitis Severity Associated with Cardio-Renal Health in Renal Disease Patients
Sharma, P.¹, Fenton, A.², Sidhu, A.¹, Rahman, M.¹, Cockwell, P.², Ferro, C.², Chapple, I. L.¹,
Dietrich, T.¹
¹University of Birmingham, ²University Hospital Birmingham

002 Mechanical Properties of Dental Composites Modified by Incorporation of Fluorapatite
Micro-rods
Al-Taie, A.¹, Bubb, N.¹, Franklin, P.¹, German, M.², Wood, D. J.¹
¹School of Dentistry, University of Leeds, ²School of Dental Sciences, University of Newcastle

003 Radiographic Estimation of Remaining Dentine Thickness in Carious Primary Molars
Almutairi, W.¹, Douglas, G. V.², Lancaster, P.¹, Day, P. F.¹,²
¹University of Leeds, ²Community Dental Service, Bradford District Care NHS Foundation
Trust

004 Factors Related to Reducing Free Sugar Intake Among White Ethnic Adults: Barriers and
Facilitators
Al Rawahi, S.¹, Asimakopoulou, K.¹, Newton, J. T.²
¹King’s College London Dental Institute

005 Is the sense of taste impaired in Sjogren’s Syndrome patients?
Al-Ezzi, M. Y.¹, Khan, K.², Tappuni, A. R.¹
¹Queen Mary, University of London/Barts and The London School of Medicine and
Dentistry, ²Blizard Institute

006 Dentists’ Perceptions of Their Roles Influence Their Patient Referral Decisions
Allen, Z.¹, Moles, D. R.¹, Nasser, M.¹, Richardson, J.¹
¹Plymouth University Peninsula Schools of Medicine and Dentistry

Wednesday, September 6, 2017  14:00 - 15:30  Room 303
Senior Colgate Heat 303.1

007 Novel Resin-modified Glass Ionomer Cement for Repairing Defective Tooth-restoration
Complexes
Al-Taee, L. A., Banerjee, A., Deb, S.
¹King’s College London Dental Institute

008 The Impact of Dental Phobia on Care Planning: A Vignette Study
Heidari, E., Banerjee, A., Andiappan, M, Newton, J. T.
King’s College London Dental Institute
009 Quantification of Mineral Deposits on Root Caries Using Dental Varnish
Mustafa, A. S., Tappuni, A. R., Davis, G., Mills, D., Baysan, A.
1Queen Mary University of London

Boytes, V., Festy, F., Abuljadayel, R., Watson, T.
1, 3, 4King’s College London, 2King’s College London Dental Institute,

011 Periodontal Regeneration in a Rat Model Using Self-Assembling Peptides
EL-Sayed, B., EL-Zehery, R., Ibrahim, M., Grawish, E., Kirkham, J., El-Gendy, R.
1School of Dentistry, University of Leeds, 2Faculty of Dentistry, Mansoura University, Egypt 3Faculty of Dentistry, Suez Canal University, Egypt

012 Characterisation and Preventive Effect of a Novel Bioactive Orthodontic Adhesive.
Aleesa, N., Wong, F., Hill, R., Johal, A.
1Barts and the London Dental Institute, 2Queen Mary University of London

Wednesday, September 6, 2017 16:00 - 17:15 Lecture Theatre 2
Senior Colgate Heat Th2.2

013 Antibacterial Properties and Molecular Biocompatibility of TiO2-ZnO Nanocomposite Coatings for Dental Implants
Danookdharree, U., Besinis, A., Tredwin, C., Handy, R.
1, 2University of Plymouth, 3University of Plymouth Peninsula Dental School,

014 Contribution of oral bacteria to Candida virulence and denture stomatitis
Morse, D., Wilson, M., Smith, A., Bradshaw, D., Lewis, M., Wei, X., Williams, D. W.
1Cardiff University, 2GSK Consumer Healthcare,

015 Tumour-stromal Crosstalk in Metastatic Lymph Nodes of Oral Cancer.
Pilborough, A., Lambert, D., Khurram, S.
1University of Sheffield

016 A Novel, Injectable Hydrogel for Endodontic Antimicrobial Delivery
Everett, E., Waddington, R., Paul, A., Sloan, A. J.
Cardiff University

017 Development and Evaluation of a Novel, Lipid-A Based Biosensor for Personalised and Predictive Periodontal Therapy
Strachan, A., Harrington, Z., McIlwaine, C., Jerreat, M., Kilar, A., Jackson, S., Foey, A., Zaric, S.
1Plymouth University Peninsula School of Medicine & Dentistry 2University of Pecs, Hungary, 3SoBHS, University of Plymouth
Senior Colgate Heat 303.2

018 Flexural Properties of UDMA Dentures are Unaffected by Water Storage
Alabdulla, I., German, M., Thomason, J.
Newcastle University

019 Protection Effects of Bioglass® and Pro-Argin® Layers Formed On Dentine
Mahmoodi, B., Wood, R., Cook, R.
University of Southampton

020 Notch signalling controls tooth mesenchymal stem cell activation
Walker, J. V. ², Zhuang, H. ¹, Singer, D. ², Tredwin, C. ², Hu, B. ²
¹Peking University, ²Plymouth University Peninsula School of Medicine & Dentistry

021 CD133 determines epithelial stem cell activation
Singer, D. ¹, Zhuang, H. ¹-², Tredwin, C. ¹, Hu, B. ¹
¹ Plymouth University Peninsula School of Medicine & Dentistry, ²Peking University, China

022 Organoid Models of Normal Human Salivary Glands
Rahman, Z., Sherborne, C., Crawford, A., Claeyssens, F., Bingle, C., Bingle, L.
University of Sheffield

023 The attending adult: do they have parental responsibility for the paediatric patient?
Gohel-Andrews, K., Chaudhary, M & Davies, J.
Dental Institute, QMUL

Junior Colgate

024 Expression of Xenobiotic Metabolising Enzymes in Oral Mucosa and Tissue-Engineered Oral Mucosa Equivalents
Slowik, K. M., Murdoch, C., Colley, H.
University of Sheffield

025 Identification of Novel Neuronal Roles in Oral Cancer Tumour Microenvironments
Wallis, H., Kaewpitak, A., Bird, E., Hunter, K., Boissonade, F., Lambert, D. W.
University of Sheffield

026 Investigation of Prognostic Biomarkers of Periodontal Treatment
Gill, T., Karim, B., Hughes, F. J.
¹King’s College London

027 Continuous Sumatriptan Causes Increased Excitability in the Rat Trigeminal System
Hall, J., De Felice, M., Boissonade, F.
The University of Sheffield
028 Epithelial activation by the novel fungal peptide toxin Candidalysin
Tan, S., Richardson, J., Naglik, J.
King's College London

029 E-Cigarette Use: an Association with Smoking Cessation Motivation and Policy Support
Kaczmarczyk, K.
University of Leeds

Thursday, September 7, 2017  09:30 - 10:30  Room 206
Stem Cell Biology and Neuroscience

030 Expression of periodontal ligament-associated markers in oral and extra-oral mesenchymal stem cells
Kaur, M., Garna, D., Hughes, F. J., Ghuman, M.
King's College London

031 Aspirin Induces Osteogenic Differentiation of Dental Pulp Stem Cells
Rankin, R.\(^2\), Lundy, F. T.\(^2\), Schock, B.\(^2\), Zhang, S.\(^2\), About, I.\(^1\), Linden, G.\(^2\), Irwin, C.\(^2\), El Karim, I. A.\(^2\)
\(^1\)Faculté d'Odontologie, \(^2\)Queen's University Belfast

032 Altered brain activity in a pre-clinical model of cephalic pain
De Felice, M., Kennerley, A., Das, D., Boissonade, F.
University of Sheffield,

033 TRPV2 mediates mechanical stress-induced IL-8 release in odontoblasts
Lundy, F. T.\(^2\), About, I.\(^1\), Curtis, T.\(^2\), Linden, G.\(^2\), Irwin, C.\(^2\), El Karim, I. A.\(^2\)
\(^1\)Faculté d'Odontologie, \(^2\)Queen's University Belfast

Thursday, September 7, 2017  09:30 - 10:30  Room 207
Dental Education Research

034 Oral Surgery Trainee Perspective on Surgical Abilities
Cho, H., Ahmed, B., Murphy, M.
Birmingham Dental Hospital

035 Issues of Work-Related Musculoskeletal Pain Amongst Dental Students
Altemimini, A.
University of Leeds

036 Prospective Austrian progress test pilot project in undergraduate dental education
Kirnbauer, B.\(^1\), Jakse, N.\(^1\), Rugani, P.\(^1\), Egger, R.\(^2\)
\(^1\)Medical University Graz, \(^2\)Karl-Franzens University, Austria

037 Challenging the Conventional Curriculum: An Inter-Professional Undergraduate Dental Programme
Plymouth University Peninsula Schools of Medicine and Dentistry
Thursday, September 7, 2017  09:30 - 10:30  Room 303
Oral Medicine and Pathology Orals

038 Isolation and characterisation of oral cancer stem cells
Al-magsoosi, M. J., Lambert, D. W., Whawell, S. A.
University of Sheffield

039 Novel tissue-engineered constructs to examine the role of fibroblast-derived extracellular matrix in oral cancer progression
Harding, A. L., Lambert, D. W., Colley, H.
The University of Sheffield

040 Functional expression of class B scavenger receptors by oral keratinocytes: implications for oral squamous cell carcinoma
Chasib Baidhani, N., Colley, H., Hunter, K., Murdoch, C.
University of Sheffield

Thursday, September 7, 2017  10:30 - 16:30
Roland Levinsky Crosspoint
Posters

041 Chemical Analysis of Resin Monomer TEGDMA Stored in Aqueous Environment
Mulligan, S., Moharamzadeh, K., Walker, H., Kakonyi, G., Thornton, S., Fairburn, A., Burrell, M., Martin, N.
University of Sheffield

042 Antimicrobial Properties of Dental Acrylics Containing Ag-FAU Zeolite
Rai, S., Tosheva, L., Liauw, C., Verran, J., Malic, S.
Manchester Metropolitan University

043 Chemical analysis of resin monomers released into the environment via urine and saliva
Mulligan, S., Kakonyi, G., Thornton, S., Moharamzadeh, K., Fairburn, A., Martin, N.
University of Sheffield

044 Effect of Bioactive Glass Addition on the Characteristics of Glass Ionomer Cements
Manna, S.², Shahid, S.², Karpukhina, N.¹
¹Barts and The London School of Medicine and Dentistry, ²Queen Mary University of London

045 Peri-Implantitis: Oral Pathogenic Anaerobes Attach Directly to Dental Metallic Surfaces
Haury, C.¹, Wescott, A.², Beeby, D.², Austin, B.², Jones, Q.¹, Nishio Ayre, W.¹, Waddington, R.¹, Sloan, A. J.¹
¹Cardiff University, ²Renishaw PLC

046 Application of a graphene nanocoating for the management of microleakage and dentine hypersensitivity
Besinis, A., Islam, K., Gombos, Z., Handy, R., Awan, S.
University of Plymouth
047 Dentine Interactions of Hybrid Self-adhesive Composite/GIC Using Advanced Optical Imaging
Abuljadayel, R. 1, 3, Festy, F. 1, Andiappan, M. 1, Boyes, V. 1, Watson, T. 2
1King’s College London, 2King’s College London Dental Institute, 3King Abdul-Aziz University, Saudi Arabia

048 The environmental impact of dental materials: A sociological study
Mulligan, S., Gibson, B., Kakonyi, G., Moharamzadeh, K., Thornton, S., Fairburn, A., Martin, N. University of Sheffield

049 The oral microbiome in periodontally healthy rheumatoid arthritis patients
Lopez-Oliva, I. 1, Paropkari, A. D. 1, Serban, S. 2, Yonell, Z. 2, Sharma, P. 2, de Pablo, P. 3, Raza, K. 4, Chapple, I. L. 2, Dietrich, T. 2, Grant, M. M. 2, Kumar, P. S. 1
1Ohio State University, 2University of Birmingham, 3Rheumatology Research Group, Institute of Inflammation and Ageing

050 Unravelling the Association Between the Denture Microbiome and Bacterial Pneumonia
Twigg, J. A. 1, Williams, D. W. 1, Wilson, M. 2, Wise, M. 2, Lees, J. 1
1Cardiff University, 2University of Wales College of Medicine

051 Assessment of Lactobacillus plantarum Biosurfactants to Fight Endodontic Infection
Hashim, Z., Wilson, M., Maillard, J., Waddington, R. Cardiff University

052 In Vitro Inhibition of Oral Biofilm Development by Stannous Fluoride
Luo, T. 3, Zsiska, M. 1, Circeo, B. T. 2, Eisenberg, M. 3, Gonzalez-Cabezas, C. 3, Foxman, B. 3, Marrs, C. 3, Rickard, A. H. 3
1P&G Professional Oral Health, Crest Oral-B, 2Procter & Gamble Company, 3University of Michigan

053 Monitoring Destabilization of Oral Biofilms Developed in a Swinnex System
1Colgate-Palmolive Co., 2Newcastle University, 3University of California San Francisco, 4University of Michigan, 5University of Michigan School of Dentistry, 6University of Michigan School of Public Health

054 Developing a 3D Oral Mucosal Model for Denture Stomatitis Infection.
Gould, S. J. 1, Upton, M. 2, Belfield, L. A. 1, Salih, V. 1
1Plymouth University School of Medicine and Dentistry, 2SoBHS University of Plymouth

055 P2X7R genotype affects transglutaminase-2 export: Implications for immune related diseases
Griffiths, R., Dewitt, S., Aeschlimann, P., Jones, A., Aeschlimann, D. Cardiff University
056 Antifungal Potential of Essential Oils and Development of an *Ex Vivo* Model for Oral Candidosis
Serra, E.¹, Alraies, A.¹, Nishio Ayre, W.¹, Hidalgo-Bastida, A.², Verran, J.², Sloan, A. J.¹, Malic, S.²
¹Cardiff University, ²Manchester Metropolitan University

057 Periodontal inflammatory burden in patients with Type 1 Diabetes Mellitus
Jimenez, C., Robertson, D., Hodge, P., Lappin, D.
University of Glasgow

058 *In vitro* analysis of Keratin K2 function in protecting against carcinogenesis
AlDehlawi, H.¹, ²
¹QMUL, ²Barts and the London School of Medicine and Dentistry

059 P16 IHC is Insufficient for Assessment of HPV Status in Oral Dysplasia
Hendawi, N. B.¹, ², Allsobrook, O.¹, Khurram, S.¹, Bolt, R.³, Hunter, K.¹
¹University of Sheffield, ²University of Benghazi

060 Brushing with Toothpaste Containing 5% CSPS Reduces Dental Plaque
Hall, C.², Hughes, A.², Mason, S. C.¹
¹GlaxoSmithKline, ²GSK Consumer Healthcare

061 Choice of Toothpaste Surfactant System Influences Plaque Regrowth
Hall, C.², Jain, R.², Hughes, A.², Moore, F.³, Mason, S. C.¹
¹GlaxoSmithKline, ²GSK Consumer Healthcare, ³Intertek CRS

062 Reducing Dentinal Hypersensitivity Improves Oral Health-Related Quality of Life
Hall, C.¹, Shaw, D.³, Sufi, F.¹, Mason, S. C.¹, Maclure, R.², Holt, J.²
¹GlaxoSmithKline, ²Intertek Life Sciences, ³InVentiv Health

063 CSPS Toothpaste Does Not Consistently Improve Gingival Health Versus Placebo
Hall, C.², Mason, S. C.¹, Butler, A.², Bosma, M.², Hughes, A.², Kakar, K.³, Kakar, A.³
¹GlaxoSmithKline, ²GSK Consumer Healthcare, ³Global Health Research Group

064 Daily Brushing with Toothpastes Helps Maintain Gingival Health
Hall, C.², Butler, A.², Mason, S. C.¹, Hughes, A.², Mahesh, M.³, Maheshwari, R.³
¹GlaxoSmithKline, ²GSK Consumer Healthcare, ³Dr Rupali's Dental Research Centre

065 Magnification Loupes Improve Accuracy of Stain and Plaque Assessments.
Maclure, R., Cullen Mahon, J., Speed, E., Rimmer, P., Moore, F., Howarth, E.
Intertek Life Sciences

066 Evaluating a Novel Hypersensitivity Relieve Gel Being Applied Before Bleaching
Bamidis, E. P., Kunzelmann, K.
Hospital of the Ludwig-Maximilians-University, Germany
067 E-cadherin Inhibition Effects on Oral Squamous Cell Carcinoma Metastatic Genes
Al-Mudhani, A. S.
University of Manchester

068 Mesenchymal Cell Function in Salivary Gland Regeneration.
Davies, J., Hu, B., Tredwin, C.
Plymouth University Peninsula School of Medicine & Dentistry

069 Mesenchymal stem cell heterogeneity regulates incisor growth in vivo
Sabalitic, M., An, Z., Sharpe, P.
King’s College London Dental Institute

070 Oxidative Stress Variations in Dental Pulp Progenitor Cell Ageing/Regenerative Potential
Alaidaroos, N. Alraies, A.² Sloan, A. J.¹ Waddington, R.³ Moseley, R.
Cardiff University

071 Comparison of Secretomes Derived from Periodontal Ligament and Bone Marrow Mesenchymal Stem Cells
Ariffin, F.¹ ², Cooper, P.¹, Scheven, B. A.¹
¹University of Birmingham, ²Universiti Teknologi MARA, KL, Malaysia

072 Mechanical strain affects mesenchymal stem cell fate
Grayson, P.¹, Yang, K.², Belfield, L. A.², Gao, Y.², Tredwin, C.¹, Hu, B.¹
³Plymouth University Peninsula Schools of Medicine & Dentistry, ²Capital Medical University, Beijing, China

073 DPSC Derived Neurons Functionally Express Sensory Neuron Specific Receptor (MRGX1).
McMillan, H., Curtis, T., Lundy, F. T., El Karim, I. A.
School of Medicine Dentistry and Biomedical Sciences Queen’s University of Belfast

074 What are the reasons why patients may consult a general medical practitioner when experiencing a dental problem? A systematic review.
Cope, A. L.², Butt, K. G.², Chestnutt, I.¹
¹Cardiff University, ²Cardiff and Vale University Health Board

075 Dental Decision Making Influencing Factors. A Systematic Map.
Plessas, A.¹, Nasser, M.¹, Bernardes Delgado, M.¹, Hanoch, Y.², Moles, D. R.¹
¹Plymouth University Peninsula Schools of Medicine & Dentistry, ²University of Plymouth

076 Leadership, Management and Dentists – A Systematic Narrative Review
Hanks, S.
Plymouth University Peninsula Schools of Medicine and Dentistry

Gartshore, L.¹ ², Fox, K.², Albadri, S.², Jarad, F.²
¹University of Liverpool, ²Liverpool School of Dentistry
078 Income Inequality Influences Adolescent’s Oral Health-Related Quality of Life
Alwadi, M., Vettore, M. V.
University of Sheffield

079 Exploring the relationships between knowledge- and skills-based assessment performance in Dental Therapy and Hygiene students as a function of prior qualifications
Plymouth University Peninsula Schools of Medicine & Dentistry

080 Screening for chronic, non-communicable diseases (NCDs) in applied healthcare practice
Yonell, Z., Yahyouche, A., Jalal, Z, Dietrich, T., Chapple, I. L.
University of Birmingham

081 Enamel Erosion Protection and Repair in vitro by Fluoride Dentifrices
Fowler, C. E. 1, brown, A. 2, Willson, R. 3
1GlaxoSmithKline, 2Lucideon Ltd, 3Modus Laboratories

082 Improved Temperature Stability for Accurate In-Vitro De/Remineralisation ISE Studies.
Ferizoli, B. 2, Anderson, P. 2, Lynch, R. J. 1
1GlaxoSmithKline, 2Queen Mary University of London

083 Cariostatic Effect of Riva Star vs Conventional Silver Diammine Fluoride
Huang, W., Anderson, P., Shahid, S.
Queen Mary University of London

084 Autofluorescent properties of bovine teeth during demineralisation – A Pilot Study
1Inspekto Research Systems BV, 2University of Liverpool, 3 Universite de Lille II, France

085 Hydrothermal Synthesis and Physicochemical Analysis of Fluorapatite and Hydroxyapatite Coatings
Marie, A. K. 1, 3, Katsikogianni, M. 2, Do, T. 1, Wood, D. J. 1
1University of Leeds, 2Faculty of Life Sciences, 3University of Mosul, Iraq

086 Complications Associated with Full-Arch Implant Supported Prostheses
Krezel, J. D. 1, Adams, R. 2, Thomas, D. W. 2
1Barts and the London School of Medicine and Dentistry, 2Cardiff University Dental School

087 Case Definition in Chronic Periodontitis: the Reliability of Half-Mouth Protocols
Didilescu, A. C., Costea, R., Cristache, C.
Carol Davila UMP, Bucharest, Romania

088 Effect of an Intensive Weight Loss Programme on Gingival Inflammation
Suvan, J. 3, Finer, N. 2, Buti, J. 3, D’Aiuto, F. 1
1UCL Eastman Dental Institute, 2UCL
090 Characterising early erosive lesions in polished and natural human enamel
Mylonas, P.¹, Austin, R.¹, Moazzez, R.², Joiner, A.³, Bartlett, D.¹
¹King’s College London, ²King’s College London Dental Institute, ³Unilever Oral Care

091 Biocompatibility and adhesion of silver nano-coating on titanium dental implants
Salai, R. N., Besinis, A., Le, H., Tredwin, C., Handy, R.
University of Plymouth, Plymouth University Peninsula Schools of Medicine & Dentistry

092 Characterization of a Novel Strontium Containing Bioactive Glass based Calcium Phosphate Cement
D’Onofrio, A., Rawlinson, S. C., Shahdad, S., Kent, N., Hill, R. G.
Queen Mary University of London

093 In Vitro Oral Biofilm Model to Assess the Efficacy of Antimicrobial Additives to Dental Restorative Materials
Elmanaseer, W., Hector, M., Edwards, D.
University of Dundee

094 Electrospun membranes with osteogenic and antimicrobial properties for orthopaedic and dental surgery.
Paterson, T. E.¹, Shi, R.², Tian, J.², Wilcock, C.¹, Tammas-Williams, S.¹, Ortega Asencio, I.¹, Li, Z.², Hatton, P. V.¹
¹University of Sheffield, ²Chinese Academy of Sciences

Thursday, September 7, 2017 11:30 - 13:00  Room 303
PER-GSK MINTIG Prize & Mineralised Tissues

095 Silver nanoparticles doped carbon nanotube–hydroxyapatite composites: biocompatibility and antibacterial property investigation.
Natesan, K.¹, Besinis, A.¹, Le, H., Handy, R.³, Tredwin, C.²
¹University of Plymouth, ²Plymouth University Peninsula School of Medicine & Dentistry, ³University of Derby

096 Effects of Chitosan on Remineralisation of Enamel Lesions in vitro
Zhang, J.², Boyes, V.², Festy, F.², Lynch, R. J.¹, Watson, T.³, Banerjee, A.³
¹GlaxoSmithKline, ²King’s College London, ³King’s College London Dental Institute

097 Mathematical, numerical and biomechanical analysis using finite element methods (FEM) of mandible after treatment with bone substitute materials and loading with implant-supported prostheses
Gurzawska, K.¹, Kozakiewicz, M.², Gradzki, R.³, Swiniarski, J.³
¹Birmingham Dental Hospital and School, University of Birmingham, ²Medicine University of Lodz Poland, ³Technical University of Lodz, Poland

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100 Understanding the effects of tooth brushing using an abrasive dentifrice on enamel
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112 Cost-effectiveness of fissure sealants versus fluoride varnish in preventing dental caries
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1University of Birmingham, 2Philips UK

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1Plymouth University Peninsula School of Medicine & Dentistry, 2University of Pecs, Hungary 3SoBHS University of Plymouth
118 Chronic periodontitis and decreased respiratory function: a prospective cross-sectional study.  
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121 The impact of Fusobacterium nucleatum sub-species on health and disease  
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1University of Birmingham, 2School of Biosciences, University of Birmingham

122 Oral LPS: Macrophage subsets are differentially sensitive to endotoxin tolerance  
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1Cardiff University, 2NHS

124 Activation of Toll-like Receptors by Putative FCGS Pathogens  
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1King's College London, 2King's College London Dental Institute,

126 Association between number of teeth and healthier food choices in older men  
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127 No Evidence that Vitamin D Causally Prevents Tooth Loss.  
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1University of Bristol, 2Lund University, 3Harvard School of Public Health
128 How Can We Improve Dental Services for Children with Autism?
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129 Oral Care of Palliative Care Patients – Carers’ and Relatives’ Experiences.
Bernardes Delgado, M., Burns, L., Quinn, C., Moles, D., Kay, E.

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130 Sustainability in Dental Practice Using an Action Research Approach
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Periodontitis Severity Associated with Cardio-Renal Health in Renal Disease Patients
Sharma, P.², Fenton, A.³, Sidhu, A.², Rahman, M.², Cockwell, P.³, Ferro, C.³, Chapple, I. L.², Dietrich, T.¹
¹University of Birmingham, ²University of Birmingham, ³University Hospital Birmingham

Objectives
Chronic kidney disease (CKD) affects 13% of UK adults and is associated with increased morbidity and mortality. Mechanisms involve systemic inflammation/oxidative stress. Periodontitis may contribute to this, thereby impacting CKD-associated morbidity/mortality.
The aim of this study was to quantify the association between periodontal and cardio-renal health and to explore mechanisms underpinning these associations.

Methods
We recruited 770 patients with high-risk CKD (stage 3-5 pre-dialysis). Periodontal measurements were recorded at interproximal sites of all teeth present; kidney function was assessed using the CKD-EPI equation for estimated glomerular filtration rate (eGFR) and vascular stiffness was measured using carotid-femoral pulse-wave velocity (PWV). Plasma protein carbonyls and F2-α-isoprostanes were employed as measures of oxidative stress. Multiple linear regression models were fit to explore the associations, accounting for differences in age, sex, ethnicity, diabetic and smoking status, BMI, BP, and socio-economic status.

Results
The mean age of participants was 63 + 16 years; 61% were male, 48% never-smokers and 37% had diabetes. According to the 2007 AAP classification of periodontitis, only 4% had mild/no periodontitis, 40% had moderate and 41% had severe periodontitis and 15% were edentulous. Measures of periodontal disease (mean probing depth/clinical attachment loss, bleeding on probing and periodontal inflamed surface area) were all significantly associated with decreasing renal function, increasing vascular stiffness, and increasing levels of oxidative stress markers in the fully adjusted model (Table1).

Conclusions
Worsening periodontal health is associated with declining renal function and increasing vascular stiffness in this large, well-characterised cohort. There was evidence of systemic oxidative damage with worsening periodontitis, therefore potential mechanisms include oxidative stress-mediated pro-inflammatory events. Therefore, treatment of periodontitis may have a beneficial impact on the general health of patients with CKD.
Mechanical Properties of Dental Composites Modified by Incorporation of Fluorapatite Micro-rods
Al-Taie, A.¹, Bubb, N.¹, Franklin, P.¹, German, M.², Wood, D. J.¹
¹School of Dentistry/University of Leeds, ²School of Dental Sciences/University of Newcastle

Objectives To evaluate the effect of varying the ratio of glass to fluorapatite (FA) fillers on the key mechanical properties of highly filled experimental dental composites.

Methods Experimental composites were formulated containing BisGMA/TEGDMA/BisEMA and barium aluminium silicate glass as the primary filler. Synthesised FA rod-like crystals and bundles were incorporated at 0 (FA0), 10 (FA10), 20 (FA20), 30 (FA30) and 40% (FA40) by mass, maintaining an overall filler content of 80%wt. TetricEvoCeram (TC) was used as a contemporary control. Two-body wear, Vickers Hardness (HV), Flexural strength (FS), Flexural modulus (FM) and Fracture Toughness (K<sub>1c</sub>) were measured. Quantitative analysis of wear volume was carried out using a noncontact profilometer. Scanning Electron Microscopy and Energy Dispersive X-ray Spectroscopy were used to analyse the wear and fracture surfaces. Statistical analysis was conducted using SPSS.

Results All experimental composites showed similar wear resistance (p>0.05) and enhanced microhardness compared to TC (p<0.05). FA containing composites showed higher FM (p<0.05) and similar FS (p>0.05) to TC but lower FM and FS when compared to 0FA. There was a moderate linear correlation between FM and FS. 30FA and 40FA showed similar K<sub>1c</sub> to TC and 0FA (p>0.05), whereas 10FA and 20FA showed lower K<sub>1c</sub> when compared to the other groups (p<0.05). Increased fracture toughness for the higher FA containing groups was attributed to the rod morphology of the FA bridging cracks as evidenced by SEM imaging of the fractured surfaces.

Conclusions Experimental composites were successfully produced incorporating FA as secondary filler. The addition of FA did not affect the key physical and mechanical properties when compared to the contemporary control. Coupled with previous observed short and long term fluoride release under acidic conditions these novel materials show a promising step towards a potential “smart” fluoride releasing dental composite.
Objectives To investigate the relationship between the histologic remaining dentine thickness RDT beneath deep caries and its radiographic appearance in primary molar teeth.

Methods Following ethical approval, primary molars with deep carious lesions were collected from children aged 5-12 years (median= 7 ±1.9) undergoing routine dental extractions under general anaesthesia. Pre-extraction digital bitewing was available for each tooth and demonstrated the presence of occlusal or proximal lesion extending into middle and inner third of dentin. Following extraction, caries (soft dentine only) was excavated and each tooth was sectioned to measure the histologic RDT. Radiographic and histologic RDT were measured in millimetres from the deepest point of the lesion to the outermost border of the pulp chamber.

Results In total, 50 primary molars were collected with a mixture of: first and second primary molars (21:29), maxillary to mandibular teeth (23:27), and proximal to occlusal caries (28:22). The median radiographic RDT was 0.9mm compared to a median histological RDT of 0.6mm. Radiographic RDT over-estimated the histologic RDT by approximately 0.4±0.1mm. The overestimation was consistent across all primary molars, both proximal and occlusal lesions.

Conclusions In primary carious molars, digital bitewing radiographs overestimate the remaining dentine thickness. This is an important finding when considering different treatment options for deep carious in primary molars.
Factors Related to Reducing Free Sugar Intake Among White Ethnic Adults: Barriers and Facilitators
Al Rawahi, S.¹, Asimakopoulou, K.¹, Newton, J. T.²
¹King’s College London, ²King’s College London Dental Institute

Objectives To determine the barriers and enablers to behavioural change to reduce free sugar intake related to dental caries among adults of White ethnicity. The COM-B Model and Theoretical Domains Framework (TDF) were used as a framework for the study.

Methods A qualitative study comprising 27 semi-structured interviews. The questions were developed based on Behaviour Change Wheel guide book. Ethical approval was granted by the BDM RESC, King’s College London. The theoretical thematic analysis was applied and MAXQDA 12 Software was used to analyse the data.

Results Data saturation occurred at 27 interviews. The COM-B Model and TDF captured various factors that influence diet behaviour. TDF elements which are reflected in the study are Knowledge; Psychological Skills; Memory, Attention, and Decision Processes; Behavioural Regulation; Physical Skills; Social influence Environmental context and resources Social and professional role and identity; Beliefs about Capabilities; Beliefs about Consequence; Intentions and Goals; Reinforcement; and Emotions. COM-B Model elements which are reflected in the study are Psychological capabilities; Physical capabilities; Social Opportunities; Physical Opportunities; Reflective Motivation; and Automatic Motivation.

Conclusions The COM-B model and TDF framework provided a comprehensive account of the barriers and facilitators of reducing sugar intake among white ethnic groups.
Is the sense of taste impaired in Sjogren’s Syndrome patients?
Al-Ezzi, M. Y.¹, Khan, K.², Tappuni, A. R.¹
¹Queen Mary, University of London/Barts & The London School of Medicine and Dentistry, ²Blizard Institute

Objectives Oral dryness is one of the most common symptoms of Sjögren’s syndrome (SS) but whether this dryness alters the ability to taste is not very well established. The literature lacks in studies investigating the prevalence and aetiology of taste dysfunction in SS, and therefore the objectives of our study were:
1) To compare the taste function in primary SS (pSS) patients vs healthy volunteers. 2) To establish whether there is an association between the ability to taste and the severity of oral dryness and/or the neurological taste threshold. 3) To investigate whether disease duration is correlated with taste dysfunction. 4) To identify the best indicator for oral dryness in pSS patients and its relation with taste function.

Methods Case-control study was carried out on 65 pSS patients and 62 sex-matched healthy volunteers. The ability to taste was measured using taste strips test, and the taste threshold was tested by an Electrogustometer. Oral dryness severity was assessed by clinical oral dryness score (CODS), stimulated and unstimulated salivary flow rate (SFR).

Results Taste dysfunction was six times more prevalent in pSS patients compared with the healthy volunteers. Similarly, the neurological taste threshold was three times higher in the pSS group compared with the healthy volunteers. Taste was not significantly associated with the SFR, but correlated with the neurological impairment of taste ($\beta = -0.5, p = 0$). Taste was not significantly compromised by the self-reported disease duration ($\beta = 0.1$). CODS correlated with the SFR ($p = 0.00$), but none of the dry mouth measures correlated significantly with the taste ability.

Conclusions Taste dysfunction is prevalent in SS patients and may be due to neurological impairment rather than caused by the oral dryness as presumed previously.
Dentists’ Perceptions of Their Roles Influence Their Patient Referral Decisions
Allen, Z.1, Moles, D. R.1, Nasser, M.1, Richardson, J.2
1University of Plymouth, 2University of Plymouth

Objectives Dentists’ views vary regarding who should receive dental care in general dental practice and who should be referred to community dental services (CDS). This qualitative interview study explores the meanings which dentists ascribe to their professional roles, and why they make, accept or decline patient referrals within primary dental care.

Methods Dentists working in primary dental care in England were recruited. Ten general dental practitioners and twelve community dentists took part in semi-structured interviews via Skype, telephone or face-to-face. Transcripts were analysed using thematic analysis.

Results Six themes were identified: professionalism, quality, disconnection, the business of dentistry, obscure rules and ‘no man’s land’ – a gap between the perceived remit of general dental practice and CDS. Vulnerable patients, who could fall into this gap, included frail elderly people, anxious and socially excluded adults, and children with moderate levels of disease. Three typologies of dentists were identified. ‘Entrepreneurs’ felt no allegiance to the NHS and no obligation to treat vulnerable patients, whom they encountered only rarely and usually referred. ‘Altruistic carers’ were committed to caring for exceptionally deserving patients, but sometimes declined referrals for less complex patients. ‘Pragmatic carers’ tried to accommodate vulnerable patients but encountered discouraging systemic barriers.

Conclusions Some primary care dentists do not perceive providing dental care for vulnerable patients to be part of their professional role. Dentists are aware that they may need to provide slightly more time and emotional effort to support such patients. This influences their referral decisions, and can obstruct access to primary dental care for the people most likely to experience the burden of oral disease. The increasing emphasis on commissioning specialist care from CDS, combined with the NHS contract for General Dental Services, appears to be eroding the potential for willing primary care dentists to provide dental care for vulnerable patients.
Novel Resin-modified Glass Ionomer Cement for Repairing Defective Tooth-restoration Complexes

Al-Taee, L. A.², Banerjee, A.¹, Deb, S.³
¹King’s College London Dental Institute, ²King’s College London, ³King’s College London

Objectives Ethylene glycol methacrylate phosphate (EGMP) is a proton-conducting electrolyte with highly reactive polar groups. The aim is to formulate and evaluate a new restorative cement based on inclusion of EGMP into a commercially available resin-modified glass ionomer (RMGIC) for its potential application as a reparative material for failed tooth-restoration complexes (TRCs).

Methods EGMP monomer (0-40%wt) was incorporated into the liquid phase of a commercial hand-mixed RMGIC (Fuji II LC, GC Corp.). The setting kinetics of varying monomer concentrations using the recommended powder: liquid ratio (2.7:1) did not interfere with cement working/setting times. Physical properties of specifically selected formulations were then characterised. 320 cylindrical specimens (n=8/group) were tested for compressive strength and microhardness, 160 discs for biaxial flexural strength (BFS), water uptake and fluoride release were also assessed. The mechanical properties were tested after sample storage: 1 day, 14 days, 28 days, 6 months. Data was analysed statistically using one-way ANOVA and Tukey’s post-hoc test (p> 0.05).

Results Experimental EGMP cements showed higher compressive strength and modulus, microhardness and a two-fold increase in BFS compared to control specimens up to 6 month storage (p<0.001). Ageing had a significant effect on the mechanical properties of the tested groups (p<0.05). The inclusion of EGMP encouraged the formation of reinforcing complexes within the RMGIC, thus improving the physical properties. The microstructure exhibited a reduced porosity, integrated structure that could account for the increased stiffness and BFS with increasing EGMP content. The phosphate groups accounted for hydrophilicity whilst the interaction with the matrix decreased solubility and fluoride release.

Conclusions The incorporation of phosphate moieties into the RMGIC matrix provides a basis for the development of physically improved cements, potentially useful for repairing defective TRCs.
The Impact of Dental Phobia on Care Planning: A Vignette Study
Heidari, E.¹, Banerjee, A.⁴, Andiappan, M.², Newton, J. T.³
¹King’s College London Dental Institute, ²King’s College London, ³King’s College London Dental Institute, ⁴King’s College London Dental Institute

Objectives People with dental phobia have poor oral health. This may be the result of prolonged avoidance of treatment or differences in care planning when the patient manages to attend for treatment. To differentiate these two hypotheses, this study sought to determine the effect of dental phobia and complexity of dental care on the proposed care plan for patients.

Methods Participants in this experimental analogue study were 79 dental practitioners. The dependent variables were care plan elements including; periodontal treatment, prevention, restorations, root canal treatment, extraction and provision of crowns, bridges and prostheses. The independent variables were presence of phobia and complexity of treatment need. Descriptive statistics were used to summarise the sample characteristics and the responses. The association between the case status (phobic vs non-phobic, simple vs complex) with the dependent variables was assessed using chi-square test for association. Logistic regression analyses were also used to find out the significant predictors of care plan elements.

Results There were no differences in care planning (in chi-square test all P values > 0.05) for phobic vs non-phobic patients in terms of periodontal treatment, prevention, restorations, root canal treatment, tooth extraction and provision of crowns, bridges and prostheses. Complexity of treatment need, using chi-square test, had significant effects on care planning for advanced periodontal treatment (P value <0.0001), restorations anterior and posterior (P value <0.0001 and P value = 0.002), root canal treatment (P value <0.0001), provision of crowns (P value <0.0001) and extraction (P value =0.01) reflecting the case’s dental needs.

Conclusions Care planning is influenced by patients’ dental needs and not phobic status, endorsing practitioners’ strong values and professionalism. The provision of oral health care prevention schemes for dentally phobic patients could help not only to simplify their care needs but to also provide cost savings for their treatment.
Quantification of Mineral Deposits on Root Caries Using Dental Varnish
Mustafa, A. S. 3, Tappuni, A. R. 1, Davis, G. 4, Mills, D. 4, Baysan, A. 2
1Queen Mary University of London, 2Queen Mary University of London, 3Queen Mary University of London, 4Queen Mary University of London

Objectives The objective of this in vitro study was to quantify the amount of mineral change in demineralised dentin after application of three different dental varnishes containing fluoride either with CPP-ACP or Bioglass or fluoride only.

Methods A total of 12 extracted human sound mandibular premolar specimens were coated with an acid-resistant varnish leaving a 2 × 3 mm window at the outer root surface. These root specimens were randomly divided into four groups, and separately subjected to a demineralising cycle with pH 4.8 for 5 days to create artificial caries-like lesions. Each sample was imaged using quantitative X-ray Microtomography (XMT) at a 15 µm voxel size. Each group then received one of the following treatments: Test A, the demineralised area painted by dental varnish containing fluoride and casein phosphopeptide-amorphous calcium phosphate (CPP-ACP, MI varnish, GC Europe). Test B, fluoride and bioglass (NUPRO Experimental, DENTSPLY). The positive control, fluoride only (NUPRO, DENTSPLY), and the negative control received no treatment. These samples were kept in a deionised water for 12 hours. The thin layer of varnish was then removed. All specimens including the non-varnish group were subjected to a second demineralising cycle with pH 5.5 for 5 days. The final XMT imaging was carried out following the second demineralising cycle. The deposited mineral contents were analysed through the demineralised area to quantify the change in mineral following varnish application.

Results The quantitative XMT assessment confirmed a significant increase in mineral content following the varnish application (p≤0.05) in all treatment cases. A significant decrease in mineral content was observed in the non-varnish group (p≤0.05).

Conclusions There is promising evidence of a remineralisation effect with dental fluoride varnish on dentin in all cases, and the ability of this varnish to resist the demineralisation during acidic conditions in a laboratory setting.

Boyes, V.¹, Festy, F.⁴, Abuljadayel, R.³, Watson, T.²
¹King’s College London, ²King’s College London Dental Institute, ³Kings College London, ⁴King’s College London

Objectives The purpose of this study was to develop an effective method to monitor the pH of novel composite/ glass polyalkenoate (ionomer) materials at the micron scale for the initial period after mixing.

Methods A fluorescent probe designed to alter its fluorescence properties in response to its environmental pH (LysoSensor™Yellow/Blue DND-160, ThermoFisher Scientific) was used to dose a series of buffer solutions pH 2- pH 7.7 at a concentration of 1 μM. A multi-channel series of fluorescence lifetime (τ)/pH standard curves were generated by analysis of the solutions using 2-photon fluorescence lifetime imaging microscopy. The fluorescence properties of probe-dosed Material X, a recently developed dual-cure system, were microscopically monitored continuously for 5 hours following the combination of the liquid and powder components (n=5). The data were processed and analysed using TRI2 software and compared to that obtained from identical experiments observing Fuji II LC. The standard curves were used to read pH measurements from the τ image series. Conventional glass ionomer cement EQUIA® Forte (GC) was used to validate the experimental model. These data were compared to that obtained using traditional pH probe analysis techniques.

Results The average pH profiles obtained using τ were similar to those obtained using the pH probes in all groups. This type of analysis allowed the observation of an evolutionary pH gradient occurring within individual glass particulates of Material X and GC Fuji II over time. We were also able to digitally separate the pH evolution of glass particulates from the continuous phase. These data allowed the deduction of the mechanisms by which chemical homeostasis of these systems were achieved.

Conclusions We have developed an adaptable experimental model which allows high-resolution micron-scale spatial analysis of pH over time in dental material systems.
Objectives To investigate the effects of a self-assembling peptide (SAP; P$_{11-4}$) on periodontal regeneration in surgically-induced periodontal critical-sized defects in rats.

Methods Twenty-six, bilateral maxillary critical periodontal defects (2 x 2 x 1.7 mm) were created surgically in 13 male Sprague Dawley rats. Defects on one side of the mouth were filled with pre-assembled P$_{11-4}$ hydrogel; the contra-lateral defect was untreated (control). Rats were sacrificed immediately post-surgery (time 0) and after 2 and 4 weeks. Maxillae were retrieved, decalcified in 10% EDTA and processed for histological analysis, immunohistochemical determination of osteocalcin, osteoprotegerin, RANKL and PCNA and histomorphometric assessments.

Results Both treated and untreated defects showed clear tissue regeneration at both time points compared to time 0. However, histological analysis showed greater organisation of periodontal fibres in defects treated with P$_{11-4}$, at both time points, when compared to untreated defects. Histomorphometric analysis showed that treated defects had both a significant increase in functional periodontal ligament length and a reduction in epithelial down growth after 4 weeks compared to untreated defects. There was no significant difference in the relative alveolar bone height between treated and untreated defects at both time points. At 2 weeks, treated defects showed a significant increase in expression of osteocalcin and osteoprotegerin (OPG) as judged by immunohistochemistry. Treated defects also showed a significantly higher OPG/RANKL ratio compared to untreated defects, suggesting greater osteoblastic activity. PCNA and RANKL expressions at both time points showed no significant difference between treated and untreated defects.

Conclusions The results suggest enhanced regeneration of periodontal tissues when SAP P$_{11-4}$ was used to treat surgically-induced periodontal defects in rats. SAP P$_{11-4}$ is currently used clinically to treat early caries, the findings of this study suggest its possible application in the treatment of periodontal disease.
Characterisation and Preventive Effect of a Novel Bioactive Orthodontic Adhesive.
Aleesa, N. A.¹, Wong, F.³, Hill, R. G.², Johal, A.¹
¹Barts and the London Dental Institute, ²QMUL, ³Queen Mary University of London

Objectives To characterise a newly designed bioactive glass in orthodontic adhesive and investigate its effect on demineralisation.

Methods A novel, high fluoride, high phosphate and low sodium containing, bioactive glass (BAG) was prepared via the melt quench route and incorporated into a light curable resin at 80% loading. Ninety discs, 10mm diameter and 1mm thick, were studied for 6 months in Tris buffer pH=7.3 (TB), artificial saliva pH=7 (AS7) and artificial saliva pH=4 (AS4), for ion release using ion selective electrode (ISE) and inductively coupled plasma optical emission spectroscopy (ICP-OES); and for apatite formation using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), magic angle spinning-nuclear magnetic resonance (MAS-NMR) technique and the scanning electron microscope (SEM). Orthodontic brackets were bonded to premolar teeth using either the BAG adhesive or Transbond™ XT (3M Unitek) as a control. The specimens were scanned using MuCAT2 X-ray microtomography (XMT), immersed individually in AS4 for 24 hours and rescanned. The amount of mineral loss after acid dissolution was calculated from the reconstructed XMT images of the two scans.

Results The BAG adhesive released up to 130ppm F⁻, 2500ppm Ca²⁺ and 200ppm PO₄³⁻. Ion release in TB and AS4 were higher than in AS7. The adhesive is forming fluorapatite in all solutions. The potential for apatite formation in TB and AS4 were similar but the dissolution rate was higher in AS4 than TB and AS7. Enamel mineral loss was significantly lower in teeth with the bracket cemented with the BAG adhesive than that with Transbond™ XT as measured from the subtracted XMT images.

Conclusions As the novel BAG orthodontic resin has long term release of therapeutic ions under acid attack and forms fluorapatite, it reduces the amount of enamel mineral loss. Consequently, it may be used as a smart adhesive to reduce white spot lesion formation around orthodontic bracket in vivo.
Antibacterial Properties and Molecular Biocompatibility of TiO$_2$-ZnO Nanocomposite Coatings for Dental Implants

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**Objectives** This study aimed to test the antibacterial properties and biocompatibility of nano-zinc oxide coatings on dental implants with and without hydroxyapatite.

**Methods** Nano-ZnO was grown on annealed TiO$_2$ nanotubes on Ti-6Al-4V discs using a hydrothermal method in the presence of zinc nitrate and hexamethylenetetramine. Nano-HA was then grown on the annealed nano-ZnO coating using a biomimetic method in simulated body fluid. Live/dead and lactate production assays as well as microscopy were used to test the antibacterial action of the titanium alloy discs with TiO$_2$, TiO$_2$-ZnO and TiO$_2$-ZnO-HA in the presence of *Staphylococcus aureus*. The genetic expression of ALP, FAK, COX-2, OC, RunX-2, CA-1, SOD, IL-6, and TNF-α in primary osteoblast cells grown on the coated discs, for 4 and 10 days, was quantitatively measured using PCR in collaboration of comparative Ct.

**Results** The biochemical assays confirmed the antibacterial activity of both TiO$_2$-ZnO and TiO$_2$-ZnO-HA with 78.0 ± 2.0 % and 69.1 ± 3.0 % bacterial cell death with respect to S. aureus growing in broth without any disc exposure as shown in Figure 1. SEM provided a visual confirmation of the latter observation. For the biocompatibility test, the expression of all the genes indicated that the osteoblast cells were able to attach, proliferate and initiate differentiation (FAK, RunX-2, ALP, OC were upregulated). The cells also showed induction of inflammatory pathways (IL-6, COX-2, TNF-α upregulated) as early as day 4; after which they successfully expressed genes involved in oxidative defences (SOD) and well as genes constitutive to the function of osteoblasts (ALP).

**Conclusions** Nano-ZnO grown on TiO$_2$ nanotubes on the surface of Ti-6Al-4V alloy was found to be antibacterial with the presence of nano HA reducing the antibacterial action of the nanocomposite coating. Both TiO$_2$-ZnO and TiO$_2$-ZnO-HA allowed the expression of genes corroborating a higher biocompatibility in comparison to TiO$_2$. 
Contribution of oral bacteria to Candida virulence and denture stomatitis
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Objectives Denture-associated stomatitis (DS), a frequent infection in denture-wearers (up to 60%), presents as areas of palatal inflammation and is normally associated with denture biofilms containing Candida albicans. However, the contribution of co-existing bacteria in these biofilms to the infection remains unclear. As current DS management strategies are primarily directed towards Candida, research demonstrating the impact of specific bacteria upon infection prognosis is important to improve treatment regimes. This research evaluated the in-vitro impact of bacteria on Candida virulence, and compared bacterial microbiomes at specific oral sites in DS and non-DS patients to determine associations with infection.

Methods In-vitro biofilm studies assessed expression of C. albicans virulence factors (morphological transformation, adhesins, hydrolytic enzymes) and their impact on pathogenesis in an infection model. In clinical studies, microbiological samples were obtained from the tongue, palate and denture-fitting surface of 19 denture-wearing patients (DS n=8, non-DS n=11). The presence of Candida was ascertained by PCR. Bacterial DNA was extracted and subjected to next generation sequencing using bacterial 16S rRNA gene targets, and differences in the bacterial microbiomes determined.

Results Certain bacterial species in acrylic biofilms significantly (P<0.05) increased the expression of C. albicans virulence factors, and subsequently, enhanced tissue damage in model systems. Candida was detected in clinical samples of 14 patients (DS n=6, non-DS n=8). Metataxonomic analyses revealed differences in relative abundance of bacterial species, but no significant differences in the bacterial microbiomes of the denture-fitting surface and palate between DS and non-DS patients were evident. Importantly, however, a significant (P=0.007) increase in the number of bacterial species was evident for the tongue microbiome of non-DS patients.

Conclusions The in-vitro modulating capacity of bacteria toward Candida virulence, and the observed species-level differences in bacteria between DS and non-DS patients highlight the need for consideration of the bacterial composition of oral biofilms in the pathogenesis of DS.
Tumour-stromal Crosstalk in Metastatic Lymph Nodes of Oral Cancer.

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Objectives Oral Squamous Cell Carcinoma (OSCC) is a significant cause of morbidity and mortality worldwide. The prognosis for patients with metastatic tumour invasion out of neck lymph nodes, termed extracapsular spread (ECS), is particularly poor. Cells of the tumour microenvironment, including myofibroblasts and endothelial cells, promote primary tumour development, including epithelial-mesenchymal transition (EMT). However, their contribution to ECS development is largely unexplored. This work aims to determine the abundance of these stromal cell types in ECS positive and negative lymph nodes and examine this mechanistically in in vitro co-culture models.

Methods ECS-positive (n=22) and negative (n=22) paired tumour specimens were examined for EMT markers (Slug, Snail, Twist, ZEB1), lymphatic (D2-40) and vascular (CD34) endothelial cells and myofibroblasts (αSMA) using immunohistochemistry. Oral cancer cell lines (OCCLs) derived from OSCC and lymph node metastases were incubated with conditioned media (CM) from oral fibroblasts, myofibroblasts and cancer-associated fibroblasts (CAFs). The expression of EMT markers by OCCLs was analysed using western blotting and qRT-PCR. The effect of OCCL CM on endothelial cell tubule formation in Matrigel was also examined.

Results Vascular density and αSMA expression were significantly elevated, and Snail and Slug were significantly depleted, in ECS+ nodes compared to ECS- (p<0.05). However, lymphovascular density, Twist and ZEB1 did not differ between ECS+ and ECS- groups. Myofibroblast (experimentally-derived CAF) and primary CAF-derived CM had limited effect on EMT marker expression in OCCLs. Lymph node metastases-derived OCCLs BICR22 and TR146 showed a significant increase in ZEB1 and Slug mRNA expression, respectively, in response to myofibroblast CM (P<0.05).

OCCL CM increased tubule formation in lymphatic and vascular endothelial cells, reaching significance only for primary tumour-derived OCCLs (p<0.05).

Conclusions This novel work indicates fibroblasts and endothelial cells may play a role in the development of ECS. With further work this could lead to novel treatment strategies for patients with advanced OSCC.
A Novel, Injectable Hydrogel for Endodontic Antimicrobial Delivery

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Objectives Microbial infection following root canal treatment is common: it is difficult to treat and, if allowed to progress, can lead to irreversible tissue damage and systemic infection. Hydrogels are used as therapeutic delivery systems due to their tuneable physical properties and good biocompatibility. These may have an application in endodontics as topical antimicrobial treatments, as systemic antibiotics are usually ineffective. This project aims to develop a novel, injectable, antimicrobial-loaded hydrogel for use in endodontic restorations with the aim of reducing the incidence of secondary microbial infections.

Methods Liposome MLVs and SUVs were prepared with the hydrophobic antimicrobial triclosan (50-500 µg/mL) and the encapsulation efficiency was measured using HPLC. Liposomes were incorporated into a methylcellulose solution and the rheological properties of the material were investigated, including viscosity, and viscoelasticity. The antimicrobial capability of the liposomes and the liposome-loaded hydrogels against clinical isolates of Enterococcus faecalis and Streptococcus anginosus was measured; both in vitro and in human root canals.

Results Triclosan could be incorporated into liposomes (maximum concentration 120µg/mL) and liposome diameter showed a negative correlation with triclosan loading dose. The rheology showed that the polymer was a viscous solution at 25°C and formed a gel at temperatures above 35°C. This was unaffected by the addition of liposomes, irrespective of liposome size or concentration. Antimicrobial assays showed inhibited growth of S. anginosus and E. faecalis when cultured with antimicrobial liposomes in methylcellulose. Triclosan liposomes were shown to be more effective than free triclosan in some instances.

Conclusions A potential hydrogel has been identified that has favourable physical properties for endodontic delivery and has an antimicrobial effect against common oral pathogens when combined with antimicrobial nanoparticles. This shows promise for a future application in restorative dental treatment, and further work aims to establish whether the material is suitable for vital pulp therapy.
Development and Evaluation of a Novel, Lipid-A Based Biosensor for Personalised and Predictive Periodontal Therapy

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\textbf{Objectives} Lipopolysaccharide (LPS) is the main virulence factor of periopathogenic bacteria and plays a key role in the development of periodontitis. Regulation of lipopolysaccharide (LPS) chemical composition is an important naturally occurring mechanism that contributes to the resolution of bacteria-host immune system interactions into either a symbiotic or pathogenic relationship. Members of subgingival microbiota have evolved adaptive mechanisms to environmental changes and can synthesize different isoforms of LPS. LPS modifications can alter the bacterium’s outer membrane integrity, susceptibility to antimicrobial peptides, immune stimulation and disease pathogenesis. The objectives of this study were to develop and evaluate a new LPS-based, chair-side use biosensor for personalised, point-of-care, periodontal therapy.

\textbf{Methods} Subgingival plaque samples were collected by paper points from 30 healthy individuals and 31 patients with chronic periodontitis before and after non-surgical periodontal therapy. LPS was extracted by Tri-reagent protocol. Endotoxin activity of extracted LPS was assessed using the recombinant factor C assay and their inflammatory potential was examined in THP-1 derived M1 and M2 macrophages by measuring TNF-\(\alpha\) and IL-8 production (ELISA). Chemical composition of LPS’s lipid-A domain was determined by MALDI-TOF analyses.

\textbf{Results} Endotoxin activity of LPS extracted from patients with chronic periodontitis was significantly higher compared to healthy individuals and post-treatment samples. Production of TNF-\(\alpha\) and IL-8 by M1 and M2 macrophages challenged by LPS extracts from chronic periodontitis patients was much higher compared to those treated with LPS extracts from healthy individuals and treated periodontitis patients. Lipid-A analysis showed the predominance of bi-phosphorylated isoforms in chronic periodontitis samples.

\textbf{Conclusions} Periodontal pathogens are able to trigger a detrimental hyper-inflammatory host immune response by producing high-potency LPS. Subgingival endotoxin activity could be a reliable, bacterially-derived biomarker for progression of periodontal diseases.
Flexural Properties of UDMA Dentures are Unaffected by Water Storage
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Objectives One of the most common reasons for premature physical failure of complete dentures is due to flexural failure at the midline. Consequently, any newly developed denture base materials must be evaluated in terms of its flexural properties to ensure that it performs at least as the most commonly used material, heat-cured polymethylmethacrylate (PMMA). In this study we evaluated the flexural properties of recently developed light-curable urethane dimethacrylate (UDMA) denture base material, comparing the results with heat-cured and cold-cured PMMA.

Methods Bar specimens (n=15, 70x10x 3.5 mm) were produced from heat-cured PMMA (HC, John Winter &Co Ltd), cold-cured PMMA (CC, John Winter &Co Ltd), and Eclipse (Dentsply International). HC and Eclipse samples were made following manufacturer’s instructions. CC samples were made using 2:1 g/ml mixing ratio and cured at 3 bar pressure for 15 minutes at room temperature (RT). After polishing, samples were stored in distilled water at RT for 2 days, and at 37°C for 1 week, 1 month, 3 months and 6 months. Samples were subjected before and after storage to 3-points bend testing using a universal testing machine (Instron 5567, Berks, UK) following ISO 20795-1:2013.

Results There was no significant change in flexural strength for Eclipse or HC specimens over 6-months storage, while that of the CC specimens dropped significantly with increasing storage time (P<0.05). The Eclipse specimens were the strongest at each time period (P<0.05, Kruskal Wallis test) with the HC specimens being stronger than the CC specimens. In general the Eclipse specimens exhibited the highest flexural modulus, which is sometimes significantly different and sometimes not significantly different.

Conclusions Within the limitations of the current study: Eclipse is a potential alternative denture base material to HC in terms of flexure. There is no significant effect of water storage on Eclipse and HC flexural strength within 6 months, while it reduced CC strength. Eclipse is not much stiffer than HC and CC.
Protection Effects of Bioglass® and Pro-Argin® Layers Formed On Dentine

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**Objectives** Exposed dentine in the oral environment is at risk from mechanical damage due to brushing or mastication as well as chemical dissolution due to acidic food or bacterial attack. Bioglasses and arginine in toothpastes have the ability to form a barrier over exposed dentine, protecting it from mechanical and chemical attack. The objective of this study was to evaluate the protection offered by three toothpastes containing Calcium-Sodium-Phosphosilicate (Novamin®), Arginine (Pro-Argin®) and Fluoro-Calcium-Phospho-Silicate (BioMin®) using nano-mechanical characterisation in a hydrated state.

**Methods** 30 Bovine dentine discs were equally divided into 3 toothpaste treatment groups. Discs were brushed twice daily for two minutes over 7 days and kept in artificial saliva (AS) between brushing. 20 indents were performed on each disc prior to brushing to form a baseline and after 7 days of brushing. Load control indentation was performed using a 5µm radius spherical diamond tip with maximum penetration depth of 700nm to avoid substrate/dentine influences, at a rate of 0.5mN/s to a maximum load of 10mN which was held for 60s to allow for creep run out. A unique liquid cell set up was used to allow testing in presence of AS. After 7 days of brushing the discs were cross sectioned to measure the thickness of the layers using SEM. The thickness for Pro-Argin®, Novamin® and BioMin® were 9µm, 13µm and 8µm respectively.

**Results** After brushing, the layers formed significantly increased the hardness and modulus for all treatment groups (p<0.05). Pro-Argin® formed a significantly harder and stiffer layer compared to Novamin® and BioMin® (p<0.05). There was no significant difference between Novamin® and BioMin® (p >0.05).

**Conclusions** All 3 toothpastes formed layers which were harder than dentine. The most improvement was seen by Pro-Argin® which formed the hardest layer compared to the other two treatment groups which may offer the best protection against damage. Results showed no significant difference between Novamin® and BioMin®.
Notch signalling controls tooth mesenchymal stem cell activation
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Objectives Crosstalk between quiescent stem cells (QSCs) and transit amplifying cells (TACs) determine tissue development and homeostasis. The molecular evidence for that communication is still missing. The continuously growing mouse incisor provides an excellent model for studying molecular mechanisms of stem cell fate regulation. This work aims to use the mouse incisor mesenchyme to study the mechanism of QSC maintenance and activation, as well as crosstalk with TACs.

Methods Laser Capture Microdissection was used to isolate regions of interest within the mouse incisor mesenchyme. Real-time RT-PCR screening of cDNA from these samples was performed with probes targeting established mesenchymal QSC and TAC markers. Corresponding protein expression levels were evaluated using immunofluorescent microscopy. Furthermore, cell culture of dissected incisor mesenchyme containing QSCs was performed and stem cell status manipulation was attempted. Transgenic mice with knocking down or overexpression of key Notch molecules were analysed. Three-dimensional reconstruction was applied to study the QSCs and TACs region volume vs. cell number. Rat and clinical human tooth capping samples were evaluated for stem cell status and activation.

Results We identified populations of QSCs and TACs within the mouse incisor mesenchyme. Notch signalling appears to be a key regulator of cellular quiescence and activation. Notch ligands, which are abundant in the TACs, could promote QSC activation into the transit amplifying stage. Conversely, epigenetic changes within QSCs leads to TAC activation. Similar findings were observed in clinical samples.

Conclusions Our study showed that Notch signalling plays a key role in tooth stem cell maintenance and differentiation. It is expected that the molecular mechanisms driving dental stem cell behaviour, can be applied to direct differentiation of stem cells into dental tissues and ultimately be utilised in clinical applications.
CD133 determines epithelial stem cell activation
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Objectives Stem cells are a valuable resource to counteract disease progression as well as aid in tissue regeneration. Despite these important capabilities, little is known on how stem cells quiescence and cell cycle entry are regulated. CD133, a five transmembrane protein has been widely used as a potent stem cell marker. However, the function of this molecule has not yet been elucidated. Our study aims to connect the function of CD133 with the molecular dynamics of cell cycle progression in stem cells.

Methods 3D immunofluorescence analysis on wild type and CD133 knock out mouse incisor was used to monitor epithelial stem cell status dynamics in the presence or absence of CD133 and the effect on the activation of stem cells. The cell cycle was analysed using a modified fluorescent cell cycle indicator system. In vitro real time RT-PCR, western blotting and colonigenic growth analysis of established mouse incisor epithelial stem cell lines were used to confirm in vivo findings. PCR array as well as Co-IP and ChIP analysis were applied to investigate the molecular link between molecular pathways and stem cell dynamics.

Results Our results show that CD133 plays a central role in controlling stem cell activation by integrating different molecular signalling pathways. This molecule is essential for regulating cellular structure changes resulting in cell status changes upon signal stimulation.

Conclusions CD133 acts as a central molecule affecting multiple aspects of cellular events during stem cell activation. Ultimately, we believe that our results will eventually lead to improved tissue regeneration therapies.
Objectives The objectives of this project were to develop organoid models of human salivary glands, to elucidate the pathogenesis of salivary gland disease and to further understand the development of salivary glands for regenerative studies.

Methods Organoids were developed from biopsy samples of normal human salivary gland tissue. The cells were isolated and cultured in extracellular matrices (Matrigel and/or myogel), as well as on Polymerised High Internal Phase Emulsions (PolyHIPES) scaffolds. They were cultured either at an Air Liquid Interface (ALI) or were submerged in tissue culture medium (non-ALI) and Wnt-3A, R-spondin1, and epidermal growth factor were added to supplement the medium. Haematoxylin and eosin stained sections of the cultures were used to visualise growth. RT-PCR, immunohistochemistry and immunofluorescence were used to determine the differential expression of cell type-specific markers in culture.

Results Salivary gland cells from single suspensions were able to proliferate and differentiate to form small structures resembling mini-glands for up to 14-days in culture. Organoid structures developed when the cells were grown in Matrigel but this was less obvious when grown in myogel. Compared to those grown at an ALI, non-ALI organoids were significantly smaller in size. Cells grown in PolyHIPES scaffolds were able to form budding and branching structures of salivary gland organoids. The organoids showed many characteristics of salivary gland tissue based on their histology and the expression of cell type-specific markers.

Conclusions Our current data indicates that our culture system enables the growth of human salivary gland organoids. This culture system can be used to study the initial stages of infectious disease and the pathogenesis of other salivary gland diseases.
The attending adult: do they have parental responsibility for the paediatric patient?
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Objectives For non-competent paediatric patients, UK law restricts consenting on behalf of a child to adults with parental responsibility (PR). Dentists should exercise caution if there is any uncertainty with regards to PR status in order to avoid invalid consent. In line with Care Quality Commission guidelines, 100% of clinical notes should show that the attending adult has PR for the paediatric patient. The primary objective is to audit whether PR status of the attending adult is documented for children seen on an undergraduate dental outreach clinic in East London.

Methods Retrospective data collection was undertaken from clinical records of 30 new paediatric patients gathered on documentation of name, relationship and PR status of the attending adult (Cycle 1: January – June 2016; cycle 2: March – May 2017). Following cycle 1, a PR assessment form was developed for use on clinic. In addition, posters were developed and displayed in clinical bays highlighting the legalities of PR and standards disseminated to dental undergraduates and teaching staff.

Results Cycle 1: Only 8 records (27%) contained enough information to determine PR status of the attending adult. Cycle 2: PR status of the attending adult was documented in 25 (83%) records. In the remaining 5 cases, 4 did not use the form (13%) and 1 completed the form incorrectly (4%).

Conclusions The agreed standard was not met. After the introduction of the PR form and posters, a large improvement was found and they’re now being used permanently. Further education of both staff and undergraduate students is necessary and a re-audit will be undertaken in 6 months time.
Expression of Xenobiotic Metabolising Enzymes in Oral Mucosa and Tissue-Engineered Oral Mucosa Equivalents

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Objectives

Xenobiotic compounds are external foreign molecules that interact with our tissues and cells. These foreign molecules need to be removed in order to maintain a healthy status and certain organs of the body, such as the liver and skin, contain metabolising enzymes that are able to deactivate xenobiotic compounds by converting them into usually less toxic molecules called metabolites. There is a movement within the pharmaceutical industry to deliver drugs via the oral mucosa. However, the abundance and location of xenobiotic metabolizing enzymes in the oral mucosa is unknown. Here we characterised, for the first time, the expression of a sub-set of metabolising enzymes in native, skin and oral mucosa, and compared these to tissue-engineered oral mucosal (TEOM) equivalents to elucidate enzymatic profiles.

Methods

Immunohistochemistry using antibodies directed against cytochrome P450 enzymes CYP2E1, CYP3A4, CYP3A43, CYP3A5, flavin-containing monooxygenase (FMO) 4 and 5, glutathione S-transferase (GST)–Pi, aldehyde dehydrogenase (ALDH2), N-acetyltransferase 1 (NAT1) and UDP-glucuronosyltransferase (UGT1A6) was performed on wax-embedded sections of native, normal oral mucosa (NOM), skin and TEOM to determine protein expression and localisation within tissue sections.

Results

Immunohistochemical results revealed that the location of xenobiotic enzyme expression varies between human skin and NOM. Expression of GST-Pi, FMO4, FMO5, NAT-1, ALDH2, CYP3A4 was similar in all tissues with immune-reactivity throughout the epithelium. CYP2E1 expression was mainly restricted to the basal epithelium as was expression for CYP3A5 and UGT1A6 although expression of this enzyme was absent in TEOM. Expression of FMO3 was throughout the normal epithelium, restricted to basal cells in skin and was weak in the TEOM.

Conclusions

We identified variations in enzyme expression between human skin, NOM and TEOM. This data will be useful when investigating xenobiotic metabolism of topically delivered compounds.
Identification of Novel Neuronal Roles in Oral Cancer Tumour Microenvironments
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Objectives Nerves have recently been implicated in breast, pancreatic and prostate cancer progression, but the molecular mechanisms underlying this are poorly understood. Little is known regarding the contribution of nerves to disease progression in oral cancer. This study's objective was to investigate neuronal-tumour interactions in oral squamous cell carcinomas (OSCCs).

Methods Quantitative polymerase chain reaction (qPCR) and immunocytochemistry were used to identify the neuropeptides calcitonin gene-related peptide (CGRP), substance P (SP) and components of their receptors in normal oral keratinocytes (NOKs), dysplastic, cancerous and metastatic cell lines and neurones. Co-culture systems were used to identify functional cross-talk mediated by neuronal, cancer cell and fibroblast (the predominant cell type of the tumour microenvironment) secretions. ELISA and qPCR were employed to identify secreted factors playing roles in neural-tumour interactions.

Results PCR identified CGRP and SP receptors in most OSCC-derived cell lines. Immunocytochemistry localised receptor components within OSCC and H357 cells. CGRP and SP were detected in primary neurones used for co-culture systems. Significant chemoattractant and proliferative effects of both neuropeptides were identified in H357 cells in a dose- and time-dependent manner. Nerve growth factor (NGF) was elevated in most cancer-derived cell lines relative to NOKs and its secretion detected from H357 cells. NGF secretion from experimentally derived cancer-associated fibroblasts was significantly increased compared to normal oral fibroblasts which correlated with increased neuronal outgrowth. H357 caused significant increases in neuronal outgrowth.

Conclusions The results indicate the existence of significant cross-talk between nerves and the OSCC tumour microenvironment. This suggests neuronal factors may have potential as therapeutic targets.
Investigation of Prognostic Biomarkers of Periodontal Treatment
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Objectives The aim of this study was to investigate the use of the putative salivary and serum biomarkers MMP-8, MMP-9 and S100-A8 to predict outcomes of periodontal treatment.

Methods 36 patients with moderate or severe chronic periodontitis received a standardised course of nonsurgical periodontal treatment. Patient treatment responses were assessed according to the percentage of deep sites preoperatively that showed a reduction following treatment. In addition subjects were dichotomised as “responders” and “non-responders” according to the percentage of non-responding deep sites (≥50%) seen in each patient. Unstimulated saliva and serum samples were collected pre- and post-operatively. Concentrations of MMP-8, MMP-9 and S100-A8 in all samples were determined by ELISA. Predictive value was assessed by ROC and correlations calculated with Pearsons Correlation test.

Results Saliva concentrations of MMP-8 (pre-op mean:572.4ng/ml, SD:418.2, post-op mean:431.5ng/ml, SD:465.1, P<0.01) and MMP-9 (pre-op mean:485.3ng/ml, SD:305.2, post-op mean:369.9ng/ml, S.D:239.3, P<0.05) significantly reduced following treatment. There was no significant change in saliva concentrations of S100-A8 or with any of the serum analytes.

Using ROC analysis, Pre-op salivary MMP-9 showed a modest predictive value for treatment outcome (Area under the Curve 0.677). Salivary MMP-8 and -9 concentrations from the same patient were significantly correlated in both pre-op (R² = 0.477, P<0.01) and post-op (R² = 0.663, P<0.01) samples. S100A8 concentrations did not correlate with MMP concentrations. In addition there were no significant correlations seen between salivary and serum samples of any analyte. In non-responders only the percentage change of serum MMP-8 (R²=-0.588) & MMP-9 (R²=-0.595) was significantly inversely correlated (P<0.05) with the percentage change of deep sites.

Conclusions In conclusion, these putative biomarkers showed little evidence of value as prognostic biomarkers. The wide variations in individual responses emphasise both the large variability and complexity of regulation of these factors in disease.
Continuous Sumatriptan Causes Increased Excitability in the Rat Trigeminal System
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Objectives Migraine remains poorly understood, despite being the third most common and disabling disease in the world, with a global prevalence of 10%. We have recently developed a novel clinically-relevant model of migraine that uses continuous sumatriptan administration to induce a migraine-like state. This model was used to investigate the hypothesis that the appearance of migraine symptoms, such as the development of facial allodynia and increased responses to migraine triggers, are associated with peripheral and central sensitisation of the trigeminovascular system.

Methods The trigeminal ganglion (TG) and trigeminal nucleus caudalis (TNC) were harvested from rats following subcutaneous infusion with sumatriptan or saline (over a period of 6 days), either on the last day of infusion (day 6) (n=4) or on day 20 (from the start of infusion) (n=2). A subgroup of the animals culled on day 20 were treated with sodium nitroprusside (a nitric oxide donor known to trigger migraine in humans) prior to tissue collection (n=2). Tissues were immunohistochemically labelled using antibodies to identify known biomarkers of neuronal and glial activation and specific cell types (pERK, pp38, Iba-1, GFAP and NeuN).

Results An increase in biomarker expression was observed in sumatriptan-infused rats in both the TG and TNC at day 6 and day 20. In the TNC, this expression was localised to areas known to be involved in nociceptive processing in migraine. Labelling for pERK and pp38 displayed a shift in expression from neurones (on day 6) to glia (on day 20), implicating a role for both of these cell types in migraine.

Conclusions Continuous sumatriptan administration causes increased expression of markers of altered excitability in neuronal and glial cells in both the TG and TNC. This suggests that both peripheral and central sensitisation of the rat trigeminovascular system are involved in the pathophysiological mechanism underlying migraine.
Epithelial activation by the novel fungal peptide toxin Candidalysin
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Objectives The human fungal pathogen *Candida albicans* causes millions of mucosal (oral, vaginal) and life-threatening systemic (blood) infections each year. Efforts to understand how *C. albicans* causes disease have remained at the forefront of medical mycology for several decades. Our recent discovery of Candidalysin, the first cytolytic peptide toxin identified in any human fungal pathogen, finally revealed how *C. albicans* activates oral epithelial cells (via the mitogen-activated protein kinase (MAPK) pathway), induces tissue damage (by forming pores) and promotes infections in a murine oral model. Given that the vast majority of *Candida* infections are vaginal, this study aimed to extend our oral studies and determine the importance of Candidalysin in activating vaginal epithelial cells.

Methods Epithelial monolayer cultures of the A431 human vulvar epidermoid carcinoma cell line were inoculated with *C. albicans* Candidalysin at a range of concentrations between 5 – 250 μg/ml. Epithelial cell lysates were assayed for MAPK pathway activation (via activation of the MAPK phosphatase (MKP-1) and the transcription factor c-Fos), the production of cytokines (GM-CSF, G-CSF, IL-1α, IL-1β, IL-6, and IL-8), and the induction of cell damage (via lactate dehydrogenase (LDH) release). Data were analysed by one-way ANOVA.

Results Candidalysin was found to activate MKP-1/c-Fos and induce cytokines and cell damage in vaginal epithelial cells in a dose-dependent manner, with increasing concentrations of Candidalysin being more stimulatory. Similar findings were observed previously in oral epithelial cells.

Conclusions These data indicate that the core epithelial response to Candidalysin is conserved between oral and vaginal epithelium and provides valuable new insights in our understanding of host epithelial responses to the medically important fungus *Candida albicans*. 
E-Cigarette Use: an Association with Smoking Cessation Motivation and Policy Support
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Objectives This study aimed to explore factors associated with support for e-cigarette-restrictive policies amongst smokers in Great Britain (GB) ahead of the implementation of the European Union Tobacco Products Directive in May 2016. It was hypothesised that 1) e-cigarette users will have higher motivation to stop smoking than non-users; 2) e-cigarette users will be less likely than non-users to support e-cigarette-restrictive policies; 3) higher motivation to stop smoking will be associated with e-cigarette-restrictive policy support amongst e-cigarette users.

Methods Secondary analysis of data from 1,703 smokers participating in a national, cross-sectional online survey in GB. Hypotheses were tested using an ANOVA (1) and binary and multivariable logistic regressions (2 and 3). Multivariable analyses adjusted for age, sex, region and social grade.

Results 1) Motivation to stop smoking was higher in e-cigarette users than non-users (p<.001), with a small effect size (partial $\eta^2=.02$); 2) E-cigarette users were no more or less likely to support a ban of sales to minors (p=.310), less likely to support a ban on e-cigarette advertising (p<.001) and less likely to support e-cigarette-free enclosed public places (p<.001); 3) Higher motivation to stop smoking was associated with increased support for e-cigarette-free public places, a ban on sale to minors and a ban on advertising while adjusting for other respondent characteristics (p<.001).

Conclusions Support for e-cigarette-restrictive policies was associated with e-cigarette use and increased motivation to stop smoking amongst adult smokers in GB, adjusting for demographics and smoking characteristics. Future research should explore support for e-cigarette-restrictive policies amongst non-smokers.
Expression of periodontal ligament-associated markers in oral and extra-oral mesenchymal stem cells
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Objectives Heterogenity of transcriptomic and proteomic profiles exists within mesenchymal stem cells (MSCs) dependent upon anatomical source. We have previously shown that periodontal ligament (PDL) MSCs express distinct gene expression profiles of PDL-associated marker proteins to those derived from bone marrow (BM) both constitutively and when driven to differentiate. Here we investigated the expression of these markers in dental pulp stem cells (DPSCs) to compare profiles with PDL and BM-derived MSCs.

Methods Primary human PDL, dental and BM-derived MSCs from different individuals were expanded in vitro and then cultured for periods of up to 21 days in normal and osteogenic media. Expression of osteogenic, adipogenic and PDL-associated genes was tested by qRT-PCR at time points until 21 days of differentiation.

Results No statistically significant differences were found in expression levels of the osteogenic and adipogenic marker genes, Runx2 and PPAR-gamma, between PDL MSCs and DPSCs. Expression levels of the PDL-associated marker gene, PLAP-1, was significantly higher in both PDL MSCs and DPSCs than in BMSCs, however there were no differences between PDL MSCs and DPSCs. Expression of nestin and periostin was not significantly different between any of the three MSC types.

Conclusions MSCs derived from different sources showed similar osteogenic and adipogenic expression profiles both constitutively and during differentiation, however the selective expression of PLAP-1 in dental derived MSCs indicates inherent differences dependent upon origin.
Aspirin Induces Osteogenic Differentiation of Dental Pulp Stem Cells

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Objectives The objectives of this study were to investigate the utility of drug reposition approach using connectivity-mapping to identify compounds that could potentially induce osteogenic differentiation of dental pulp stem cells (DPSCs) and to validate their effects by in-vitro testing.

Methods Connectivity mapping was carried out using the programme sscMap and publicly-available datasets to create initially an osteogenic gene signature for DPSCs and then identify compounds that could modify the gene signature to potentially induce osteogenic differentiation of DPSCs. One compound with a significant positive connection score was then selected. Compound toxicity was tested by 3-day, 5-day and 7-day MTT assays. Expression of the osteogenic genes, RUNX2, ALPL, COL1A1 and DSPP was assessed at 24h, 7 days and 14 days by qPCR. Calcification at day 14 and 21 was assessed by Alizarin Red staining assay.

Results Gene expression analysis using sscMap revealed novel osteogenic gene signature for DPSCs undergoing osteogenic differentiation. Mapping thin gene signature to compounds library identified aspirin as a potential osteogenic candidate with significant positive connection score. MTT assays showed a lack of toxicity for aspirin at concentrations of 0.5mM and 0.05mM at all time points. Osteogenic genes, RUNX2, COL1A1, DSPP and ALPL were upregulated in DPSCs treated with 0.05mM aspirin in comparison to negative controls. Increased calcification at 14 and 21 days were also evident in aspirin-treated cells compared to negative controls.

Conclusions This study shows that aspirin increases expression of osteogenic genes and induces calcification and ALPL activity in DPSCs. Therefore, aspirin may be a viable alternative for inducing osteogenic differentiation of DPSCs in-vitro and a potential pulp capping material in-vivo. Furthermore, the results suggest that connectivity-mapping may be a valid approach for identifying compounds that can induce stem cell differentiation.
Altered brain activity in a pre-clinical model of cephalic pain
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Objectives Migraine is the third most prevalent, and sixth most disabling disease in the world. However, its neurobiology is not completely understood and treatments available are often inadequate. The current study aimed to investigate altered brain activity under migraine-like conditions, using a clinically relevant model of migraine in rats in combination with pre-clinical functional magnetic resonance imaging (fMRI).

Methods Naïve rats underwent continuous subcutaneous administration of either sumatriptan (n=4) or saline (n=4) for 6 days. Under isoflurane anaesthesia, 7 Tesla MRI measurements were performed before (day 0), during (day 6) and after (day 20) sumatriptan administration to investigate changes in brain activity associated with development and subsequent recovery from allodynia.

Results On day 6 of triptan infusion, the cerebral blood flow in grey matter structures was significantly reduced compared with that in saline-treated rats. Furthermore, in response to a stimulus train to the whisker pad region, rats showed a distinct, constant and unusually slow oscillation in the BOLD fMRI signal (standard GE-EPI sequence), occurring only in areas of superficial cortex and thalamus. The oscillation was not observed in saline-treated rats. Critically, at day 20 post-triptan administration, rats showed increased activity in response to whisker pad stimulation in deeper regions of the brain including brainstem and thalamus. Moreover, at day 20, sumatriptan- but not saline-treated rats showed high connectivity between the thalamus (seed region), the cortex and the brainstem.

Conclusions Consistent with human data showing altered activity in the cortex and/or deeper regions of the migraineurs’ brain, the data from this study suggest that administration of sumatriptan results in MRI changes similar to those observed in humans, and that these are correlated with the development of allostynia. Thus, the use of this migraine model coupled with MRI techniques may facilitate the development of translational research advancing our understanding of migraine pathophysiology.
**033**

**TRPV2 mediates mechanical stress-induced IL-8 release in odontoblasts**

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**Objectives** The objectives of the current study were to determine whether exposure of odontoblast-like cells to mechanical stress was capable of eliciting an inflammatory response. We have previously demonstrated the presence of the mechanosensitive ion channel transient receptor potential vanilloid 2 (TRPV2) on odontoblast-like cells and the focus of this work was to investigate a novel role for TRPV2 in mechanical stress-induced inflammatory cytokine release in odontoblasts.

**Methods** Human dental pulp cells were cultured in the presence of 2 mM β-glycerophosphate to induce an odontoblast phenotype. Odontoblast-like cells were seeded in 24-well plates and exposed to centrifugation force (475g/cm) for 20 min. To evaluate the effect of mechanical force on cytokine release we undertook a custom-designed human cytokine magnetic luminex screening assay according to the manufacturer’s instructions (R&D Systems).

**Results** Exposure of odontoblasts to pressure force resulted in modest but significant increase in release of the pro-inflammatory cytokine IL-8, but there was no significant change in TNF-alpha, IL-1 beta, IFN-gamma or IL-1 receptor antagonist levels. We were not able to detect measurable levels of IL-10 in this assay. To evaluate the effect of pharmacological activation of TRPV2 on IL-8 release, cells were treated with a specific agonist for TRPV2 (cannabidiol), which dose dependently increased IL-8 release in odontoblast-like cell supernatant. This effect was inhibited by the specific TRPV2 antagonist, tranilast. Further confirmation of a specific role for TRPV2 in mechanical stress induced IL-8 release was obtained in SiRNA treated cells in which IL-8 release was reduced following exposure to force.

**Conclusions** These results provide the first evidence for a functional role of TRPV2 in human odontoblast-like cells in mediating mechanical injury induced pulpal inflammation, providing further support for the role of odontoblast TRP channels in pulpal physiology.
Objectives To determine the confidence levels of Dental Core Trainees (DCT), i.e. junior trainees within 4 years of graduation, in the management of procedures/conditions classed as Level 1&2 in the new National Health Service Oral Surgery Commissioning document. To inform the training needs of the DCTs.

Methods All Oral Surgery (OS) DCTs at the Birmingham Dental Hospital, UK, in 2015/16 were identified. A questionnaire was devised on the trainee’s confidence levels related to Care Complexity Levels 1&2 for OS procedures/conditions. Level 1- procedure/conditions to be performed or managed by a clinician with level of competence on completion of undergraduate and 1 year of post-graduate Dental Foundation Training (DFT). Level 2- procedural and/or patient complexity requiring a clinician with enhanced skills and experience. This was completed at the beginning of the post for baseline abilities.

Results Nine OS trainees participated (7 female). All DCTs had completed DFT. Over half (5 out of 9) had previous OS experience in a hospital setting.

Level 1:
All trainees were fairly/very confident in extractions of erupted teeth. More experienced DCTs had greater confidence (80% fairly/very confident) than inexperienced DCTs (25% fairly confident) in the management of various conditions including oral mucosal disease and dental trauma.

Level 2:
Most DCTs (8 of 9) were fairly confident in the surgical removal of uncomplicated third molars and retained roots. Their confidence levels dropped dramatically, with only one DCT being fairly confident in performing more complex surgical procedures such as surgical exposure of ectopic teeth. 100% of DCTs were either fairly/very unconfident in implant placement.

Conclusions All DCTs had greater confidence in embarking in the management of Level 1 procedures/conditions compared to Level 2. Previous OS experience accounted for the greater confidence levels for Level 1 procedures. Further training is required to address their training needs, in particular Level 2.
Objectives This study aimed to investigate the prevalence of work-related musculoskeletal pain amongst dental students and possible risk factors.

Methods Single-blinded (participant), cross-sectional study based in the University of Leeds School of Dentistry aimed at all 4th/5th year dental surgery students (n=184). Observation of each students’ working practices were completed by 2 Independent examiners, using a checklist to record posture-related errors. In addition, questions were posed through self-administered questionnaires on presence of pain, working habits, environment, physical activity and some unrelated questions to mask the study purpose.

Results 116 students consented to take part, 8 were excluded due to pre-existing musculoskeletal conditions leaving 108 participants. Observations revealed poor posture habits, the two commonest affecting more than 80% of students were lack of back support and incorrect patient position. Many reported musculoskeletal pain whilst or after they were working (70%), the most frequent pain that was reported was back followed by neck pain. There was however no statistical association between the posture related errors observed and prevalence of self-reported pain (P>0.05). A large number of participants however reported taking part in physical activity.

Conclusions In conclusion, a high prevalence of musculoskeletal pain was reported amongst senior dental students in this study. Although the observed poor posture did not correlate to musculoskeletal pain in this study, pain is multifactorial and difficult to measure. Additionally, a large proportion of participants reported participating in physical activity which may be protective. Repeated postural errors may in time cause problems and this study showed that there are numerous issues which could be addressed in improving students’ working practices.
Prospective Austrian progress test pilot project in undergraduate dental education
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Objectives Progress testing was developed during the 1970ies as an assessment tool to verify knowledge growth of students during an educational program. Nowadays it is an established instrument in human medicine curricula all over Europe and beyond. Nevertheless, this useful tool is not well established in dental education. A PubMed search revealed only one result concerning a dental progress test in the Peninsula schools of medicine and dentistry in Plymouth.

Aim of this prospective study was the development of a German-language dental progress test for the undergraduate dental curriculum at the Dental School of Medical University of Graz (Austria).

Methods A pool of around 375 multiple-choice items at graduation-level out of the specialties Oral Surgery, Oral Medicine and Oral Radiology was created by a single author at the Division of Oral Surgery and Orthodontics, Medical University of Graz. Each question underwent a multistage review process before final inclusion in the question pool. Progress test project started in June 2016 and was continued for two further terms. Participation was mandatory for all dental students at term 7 to 12, but results were not relevant for students’ grades. For each test 100 items were randomly selected based on a predesigned blueprint. Data analysis was conducted anonymously and blinded for the study leader. Students got detailed feedback about their scores and their position among their colleges by the examination department.

Results At the first test 55 students participated. The mean score of correct answers was 61.02 with a standard deviation of 13.15. The minimum number of correct answers was 25, the maximum was 82. At the second test 62 students took part. The mean score of correct answers was 55.5 with a standard deviation of 12.87. The minimum number of correct answers was 14, the maximum was 82 again. Both tests are showing an increase of correct answers between 7th and 9th term, a decrease in term 10 and again an increase during term 11 and 12. Results of third progress test will be presented after analysis.

Conclusions This is the first report of the installation of a dental progress test in German speaking countries. Although labour intensive, it is thought to be a desirable assessment tool in dental education whereof students and educators can profit by.
Challenging the Conventional Curriculum: An Inter-Professional Undergraduate Dental Programme
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Objectives To explore student attitudes towards inter-professional education, and their experience of shared learning.

Methods Dental Therapy and Hygiene (DTH) students from the final year of a 3-year programme participated in a pilot questionnaire study at the end of the academic year.

Results Information gathered from the pilot study has shown that students’ attitudes towards elements of the programme which are integrated with the Bachelor of Dental Science (BDS) programme are overwhelmingly positive. Making friendships and networks that will extend into professional practice, all being ‘in the same boat’, and the opportunity to learn from one another were all areas of importance and value identified by students. Learning about each other’s professional perspective, and supporting one another were identified as areas of particular success, and are considered in relation to the emphasis on teamworking in dental education. This study is currently being developed into a longitudinal project which aims to explore both BDS and DTH students, and staff, perceptions and attitudes towards inter-professional education, and their experience of shared learning.

Conclusions There is heavy emphasis on teamwork within the healthcare sector, yet inter-professional education is not consistently utilised across dental education. We believe the Peninsula Dental School approach develops excellent teamwork and communication skills, preparing our clinicians for careers within the dental team and profession; aspirations supported by, and which can be developed in light of, the current data. To our knowledge, this is the only inter-professional dental programme in the UK. Our curriculum, designed to promote inter-professional skills in environments true to the actualities of practice has been extremely well received by students. Exploring these perceptions further through the development of a comprehensive longitudinal research project will assist in exploring further the barriers (and benefits) to shared care in such programmes.
Isolation and characterisation of oral cancer stem cells
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Objectives Cancer stem cells (CSCs) are a subset of the tumour cell population which possess the capability for indefinite self-renewal, are highly tumorigenic, and are also resistant to anticancer therapy. Identifying and isolating CSCs is crucial to study their characteristics with the aim of specifically targeting and eradicating them. We hypothesize that CSCs can be functionally isolated from oral cancer cell lines and used two different assays (cell adhesion and chemo-resistance) to investigate the stem cell characteristics of these cells, compared to unsorted cells.

Methods Cancer stem-like cells were isolated from two oral cancer cell lines (H357 and SCC4) on the basis of their rapid adherence (within 10 minutes) to fibronectin (FN) or their resistance to conventional chemotherapy (5μM cisplatin for 3 days). The stem cell characteristics of the isolated cells were investigated using FACs analysis, proliferation and colony forming assays.

Results Cells isolated using both methods expressed significantly increased levels of stem cell markers CD24, CD44 and CD29 compared to unsorted cells. In addition, the growth rate of early adherent cells was two-fold lower and the colony forming efficiency three-fold higher than unsorted cells. Moreover, these cells exhibited increased cisplatin resistance compared to unsorted cells. Conversely, the cisplatin-resistant cells adhered to fibronectin more highly than unsorted cells and exhibited a higher growth rate compared to unsorted cells after a second cisplatin exposure.

Conclusions Rapid adherence to FN and chemo-resistance effectively isolates a sub-population of cells from cell lines which show stem cell-like characteristics. The increased chemoresistance of early adherent cells and the increased adherence of cisplatin-resistant cells suggest that these two methods are isolating the same population of CSCs. Future work will investigate the stability in culture of these CSCs with the aim of developing strategies to eradicate them from cultures and subsequently tumours in vivo.
Novel tissue-engineered constructs to examine the role of fibroblast-derived extracellular matrix in oral cancer progression

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Objectives Cancer progression is determined by the interaction between tumour cells, stromal cells (fibroblasts and leukocytes) and other components of the microenvironment such as the extracellular matrix (ECM). The ECM is predominantly deposited by cancer-associated fibroblasts (CAF) and plays a key role in cancer progression. Although evidence exists demonstrating a role for CAF in oral squamous cell carcinoma (OSCC), little is known about their influence on ECM: tumour interactions. This project aims to generate novel tissue-engineered 3D constructs using normal oral fibroblast- (NOF) and CAF-derived ECM, as a native scaffold to accurately model ECM: tumour interactions in OSCC progression.

Methods NOF isolated from normal oral mucosa, CAF isolated from OSCC and NOF stimulated with TGFβ-1 (to induce transdifferentiation into an αSMA-positive ‘CAF-like’ phenotype) were cultured as monolayers and their phenotype analysed using qPCR and immunoblotting both short (24-72 hours) and longer-term (14 days). Different culture conditions were investigated to stimulate NOF- and CAF-derived ECM deposition and full-thickness epithelium models produced using normal and OSCC cell lines. Models were characterised by immunoblotting and immunohistochemistry for markers of proliferation (Ki67), epithelial differentiation (AE1/3) and ECM deposition (collagen I).

Results TGFβ-1 treatment of NOF stimulated transdifferentiation into a CAF-like phenotype with cells expressing αSMA-rich stress fibres and fibronectin extra domain A (FN1-EDA). Tumour-derived CAF expressed αSMA, FN1-EDA, collagen I and versican. NOF stimulated to produce ECM over a four-week culture period, generated an organised matrix with an average thickness of ~200 µm compared to TGFβ-1-treated NOF and CAF that produced thicker (350 µm), irregular ECM. Immunoblotting and immunohistochemical analysis of the models revealed a significantly different protein deposition between the NOF and CAF phenotypes.

Conclusions Using tissue-engineering techniques it is possible to model fibroblast-mediated ECM deposition providing a novel, pathophysiologically relevant in vitro tool for the study of OSCC progression.
Functional expression of class B scavenger receptors by oral keratinocytes: implications for oral squamous cell carcinoma

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Objectives Scavenger receptors (SR) belong to a large receptor family that primarily bind lipid-containing molecules. Until recently their expression has been described on innate immune cells (macrophages) and endothelial cells where their principal role is internalization of lipoproteins and bacteria. This study aimed to determine functional expression of Class B SR by oral keratinocytes.

Methods A panel of normal, dysplastic or cancerous oral keratinocytes from various oral sites were tested for the expression of class B SR by qPCR, flow cytometry and immunohistochemistry. Oxidised (Ox) or acetylated (Ac) low-density lipoprotein (LDL) internalization was measured by immunofluorescence microscopy and receptor activation by immunoblotting for several intracellular signaling molecules. The effects of Ox/Ac-LDL on cell adhesion, invasion and migration as well as markers for epithelial to mesenchymal transition (EMT) were also measured in vitro.

Results Class B SR family members were expressed by both normal and oral cancer cells with some cancer cells expressing elevated levels. Expression was markedly greater in oral cancer tissue than in normal oral mucosa. SCC4 cancer cells rapidly internalized Ox/Ac-LDL in a receptor-dependent manner that initiated phosphorylation of JNK. Stimulation with Ac, and in particular, Ox-LDL caused SCC4 cells to be less adherent, more invasive and display increased migration compared to controls. These cell functions were inhibited using a pan-Class B antagonist or a JNK inhibitor. In addition, Ox-LDL altered the expression of EMT markers.

Conclusions These data suggest that Class B SR are up-regulated by oral cancer cells and that their activation by Ox-LDL may significantly impact on their ability to migrate and metastasise. Our findings may have a significant impact on oral cancer biology.
Chemical Analysis of Resin Monomer TEGDMA Stored in Aqueous Environment
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Objectives Triethylene glycol dimethacrylate (TEGDMA) is the major monomer released from dental composite resins and it leaches at levels to have toxic effects on monolayer cell cultures of oral epithelial cells. The aim of this study was to assess the long-term stability and composition changes of TEGDMA stored in aqueous media using liquid chromatography–mass spectrometry (LC-MS).

Methods C18 reversed phase chromatography column (Sigma Aldrich, UK) with flow speed of 1 mL/min, 150 µL injection volume and 15-minute run time was used. A TEGDMA sample was diluted in 65% gradient grade acetonitrile and 35% ultra-high quality water and run through the LC-MS column. TEGDMA in freshly prepared water and TEGDMA in water that had been stored for 4 months were run for comparison. Run was isocratic, using 65% gradient grade acetonitrile and 35% ultra-high quality water as the mobile phase.

Results Comparing the spectra obtained from the LC-MS, there was an obvious difference between the stored sample and the fresh sample with the presence of approximately 4 times as much of m/z 241 in the stored sample as opposed to the fresh sample, indicating the presence of a breakdown product of TEGDMA. The presence of m/z 241 was reconfirmed by direct injection (without the LC column) into the mass spectrometer.

Conclusions The results of LC-MS analysis indicate that the monomer TEGDMA can break into smaller molecules after long-term storage in aqueous media. This is a particularly important discovery that has not been previously reported. This data can have significant implications in long-term oral biocompatibility studies of resin-based dental materials and also provides a better understanding of the fate of such materials when released into the environment.
Antimicrobial Properties of Dental Acrylics Containing Ag-FAU Zeolite

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Objectives The aim of the present work is to fabricate dentures containing antimicrobial silver (Ag) zeolites, which can be re-charged with Ag upon silver depletion. The objectives are two-fold; firstly, to test the antimicrobial activity of dental acrylic polymers containing silver zeolites against oral microorganisms, namely *Streptococcus mutans, Fusobacterium nucleatum* and *Candida albicans* (x2), and secondly, to test the Ag release in distilled water over 2 months.

Methods In total, four dental acrylic resins were prepared, dental acrylic (blank), dental acrylic containing Na-FAU, AgNO₃ treated acrylic and AgNO₃ treated dental acrylic containing Na-FAU (to charge it with silver). Dental acrylic surfaces were incubated at 37 °C under aerobic conditions for *Candida albicans* and under anaerobic conditions for *S. mutans* and *F. nucleatum* (approx. 10⁶ CFU/m). Immediately after inoculation, the coupons were placed individually into 10 mL neutralizing agent to halt the antimicrobial effect of silver and vortexed for 30 s and the CFU/ml were established. All coupons were incubated for 0, 1 and 5 h at 37 °C prior to testing.

Results It was determined that dental acrylic resin containing silver-zeolite showed antimicrobial efficacy against *C. albicans* and *S. mutans*. Antimicrobial efficacy of the acrylic resin coupons was still evident after 45 days of storage. After 60 days, the antimicrobial efficacy was lost indicating that Ag needs recharging after 45 days to restore the resin’s initial activity. Dental acrylics treated with AgNO₃ showed no activity after an initial period of 5 days, during which adsorbed silver was removed from the surfaces. All silver-charged acrylics containing zeolites were tested after removal of this adsorbed silver, i.e. after 5 days of incubation in distilled water.

Conclusions Dental acrylic containing antimicrobial Ag zeolites showed antimicrobial properties over a period of 45 days. Silver can be recharged into the zeolite-loaded resin upon silver depletion.
Chemical analysis of resin monomers released into the environment via urine and saliva
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Objectives To assess and quantify the potential environmental pollutant risk of the principal monomers used in resin-based composite-adhesive dental restorative complexes utilising a novel detection method following in-vivo placement in patients.

Methods A clinical pilot trial on 22 patients was carried out for the provision of one multi-surface composite restoration on a posterior tooth. Patients that had any other recent (< 6 months) resin-based composite restoration were excluded from the study. A representative commercially available resin-based composite (RBC) and dentine adhesive containing the study monomers was used. Urine and saliva/mouth rinse samples were obtained from every participating patient at the following time intervals: Baseline (control), immediate pre-intervention, immediate post-intervention and 24hr post-intervention. Potential exposure to the study monomers from food and drink, that may act as confounders, was identified by means of a comprehensive baseline questionnaire and intervention-period diet sheet. Sample analysis for test analytes [Bis-phenol A (BPA), Tri-Ethylene Glycol di-methacrylate (TEGDMA), Bis-phenol A Glycidyl di-methacrylate (BisGMA) and Urethane di-methacrylate (UDMA)] were carried out using solid phase micro-extraction (SPME) coupled with high performance liquid chromatography (HPLC) to a resolution of parts per million.

Results Pre-placement levels of BPA were detected in all samples with mean concentrations of 1.13mg/L (saliva) and 1.09mg/L (urine); indicating a baseline exposure from other sources. Following placement of a RBC-adhesive restoration, concentrations of BPA increased to between 1.15mg/L and 1.25mg/L in 50% of participants. TEGDMA, BisGMA and UDMA concentrations varied, showing no increase or significant difference post-treatment.

Conclusions Bisphenol-A and methacrylates in mg/L=ppm concentrations can be detected in urine and saliva. Resin based dental restorations increase BPA concentrations in both saliva and urine at 24hr post-intervention. This study provides a better understanding of the release of RBC components into the environment.
Effect of Bioactive Glass Addition on the Characteristics of Glass Ionomer Cements
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Objectives
Glass Ionomer Cements are one of the widely used dental restorative materials. They have chemical adhesion to tooth structure, and anti-cariogenic properties due to fluoride release. Our aim is to develop GIC compositions containing bioactive glasses (BAG) and to evaluate the effect of varying BAG concentrations in the cement on the mechanical properties, and setting characteristics.

Methods
Alkali free fluoride containing BAGs were produced via melt quench route based on the composition 35.9SiO2-5.9P2O5-52.2CaO-6.0CaF2. Two fluoride containing calcium and strontium alumino-silicate glasses (ASG) were commercially obtained. Glass transition temperatures (Tg) were determined using Differential Scanning Calorimetry(DSC). Homogeneity of the glasses was evaluated using X-Ray Diffraction (XRD). ASG powder was blended with 80KDa poly (acrylic acid) 2.5:1 ratio. This was then mixed with 15% Tartaric acid solution at 3.5:1 powder:liquid ratio. The mixture was packed into Teflon mould (4mmx6mm), clamped and stored for 1hr at 37°C. Thereafter, the cylinders were removed and stored in deionised water for 24h at 37°C. BAG containing cements were produced using the same method except the ASG powder was pre-blended with 10%BAG. Samples (n=8 for each cement) were tested for compressive strength using Instron. Oscillating rheometer was used to characterise the cements. Cements powder and liquid components were mixed for 20sec. Changes in oscillation were recorded as a measure of working-time (Wt) and setting-time (St).

Results
XRD patterns show that BAG and ionomer glasses were amorphous. Tg of ionomer glasses were lower than BAG. Compressive strength values are 90 ±14 SD (MPa) with 10%BAG, and 124±28 SD (MPa) for GIC with no BAG. Wt values are 0.84±0.05 SD (min) and 0.85±0.02 SD (min), St values are 1.48±0.1SD (min) and 1.49±0.1SD (min) for cements containing no, and 10%BAG respectively.

Conclusions Addition of BAG has no significant effect on Wt and St. The compressive strength values are reduced with increasing BAG. This needs to be further investigated.
Peri-Implantitis: Oral Pathogenic Anaerobes Attach Directly to Dental Metallic Surfaces
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Objectives Peri-implantitis is an infectious disease associated with inflammatory destruction of supporting tissues, leading to implant failure. The inflammatory host response is stimulated by anaerobic pathogens accumulating in implant-associated biofilms then migrating into the gingival sulcus. Canonically, it is believed that implants are sequentially colonised. This involves deposition of salivary proteins which mediate adhesion of commensal aerobic microbes. These microorganisms establish a favourable environment for the attachment of anaerobic late colonisers, including those associated with peri-implantitis. Previous research in our laboratory showed late colonisers can attach directly to metal surfaces.

This study aimed to develop a standard to assess direct attachment of putative peri-implantitis pathogens to implant abutment metals without the presence of “early coloniser” species.

Methods The peri-implantitis-associated species *Fusobacterium nucleatum* and *Porphyromonas gingivalis* were anaerobically cultured in Fastidious Anaerobe Broth at 37°C until mid-log phase. Medical-grade titanium alloy discs (Renishaw PLC – Medical and Dental Products Division), were incubated for up to 120 min in the bacterial suspensions. Attachment and viability were quantified using a live/dead stain observed by fluorescent microscopy, a metabolic reduction assay, and microbiologic culture giving Colony Forming Units/mL.

Results Titanium disc surfaces showed smooth roughness profiles ($R_a = 0.058\mu m +/−0.005$) with partial wetting properties ($\theta = 64° +/−5.494$). Tested anaerobes were able to attach readily to unconditioned titanium surfaces. Metabolic activity and culture analysis were consistent with microscopic image analysis, indicating that over 50% of attached microbes were viable.

Conclusions Direct adherence of putative peri-implantitis pathogens to plain metal in the absence of “early colonisers” has been shown. Of clinical importance, attachment of such species to dental implants and abutments immediately after placement is likely to induce an inflammatory response, which may lead to subsequent destruction of the peri-implant tissues.
Application of a graphene nanocoating for the management of microleakage and dentine hypersensitivity
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Objectives To successfully apply a graphene monolayer coating to dentine and investigate its sealing effect by occluding the orifices of the dentinal tubules. Also, to quantify the bonding strength between the graphene nanocoating and the underlying dentinal tissue.

Methods Dentine discs were obtained from the crowns of intact human premolar and molar teeth. A monoatomic layer of graphene was then transferred to the surface of each dentine disc. Surface microtopography was investigated with scanning electron microscopy (SEM). The bonding strength between graphene and dentine was measured by a pull-off test according to BS EN ISO 4624:2002 using an Instron 5582. The presence of graphene on dentine before and after the pull-off test was further examined by energy dispersive X-ray spectroscopy (EDS) and Raman spectroscopy.

Results EDS analysis confirmed that graphene was successfully transferred to the surface of dentine. Further examination with Raman spectroscopy showed characteristic peaks at 1576 cm\(^{-1}\) (G band) and 2675 cm\(^{-1}\) (2D band) matching the peaks expected in Raman spectra for the graphene monolayer. SEM examination showed dentine coated by a continuous layer of graphene masking the surface microtopography, including the orifices of dentinal tubules. The bonding strength between the graphene coating and dentine was determined by the pull-off test and was found to be 23.56 ± 1.32 MPa (n = 3), two-fold higher when compared to a reference value of 12.90 ± 0.69 MPa (n = 3) for uncoated dentine.

Conclusions A continuous monoatomic layer of graphene was successfully transferred to dentine and a strong bond was achieved with the underlying surface. It is suggested that application of graphene to dentine can minimise its permeability by creating a physical barrier and therefore provide an alternative strategy for managing microleakage and dentine hypersensitivity.
**Dentine Interactions of Hybrid Self-adhesive Composite/GIC Using Advanced Optical Imaging**

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**Objectives** This study compared the micro-shear bond strength (µSBS) and morphological interactions of sound and demineralised dentine to an experimental hybrid composite/GIC material (X) with conventional glass ionomer cement (G) EQUIA® Forte (GC) and Filtek™ Bulk Fill composite (BF) with Scotchbond™ Universal Adhesive (3M).

**Methods**
Sixty molars were randomly distributed into six groups of sound and demineralised dentine (phosphoric acid 37% etched for 1 min.). All samples were bonded with a micro cylinder of three tested materials as per manufactures’ instructions for G, BF and X material. Bond strength was measured at 24hrs and following 4 weeks’ storage in phosphate buffered saline. A further nineteen teeth were used to evaluate microscopically the interaction of the materials with dentine using fluorescence double labelled micro-permeability, fluorescence lifetime and second harmonic generation by two-photon excitation imaging; assessing optical changes before and after storage with the materials. Raman spectroscopy was used to detect the percentage changes in the intensity of the mineral phosphate peak, which were correlated with micro-hardness readings of the same samples.

**Results**
The experimental material (X) showed a significant increase in µSBS compared to (G) EQUIA® Forte (p<0.006). They both showed an improved bond with the etched dentine compared to unetched/sound dentine (p<0.0001). Filtek™ composite (BF) recorded the highest bond strength values amongst all groups (p<0.00001). Storage time didn’t affect the bond strength significantly (p=0.89, 0.78). Good adaptation, no voids and a similar increase in the mineral peaks and hardness were noted with the etched dentine for the G & X groups.

**Conclusions**
Pre-conditioning of the dentine surface may improve the adhesion properties of the experimental material and could enhance dentine wettability and ionic interactions at the interface. Multiphoton fluorescence microscopy is a promising minimally invasive microscopic technique to study the dental tissue/materials interface overtime.
The environmental impact of dental materials: A sociological study
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Objectives To assess the attitudes and opinions of the general public in the UK to potential environmental pollution arising from plastic dental restorative materials. 

Methods A nation-wide omnibus survey of 2015 members of the general public across the UK was commissioned to Ipsos MORI, an independent market research organisation. Questions were designed to determine individual views regarding environmental pollution in three themes; (1) arising from all sources, (2) from healthcare industry and (3) from dental materials. Six stem questions with multiple closed-ended options, explored these themes using an eight-point Likert scale of categorical nominal variables. The questions were designed following a consultation process with a Patient and Public Involvement group. The survey was pre-tested for syntax, readability, understanding and accuracy. Extensive demographic data was collected from the general public survey. A descriptive analysis of the data allowed for an overall perspective on trends within the dataset.

Results (i) Less concern was exhibited for potential pollution from a dental source (55% respondents) compared to that from other industries; cosmetics (66%), construction (75%), farming (76%) and energy production (79%). (ii) Respondents were more concerned with longevity (90%) and low cost (80%) of dental restorations, than their environmental impact (57%). (iii) Trust is placed upon the dental profession to ensure safe environmental credentials of dental materials used (54%). (iv) The concern for potential pollution arising from plastic dental fillings was significant (53%), but less than that of the concern from plastic bags (78%), beads in cosmetics (69%) and fibres from synthetic clothing (55%). (v) Dental amalgam was a significantly greater source of concern (67%) than plastic dental fillings (47%) and other medical prostheses (51%).

Conclusions This survey of the UK population reveals that there is a low awareness and concern of the effect of plastic dental restorative materials on the environment.
The oral microbiome in periodontally healthy rheumatoid arthritis patients
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Objectives The aim of this study was to characterize the RA subgingival biodiversity of periodontally healthy patients, as it has been proposed that oral microbiome might play a role in rheumatoid arthritis (RA) aetiology.

Methods Plaque samples from 41 periodontally healthy volunteers (22 RA and 19 controls) were investigated using 16S-rRNA analysis Ilumina MiSeq platform targeting regions V1-V4 and V7-V9. Bacterial biodiversity and co-occurrence patterns were examined using the QIIME and PhyloToAST pipelines.

Results 558 OTUs were identified from 3,963,291 classifiable sequences, of which 229 differed significantly in abundance and 105 in detection frequency. The subgingival microbiomes differed significantly based on both community membership and as well as the abundance of lineages, with 41.9% of the community differing in abundance and 19% in membership. RA microbiome was characterized by a higher number of anaerobic species (p<0.001) compared to controls. Network analysis revealed that, in contrast to the sparse and predominantly congeneric co-occurrence networks seen in controls, RA microbiome has a highly connected grid containing a large inter-generic hub anchored by known periodontal pathogens. As expected from a periodontally healthy cohort, Porphyromonas gingivalis and Aggregatibacter actinomycetemcomitans were not significantly different between groups, however, Cryptobacterium curtum (priory Eubacterium saburreum), another organism capable of producing large amounts of citrulline, emerged as a powerful discriminant of the RA-influenced microbiome.

Conclusions In summary, our data suggest that rheumatoid arthritis plays a major role in shaping the oral microbiome, enriching this environment for inflammophilic organisms and those capable of producing citrulline.
Unravelling the Association Between the Denture Microbiome and Bacterial Pneumonia

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Objectives Pneumonia predominantly affects the frail elderly, presents diagnostic challenges, and in this vulnerable population bears a high mortality rate. Frequently, sputum or lung fluid samples yield inconclusive microbiologic results, hampering effective treatment. The oral cavity has been implicated as a reservoir for respiratory pathogens, which may cause pneumonia in susceptible individuals. A potential niche for respiratory pathogen colonisation is offered by the biomaterial surfaces of dentures. This study compared the oral and denture microbiomes of two cohorts: care home residents typically considered at-risk of respiratory infection; and hospital patients with confirmed diagnosis of bacterial pneumonia.

Methods This is an ongoing study involving analysis of microbial samples from the dorsal tongue, denture-bearing palate and denture fit-surface of patients using imprint cultures and swabs. Imprints were transferred to blood and selective agars targeting Candida albicans, Staphylococcus aureus and Pseudomonas aeruginosa. Bacterial DNA extracted from swabs was analysed using metataxonomic sequencing of bacterial 16S rRNA genes providing community profiles for each microbiome. Antimicrobial sensitivity profiling of cultured strains is ongoing.

Results To date, C. albicans and S. aureus were found to commonly colonise denture surfaces (results to date indicate 100% and 77% of dentures, respectively) and other oral surfaces. Pseudomonas aeruginosa was isolated from 15% of dentures. However, there was a trend for this bacterium to preferentially colonise denture surfaces compared to other sites.

Conclusions Preliminary results corroborate the growing body of research emphasising that dentures can serve as potential reservoirs for pathogenic microorganisms, which could seed respiratory infections. Sequencing data provides more in depth analysis of the complex interactions in these microbial communities and was supportive of culture based investigations. The findings have the potential to aid early diagnostic and prognostic support in both identifying likely aetiologic bacteria involved in respiratory infection and in subsequent guidance of appropriate antimicrobial therapy.
Assessment of *Lactobacillus plantarum* Biosurfactants to Fight Endodontic Infection

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**Objectives** The inability of current endodontic procedures to prevent/eradicate bacterial biofilms persisting within the root canal complexities comprises a major challenge. It has been reported that tensioactive microbe-derived molecules termed biosurfactant (BS) can exhibit antimicrobial and/or anti-adhesive properties. The aim of this study is to assess the antimicrobial and anti-adhesive abilities of biosurfactant against potential biofilm forming endodontic pathogens.

**Methods** Screening assays identified a potential anti-microbial activity for *Lactobacillus plantarum* following its co-culture with endodontic pathogens within the Streptococcus anginosus group (SAG; *S.anginosus, S.intermedius, S.constellatus*) and *Enterococcus faecalis*. A cell-bound BS was extracted from *L.plantarum* into PBS overnight with constant agitation and partially biochemically and physically characterized. Commercially sourced Rhamnolipid from *Pseudomonas aeruginosa*, was also examined as a proven BS with broad range antimicrobial activity. Effects of BS on growth of endodontic pathogens was performed to determine the minimal inhibitory concentration (MIC). Anti-adhesive activity of BS was determined on glass or acrylic discs. Maximum tolerable concentrations of BS by pulp fibroblasts was determined by trypan blue viability staining.

**Results** Demonstrating biosurfactant properties, *L.plantarum*-derived biosurfactant lowered surface tension of PBS by 17mN/m². Biochemical analysis using SDS-PAGE with silver staining, anthrone assay and Fourier Transform Infra-Red spectroscopy revealed a glycoprotein nature. *L.plantarum* BS demonstrated minimal antimicrobial activity against endodontic pathogens, but at 20mg/mL greatly reduced adhesion of SAG and *E.faecalis*. The maximal tolerable concentration of rhamnolipid by pulp fibroblasts was 0.1mg/mL. At these sub-cytotoxic concentration, rhamnolipid was shown to be bacteriostatic against SAG, but not *E.faecalis* (MIC determined to be 50mg/mL) and showed antiadhesive activity against *S.anginosus* and *S.intermedius*.

**Conclusions** The combined antimicrobial and anti-adhesive activities of the two biosurfactants examined identify them good candidates for consideration as an alternative therapeutic approach for the prevention and/or treatment of root canal infection.
In Vitro Inhibition of Oral Biofilm Development by Stannous Fluoride
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Objectives Multi-species oral biofilms can, under certain conditions, cause dental caries and periodontal disease. Together, these diseases affect an estimated 3.9 billion people worldwide. One potentially effective prevention and control strategy would be to retard biofilm development. The aim of this study was to use a microfluidic system to study the effects of stannous fluoride (SnF₂), a clinically proven plaque and gingivitis active, on the development of multi-species oral biofilms.

Methods A 24-well Bioflux microfluidic system inoculated with pooled saliva from five healthy individuals was used to reproducibly grow oral biofilms using filter-sterilized saliva as media. A protocol was developed to introduce 1,000, 3,439, and 10,000 PPM Sn²⁺, during biofilm development, at 8 and 18 hours post-inoculation. After 22 hours of growth, biofilm was stained with Live/Dead stain and imaged using a confocal laser scanning microscope. Image stacks were analyzed for baseline biofilm characteristics. Stannous treatment groups were compared to corresponding negative controls which include identical formulations without SnF₂.

Results Oral biofilm development was inhibited by 1,000 PPM Sn²⁺ revealing significant effects on biovolume, surface area, and compactness (p<.05) in the second half of the viewing port. Effects were heterogeneous across the viewing port, possibly due to a concentration gradient of bioavailable Sn²⁺ ions. Significant inhibition of biofilm development by 3,439 and 10,000 PPM stannous treatments at 8 and 18 hours post-inoculation resulted in less accumulation of biovolume (p<.001), decreased exposed surface area (p<.001), and decreased biofilm compactness (p<.001) suggesting a dose response.

Conclusions In conclusion, sustained periodic exposure to stannous fluoride inhibited the growth and altered the architecture of in vitro oral biofilms, and show a direct dose response.
Monitoring Destabilization of Oral Biofilms Developed in a Swinnex System
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Objectives Dental plaque is a multispecies biofilm that can cause and promote oral and systemic diseases. The development of robust and reproducible in vitro model systems are essential to study these biofilms and different anti-biofilm strategies. Here, a modified Swinnex-based biofilm model was used to evaluate and quantify the destabilization effects of arginine on salivary biofilms as well as its physicochemical role in inhibiting interbacterial coaggregation.

Methods Biofilms were cultured for 40 h using pooled human saliva and treated with either water, L-arginine (Arg; 50 – 400 mM), L-lysine (Lys; 400 mM), or cetylpyridinium chloride (CPC; 0.075%). Biofilm parameters such as bio-volume, thickness, viability and dispersal rate were captured using confocal microscopy and FlowCam® technology. The biofilms and collected dispersed bacterial aggregates were analyzed using 16S rRNA sequencing for community composition comparisons.

Results After a short exposure with Arg, a dose-dependent reduction in biofilm bio-volume and thickness was observed. Significant biomass reduction was observed for biofilms treated with 400 mM Arg as compared against water and Lys-treated samples. Similarly, increasing the Arg concentrations led to a greater dispersal of bacterial aggregates relative to their size and the number of aggregates that were released from the biofilms. As compared to CPC, no antibacterial effect was observed for either Arg or Lys-treated biofilms. Short-term exposure of the multispecies biofilms with Arg did not significantly alter the biofilm community composition relative to water-treated control. This suggests that the observed physicochemical effect of Arg on biofilms is non-specific, however, Arg can significantly impact the biofilm architecture to promote biofilm destabilization.

Conclusions In conclusion, the Swinnex model allows the study of various aspects of biofilm biology and is particularly useful in studying biofilm dispersion in conjunction with the FlowCam®. Consistent with previously published findings, this work indicates that Arg can destabilize in vitro oral biofilms.
Developing a 3D Oral Mucosal Model for Denture Stomatitis Infection.
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Objectives In vitro three-dimensional oral mucosal models are analogous to the native oral mucosa; reproducible, robust, and adaptable, and therefore suitable for a wide range of applications. The disease denture stomatitis (DS) ranges in severity, and is highly prevalent within upper denture wearers. DS has a multifactorial aetiology, which is not fully understood. Although the fungus Candida albicans is known to be involved, the presence of the bacterium Staphylococcus aureus is clear but its role is uncertain. In order to ascertain the role of S. aureus in DS, a 3D oral mucosal model has been developed to determine the interactions of S. aureus with C. albicans and the mucosa. Laboratory strains of these microorganisms will be compared with clinical samples obtained from patients.

Methods Three dimensional oral mucosal infection models were created in the laboratory using a collagen matrix embedded with human gingival fibroblasts (HuGF), and overlain with HaCaT keratinocytes. Once mature (19 days) these models were used to study single and dual biofilms of clinically relevant C. albicans and S. aureus, obtained from clinical samples taken from swabs of patient’s hard palate and upper dentures. These were analysed using histology, electron microscopy and biochemical assays.

Results Reproducible, keratinised, analogous models of the oral mucosa have been achieved, as confirmed by histology and microscopic studies. Immunological staining has revealed specific cytokeratin expression as well as epithelial proliferation. Cytokine production by the epithelial cells provided further evidence of these models as suitable in vitro infection tools and demonstrating these models are appropriate for dual biofilm infection studies.

Conclusions The 3D models have been developed and exhibited to be suitable for use as oral infection tool; the synergistic effects of dual infection with C. albicans and S. aureus were confirmed.
**055**

**P2X7R genotype affects transglutaminase-2 export: Implications for immune related diseases**

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**Objectives** We aim to elucidate the process by which cells export TG2 in the context of the immune response. Transglutaminase 2 (TG2)-mediated stabilization of extracellular protein assemblies has a pivotal function in tissue repair. However, aberrant TG2 activity has been linked to fibrosis and autoimmunity. TG2 is secreted via an unconventional pathway, which we have shown is linked to purinergic signalling, implicating P2X7 receptor activation. Here, we investigate the relationship between TG2 secretion and inflammasome assembly in innate immune cells.

**Methods** Cell models included macrophages derived from human PBMCs, THP-1 cells and P2X7R-expressing HEK293 cells. TG2/thioredoxin-1 secretion was assessed by Western blotting.

**Results** Gasdermin D is a critical effector of the canonical NLRP3, AIM2 and NAIP-NLRC4 inflammasome pathways, activated by caspase-4/5 and triggering pyroptosis. Appropriate stimulation of human macrophages revealed that TG2 externalization is independent of gasdermin D pore formation, is not linked to inflammasome assembly and occurs in the absence of cell death but relates to ‘membrane pore’ activity of P2X7R. Unlike HEK293-P2X7R cells, TG2 secreted by myeloid cells is a soluble ~66kD truncated form, generated by proteolytic processing, linked to NLRP3 inflammasome assembly. Using pharmacological agents, we show that functional thioredoxin-1 is not required for TG2 secretion per se. The propensity for TG2 secretion differs between individuals (n=18), and sequencing of P2X7R identified candidate polymorphisms explaining these differences.

**Conclusions** This work begins to delineate a mechanism for unconventional protein secretion crucial to innate immunity and shows that it is not part of a pathway triggering cell death. P2X7R polymorphisms affecting membrane pore formation may affect the extracellular levels of TG2 secreted via this pathway. This was confirmed here in a small cohort study analysing the response in primary macrophages. The resulting intrinsic differences in TG2-mediated protein modifications are likely affecting the inflammatory response in pathology, and this is currently under investigation.
Antifungal Potential of Essential Oils and Development of an Ex Vivo Model for Oral Candidosis
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Objectives This study has two main aims. Firstly, the antifungal activity of a range of essential oils (14), chlorhexidine and triclosan were evaluated against C. albicans under planktonic and biofilm conditions. Secondly, an ex vivo rodent mandible model to mimic oral candidosis was developed in order to investigate the antimicrobial properties of the successful compound.

Methods Antifungal properties were determined using a microtitre plate assay. In vitro biofilms were constructed using 96-well plates and exposed to a range of antimicrobial concentrations. The minimum biofilm eradication concentrations (MBECs) were established by examining subsequent re-growth of biofilm cells. Results were compared with the minimum inhibitory concentrations (MICs) obtained for planktonic cells cultured in 96-wells plates. The ex vivo rodent mandible model was obtained by dissecting the mandible from a 28-day-old male Wistar rat and infecting it with C. albicans. Candida growth was monitored through histological examination and image analysis after incubation for 24 and 48 hours, whilst host tissue response was assessed by cytokine expression through RT-PCR.

Results In the planktonic form, all the compounds tested showed Candida specific antimicrobial potential with MICs ranging from 0.002% (v/v) to 0.638% (v/v). There was also a noticeable increase in resistance in pre-formed biofilms (MBECs > 0.068% (v/v)). The infection of the rodent mandible showed Candida invasion of the gingiva and the release of pro-inflammatory cytokines (TNF, IL1, and IL6).

Conclusions Despite an increase in resistance against pre-formed biofilms, this study showed that essential oils are promising agents to be used against oral candidosis, being able to inhibit Candida growth in the planktonic form. In addition, the development of an ex-vivo rodent mandible model allowed testing the antifungal properties of a variety of essential oils in a system that better mimics the in vivo conditions (e.g. tissue organization, penetration of the microorganisms into the tissues and host response).
Periodontal inflammatory burden in patients with Type 1 Diabetes Mellitus
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**Objectives** 1. To determine whether the Periodontal Inflamed Surface Area is higher in patients suffering from type 1 diabetes Mellitus (T1DM) compared with controls (NDS). 2. To determine whether poorly controlled T1DM (PCD) have a higher PISA than well-controlled T1DM (WCD) and non-diabetic subjects (NDS). 3. To determine the relationship between PISA and inflammatory biomarkers in plasma in NDS and T1DM.

**Methods** Type 1 diabetes mellitus patients, aged 20-55 years, were recruited from 5 hospitals at Glasgow. Control subjects were recruited from physiotherapy clinics, through an advertisement in a free newspaper and using the buddy system with the cases patients. Current smokers were excluded in the study. Full periodontal examination was carried out, PPD, CAL, BOP and gingival margin was recorded. PISA was calculated through these periodontal parameters using a modified excel PISA calculation spreadsheet. Blood samples from patients were taken to obtain inflammatory biomarker in order to associate them with PISA.

**Results** There were 89 NDS and 159 T1DM which they were sub grouped accordingly to glycated haemoglobin level in 30 WCD (IFCC≤ 58.5 mmol/mol) and 129 PCD (IFCC >58.5 mmol/mol). PISA was highly significant correlated with periodontal parameters CAL mean, PPD mean and HbA1c (p< 0.001). PISA was significantly higher in T1DM compared with NDS (p=0.002). PISA was increased between NDS and PCD and PCD and WCD but there were no differences between WCD and NDS (p<0.001). PISA only correlated with a small number of the inflammatory markers measured.

**Conclusions** PISA gives an excellent measure of the localised inflammatory burden in the mouth caused by gingivitis and periodontitis. PISA correlated with other periodontal measurements and was related to poor glycaemic control in T1DM subjects. More work is required to determine the relationship between PISA and circulating plasma levels of inflammatory biomarkers related to systemic health such as T1DM.
**In vitro** analysis of Keratin K2 function in protecting against carcinogenesis

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**Objectives** Keratin K2 is an important marker of terminal differentiation in oral epithelium. K2 is also upregulated in pre-cancerous lesions of the oral cavity which is believed to be a protective mechanism to prevent carcinogenesis. For keratinocytes, undergoing terminal differentiation is an essential process to prevent carcinogenesis as cancer requires cells to be immortalised and able to proliferate uncontrollably, both of which are fundamentally incompatible with terminal differentiation. We have developed an **in vitro** model to study the function of K2 in keratinocytes which will provide insights into K2’s role in protection against carcinogenesis.

**Methods** Full-length K2 cDNA was cloned in a retroviral vector and expressed as a fusion protein on which two tags, AcGFP or 3x Flag, were fused in-frame at the N-terminus. The recombinant retroviruses were transduced in MCF7 cells that express only K8/K18/K19, but no K2 or its type 1 partner K10. Immunostaining and live cell imaging were performed to investigate the behaviour of K2 in MCF7 cells. For comparison the endogenous expression of K2 was investigated in 2-D and 3-D cultures of HaCaT, IHOK and SVpgC2 cells using immunocytochemistry.

**Results** Keratin K2 was completely incorporated into the pre-existing keratin network of MCF7 cell line. When treated with phosphatase inhibitors (okadaic acid and calyculin A) K2 containing filaments broke down due to the increased phosphorylation. The K2 tagged with AcGFP at the N-terminus disintegrated at a much lower concentration of the drugs than FLAG tagged K2. K2 expression in 3D cultures showed low level induction in differentiating keratinocytes.

**Conclusions** K2 was able to integrate into the pre-existing cytoskeletal network of MCF7 cells, which is fundamental for its function. As the larger molecular tag (AcGFP) at the N-terminus destabilised the network more than the smaller tag (FLAG) this suggests a role for the K2 N-terminus in filament stabilisation and a potential mechanism by which the carcinogenesis process can bypass the protective effects of K2 upregulation in pre-cancer. Further investigation is required to fully understand the protective effect of K2 against carcinogenesis.
P16 IHC is Insufficient for Assessment of HPV Status in Oral Dysplasia
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Objectives Previous studies have reported the presence of transcriptionally active high-risk Human Papillomavirus (HR-HPV) in a subtype of oral epithelial dysplasia. HPV status was assessed by previous authors using p16 immunohistochemistry (IHC) and HR-HPV in-situ hybridization (ISH), however, the clinical implications of this are not known. This study aimed to assess the sensitivity and specificity of p16 IHC alone for the detection of HR-HPV infection in oral severely dysplastic lesions, using ISH as the gold standard. Furthermore, we undertook immunohistochemical analysis to study the viral life cycle within these lesions.

Methods A retrospective cohort of thirty-seven cases of oral severe dysplastic lesions biopsied at Sheffield Teaching Hospital NHS Trust from 2011 to 2016 was established, with matched clinicopathological data and detailed histological features. Sections were subjected to p16, MCM2 and E4 IHC and HPV RNA-ISH and were assessed semiquantitatively. Statistical analysis was performed using SPSS, with p<0.05 considered significant.

Results 29.7% (n=11/37) of cases were HPV RNA-ISH positive. The HPV-positive group was significantly younger than HPV-negative group (57± 11.3, 69 ± 11.7, p<0.05), and predominantly affected lateral tongue and buccal mucosa (3 cases each). Lack of p16 expression was predictive of HPV-negative status, but overall sensitivity (63.6%) and specificity (77%) against the reference test were low. Histologically, RNA-ISH positive cases demonstrated typical changes of a viral aetiology, however, these were not statistically different from uninfected dysplasia. Expression of HPV-E4 was noted in surface keratinocytes in 4/11 (36%) of HPV-positive cases, indicative of productive HPV infection.

Conclusions This study highlights the importance of establishing a reliable diagnostic test for HPV infection in oral severe dysplastic lesions. p16 is not a definitive marker for HPV infection in dysplastic oral mucosa and histologic features are an inaccurate method of assessing viral infection.
Brushing with Toothpaste Containing 5% CSPS Reduces Dental Plaque

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Objectives To evaluate the effectiveness in controlling plaque of a toothpaste containing 5% calcium sodium phosphosilicate (CSPS).

Methods A 4-week, randomised (stratified by baseline plaque score), controlled, examiner-blind, parallel-group clinical study was conducted in healthy adults with a mean Turesky Plaque Index (TPI) score ≥2.0 (assessed at baseline, 24 hours after last oral hygiene). Eligible subjects were randomised to: (i) an experimental toothpaste containing 5% CSPS and cocamidopropyl betaine/sodium methyl cocoyl taurate (CAPB/SMCT) (relative dentine abrasivity [RDA] ~160; 927 ppm fluoride as sodium monofluorophosphate [SMFP]); (ii) a 0% CSPS, CAPB/SMCT toothpaste (RDA ~150; 927 ppm fluoride as SMFP); or (iii) a regular fluoride/sodium lauryl sulphate toothpaste (negative control; RDA ~90; 1450 ppm fluoride as sodium fluoride). They were instructed to brush with their allocated toothpaste twice daily for 4 weeks. Supra-gingival plaque (TPI) was re-assessed after 2 and 4 weeks of treatment, and before and after single brushings carried out at the baseline and Week 4 visits.

Results A total of 168 subjects were included in the intent-to-treat analysis population. At Week 4 (primary endpoint), all study treatments demonstrated small but statistically significant reductions from baseline in mean TPI scores (p<0.05); no statistically significant between-treatment differences were detected. All treatments showed statistically significant within-treatment reductions in TPI scores after a single brushing (p<0.0001, baseline and Week 4), with only one statistically significant between-treatment difference detected (in favour of placebo; p<0.0474, Week 4 only). Study treatments were generally well tolerated.

Conclusions Brushing with a toothpaste containing 5% CSPS reduced supra-gingival plaque levels and provided plaque-removal efficacy comparable with that of an abrasivity-matched placebo and a regular fluoride toothpaste.
Choice of Toothpaste Surfactant System Influences Plaque Regrowth

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Objectives To evaluate the efficacy of an experimental toothpaste containing 5% (w/w) calcium sodium phosphosilicate (CSPS) and a modified surfactant system in preventing 24-hour plaque regrowth.

Methods Two sequential exploratory, randomised, controlled, four-treatment, four-period crossover, single-use (on clean and non-clean tooth surfaces), examiner-blind studies were conducted in healthy adult subjects with individual mean whole-mouth Turesky Plaque Index (TPI) scores ≥2.0. In both studies, the experimental toothpaste contained 5% (w/w) CSPS, 927 ppm fluoride as sodium monofluorophosphate (SMFP) and a cocamidopropyl betaine/sodium methyl cocoyl taurate (CAPB/SMCT) surfactant system (relative dentine abrasivity [RDA] ~160). Efficacy was compared with that of: (i) two marketed comparator toothpastes (both 5% CSPS, 1426 ppm fluoride as SMFP, sodium lauryl sulphate [SLS] surfactant [one with RDA ~100 in both studies; one with RDA ~140 in Study 2]); (ii) a placebo toothpaste (0% CSPS, 927 ppm fluoride as SMFP, CAPB/SMCT surfactant; RDA ~150) (Study 1); and (iii) a marketed control toothpaste (1450 ppm fluoride as NaF, SLS surfactant, RDA ~90) (both studies). Following supragingival prophylaxis, subjects brushed with the study toothpastes on two occasions per treatment period to evaluate efficacy on clean tooth surfaces on Day 1, non-clean surfaces on Day 2. Plaque regrowth was measured 24 hours after each brushing using the TPI and Gingival Margin Plaque Index.

Results Overall, 37 subjects in Study 1 and 36 subjects in Study 2 were included in the efficacy (intent-to-treat) and safety populations. In both studies, plaque regrowth after 24 hours was consistently lower (statistically significant differences or numerical trends depending on measure and comparison) for the SLS-containing toothpastes compared with the CAPB/SMCT-containing toothpastes, on both clean and non-clean tooth surfaces, with both plaque measures. Treatments were generally well tolerated.

Conclusions The SLS surfactant system appears to contribute to the slowing of plaque regrowth after brushing with CSPS-containing toothpastes.
Reducing Dentinal Hypersensitivity Improves Oral Health-Related Quality of Life
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Objectives To investigate the impact of long-term management of dentine hypersensitivity (DH) on oral hygiene and oral health-related quality of life (OHRQoL).

Methods This was a 24-week, non-comparative, exploratory, clinical study conducted in healthy adults with clinically confirmed dentine hypersensitivity. Subjects brushed twice daily for 24 weeks with an anti-hypersensitivity toothpaste containing 5% calcium sodium phosphosilicate (CSPS) and 1426 ppm fluoride as sodium monofluorophosphate. DH was assessed at intervals over the study period in response to an evaporative (air) stimulus (Schiff sensitivity score; Labelled Magnitude Scales for Intensity, Duration, Tolerability and Description of sensation; number of sensitive teeth) and a tactile (Yeaple probe) stimulus. Supra-gingival plaque and gingival health were monitored using the Turesky Plaque Index (TPI) and the Modified Gingival Index (MGI), respectively. Subject-perceived OHRQoL was evaluated using the Dentine Hypersensitivity Experience Questionnaire (DHEQ).

Results Seventy-five subjects were included in the safety and intent-to-treat analysis populations. All sensitivity measures demonstrated ongoing reductions in DH compared with baseline over the 24-week treatment period. Mean TPI scores decreased for sensitive teeth, and were lower than the mean whole-mouth scores, throughout the study; MGI scores were unchanged. All DHEQ measures, with the exception of the global oral health rating, demonstrated ongoing improvements in OHRQoL across the extended study period. Improvements in DH were statistically significantly (p<0.05) correlated with improvements in DHEQ measures for a number of DHEQ summary measures and DH measures. No correlations were seen between changes in DH and plaque accumulation. The study treatment was generally well tolerated.

Conclusions Twice-daily brushing with a 5% CSPS toothpaste reduced DH across the 24-week study period. The ongoing, clinically significant improvements in DH were associated with improved OHRQoL. The results did not indicate a relationship between DH and oral hygiene.
CSPS Toothpaste Does Not Consistently Improve Gingival Health Versus Placebo
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Objectives To evaluate the effectiveness of toothpastes containing 5% calcium sodium phosphosilicate (CSPS) in controlling plaque and gingivitis.

Methods Two sequential 12-week, randomised (stratified by baseline Gingival Index [GI] score), controlled, examiner-blind, parallel-group studies were conducted in healthy subjects with mild–severe gingivitis and plaque accumulation. Study 1: 331 subjects were randomised to (i) a 5% CSPS/sodium lauryl sulphate (SLS) toothpaste (relative dentine abrasivity [RDA] ~140); (ii) a 0% CSPS/SLS placebo (RDA ~131); or (iii) a negative control (silica, SLS; 923 ppm fluoride as NaF; RDA ~90). Study 2: 254 subjects were randomised to (i) a 5% CSPS/SLS toothpaste (RDA ~140); (ii) a 5% CSPS/SLS toothpaste (RDA ~100); (iii) a 5% CSPS toothpaste with cocamidopropyl betaine/sodium methyl cocoyl taurate (RDA ~100); (iv) a 0% CSPS/SLS placebo (RDA ~100); or (v) Study 1 negative control. All experimental and placebo toothpastes contained 927 ppm fluoride as sodium monofluorophosphate. Subjects brushed their teeth for 1 minute using the allocated toothpaste twice daily. After 6 and 12 weeks, gingival health was assessed using the GI and the Gingival Severity Index (GSI); plaque was assessed using the Turesky Plaque Index (TPI).

Results Study 1: mean GI, GSI and TPI scores were statistically significantly in favour of the 5% CSPS/SLS toothpaste compared with placebo and negative-control toothpastes at both 6 and 12 weeks (all p<0.05). Study 2: the mean TPI score at Week 12 was significantly improved for the negative-control toothpaste compared with the 5% CSPS/SLS toothpaste (RDA ~100) (p<0.01); no other significant between-treatment differences were observed in TPI, GI or GSI scores. All treatments were generally well tolerated.

Conclusions While in Study 1 the 5% CSPS-containing toothpaste demonstrated an advantage in maintaining gingival health over a non-CSPS toothpaste, this was not repeated with the three similar 5% CSPS-containing toothpastes in Study 2.
Daily Brushing with Toothpastes Helps Maintain Gingival Health
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Objectives To evaluate the effectiveness of 5% calcium sodium phosphosilicate (CSPS) toothpastes in maintaining gingival health and controlling dental plaque.

Methods Two sequential, 12-week, randomised (stratified by Modified Gingival Index [MGI] score), controlled, examiner-blind, parallel group studies were conducted in adults with a mean screening MGI score 1.50–2.50, who showed gingival health improvement following prophylaxis and 2 weeks rigorous oral hygiene. Eligible subjects were randomised to study toothpastes. Study 1: (i) 5% CSPS with cocoamidopropyl betaine/sodium methyl cocoyl taurate (CAPB/SMCT) (relative dentine abrasivity [RDA]~160); (ii) 0% CSPS/[CAPB/SMCT] (placebo; RDA~150) or (iii) 923 ppm fluoride as NaF/sodium lauryl sulphate [SLS] (negative control; RDA~90). Study 2: (i) 5% CSPS/SLS (RDA~140); (ii) 5% CSPS/SLS (RDA~100); (iii) 5% CSPS/[CAPB/SMCT] (RDA~100) or (iv) 0% CSPS/SLS (placebo; RDA~100) or v) Study 1 negative control. Study 1 toothpastes (i) and (ii) and all Study 2 toothpastes contained 927 ppm fluoride as sodium monofluorophosphate. Subjects brushed twice daily for 12 weeks. Gingival health and supra-gingival plaque were assessed after 6 and 12 weeks (MGI, Bleeding Index [BI] and Turesky Plaque Index [TPI]).

Results 148/253 subjects in Study 1/Study 2 formed the intent-to-treat populations. Following prophylaxis, twice daily brushing with all study toothpastes helped maintain gingival health over 12 weeks in both studies, with only small changes in MGI, BI and TPI scores compared with baseline. Overall, observed differences between treatments were small, with few statistically significant (p<0.05) differences. Toothpastes were generally well tolerated. Some instances of ‘oral discomfort’ were reported in both studies, mainly by subjects using CSPS/placebo toothpastes. Non-aqueous formulations are known to produce warming/heating sensations. No oral pathologies were noted in most cases.

Conclusions Daily brushing with all toothpastes helped maintain gingival health for 12 weeks following prophylaxis. Few between-treatment differences were reported; the 5% CSPS toothpastes provided only comparable benefits to placebo and negative-control.
Magnification Loupes Improve Accuracy of Stain and Plaque Assessments.
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Objectives It has been shown that Loupes can improve Fleiss Cohen Kappa (K) scores and Perfect Agreement (PA) in the MGI assessment. A study was conducted to investigate if this improvement would be replicated in plaque and stain assessments with and without loupes.

Methods Calibration exercises were performed on the Quiqley and Hein plaque assessment (Lobene Modification, LP) and the Lobene Stain assessment (Macpherson modification, MS) using healthy volunteers (n =10). LP and MS were performed by a single experienced calibrated assessor. 2.5x magnification Galilean loupes were used. Assessments were performed without loupes on LP and MS and repeated after 10 minutes. This process was repeated with the use of loupes. K was used to assess intra-examiner reproducibility with and without loupes.

Results MS: Mean intensity and area scores increased with the use of loupes compared to without (≈ 1.52 to ≈ 1.64 ).
K changed in both intensity and area from “substantial agreement” (0.77) without loupes to “almost perfect agreement” (0.84) with loupes.
The level of PA was high for both with and without loupes, with a slight improvement in the level of PA in the “with loupes” group. With loupes versus without loupes there were a higher number of 1s scored compared to 0s.
LP: The results suggest very little difference in the mean plaque scores with and without loupes.(≈ 3.40) There was a very high level of K for assessments both with and without loupes. (≈ 0.89) PA increased with the use of loupes. (79.2% to 82.5%)

Conclusions With the use of loupes, mean values for MS increased, reflecting the ability to discern faint stain with loupes. There was a higher K and PA for both indices with the aid of loupes, suggesting greater accuracy in both indices.
Evaluating a Novel Hypersensitivity Relieve Gel Being Applied Before Bleaching
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Objectives Curodont™ D’Senz is a new desensitizer based on a self-assembling peptide matrix, which is applied prior to bleaching to the tooth surface. The self-assembling peptide matrix could hypothetically act as a diffusion barrier or could interact with the oxidizing agent. Both hypothetical interactions could affect the bleaching outcome. This in-vitro experiment aimed to determine a possible influence of the desensitizer Curodont™ D’Senz on the efficacy of tooth bleaching.

Methods 20 bovine lower incisors were randomly selected and divided into two groups (n=10). They were stained with a standardized solution (tea-coffee-soy-source-extract) for 72 h. Two bleaching agents (at-home and in-office version) were used. According to manufacturers' instructions, the 16% carbamide peroxide agent (Ultradent 16% PF, Ultradent Products, USA) (group 1) was applied for 5 hours a day for 5 consecutive days and the 40% hydrogen peroxide agent (Ultradent Boost) (group 2) was applied two times (20 minutes each). Before each application a sellotape was used to separate treatment and control side (= split-tooth-design). The desensitiser D’Senz (Credentis, Switzerland) was then applied to the treatment side. The colour-matching device Vita Easyshade 3.0 (Vita Zahnfabrik, Germany) was used to record the L*a*b* values. Each tooth sample was measured at two points (control side and treatment side) before (t0) and after 24h water storage (t1) after bleaching. These values were then used to calculate the colour difference (ΔE) between t0 and t1 for each treatment condition utilising the Euclidian distance. In order to statistically evaluate the effects of D’Senz on bleaching, a null hypothesis significance testing (NHST) was conducted using the Welch Two Sample t-test.

Results The mean colour differences in the two treatment groups were 10.3 (Ultradent 16% PF) and 8.99 (Ultradent 40%), whereas the colour changes in the control groups were 9.49 and 9.31 respectively. Based on the Welch Two Sample t-test, the data showed no significant differences (p < 0.05) between control and treatment side - neither in group 1 nor in group 2.

Conclusions The results indicate that there is no statistically significant reduction in the effectiveness of the two bleaching agents in terms of tooth whitening when applying D’Senz prior to bleaching.
E-cadherin Inhibition Effects on Oral Squamous Cell Carcinoma Metastatic Genes
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**Objectives** Oral Squamous Cell Carcinoma (OSCC) is an invasive multistage process malignancy that affects the oral stratified squamous epithelial cells. It is associated with high death rates worldwide. E-cadherin protein is an important marker of epithelial tissue and it is one of the key regulators of tissue integrity and polarity. Generally, the effect of E-cadherin protein down regulation in tumour progression is well known to affect overall prognosis of cancer patients. This down regulation might have a role in metastatic process of the cancer which require assessing the Epithelial-Mesenchymal Transition genes (EMT) that initiate this process.

**Methods** Mouse Embryonic Stem cells (mESCs) were used as a model of epithelial tissue to study the effect of E-cadherin inhibition in regulation of EMT genes and compared to E-cadherin knock out mESCs (E-cad/-/- mESCs). Microarray analysis and Chromatin immunoprecipitation ChIP-seq were done and results were assessed using Cytoscape Network modelling programme (ModuLand) and the UCSC genome browser respectively. Methylation sequencing was done for these cells to assess the methylated promotor areas for genes of interest.

**Results** The Microarray has shown several thousand transcripts alterations which govern a number of biological processes and Histone acetyltransferases EP300 was identified as putative key central regulatory factor in network modelling. Therefore, EP300 and Histone H3 (H3K27ac) antibodies ChIP-seq was done to determine how transcription factors influence phenotype-affecting mechanisms. Methylation sequencing revealed a significant difference between mESCs and Ecad/-/- mESCs.

**Conclusions** The inhibition of E-cadherin protein causes wide alteration of some EMT genes and changing of the binding sites of EP300 and H3K27ac to these genes between mESC and E-cad/-/- mESC. In addition, this inhibition affects the methylation of promotor areas of some EMT genes. The key targets from microarray, ChIP-seq and methylation sequencing need to be further validated and investigated on mESC model and OSCC tissue sections.
Mesenchymal Cell Function in Salivary Gland Regeneration.
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Objectives Mesenchymal cells (MCs) are important during tissue developmental and regeneration, as well as disease progression. MCs are prevalent in developing and adult salivary glands. However, their roles in salivary gland diseases such as Primary Sjogren’s Syndrome (PSS) have not been investigated. In this research, we aimed to identify how MCs are modified during the disease state and explored ways to model this disease in vitro.

Methods Immunofluorescence analysis was used to establish an in vivo panel of markers in mice and human salivary gland tissues. Real Time PCR analysis and flow cytometry confirmed cell phenotypes in in vitro models. Cell growth was evaluated using colonigenic growth analysis. Matrigel aided development of a spheroid model was also applied. Analysing human clinical PSS samples involved immunofluorescence and laser capturing microdissection to obtain RNA and protein samples.

Results The following are MCs markers for in vivo and in vitro cell phenotypes: Vimentin, CD29, and PDFGRb. The 3D spheroids demonstrated that the addition of mesenchymal cells to epithelial cells greatly enhanced the developed structures until functional stages. It was also shown that mesenchymal cells from human PSS samples produced less developed spheroids than healthy controls. The key molecular pathways were functionally analysed.

Conclusions We have shown that the mesenchymal cells do play an important role in the development and morphology of the salivary glands and are significantly affected during PSS in human patients. The cells are able to cross talk with epithelial cells in tissue regeneration and disease initiation and progression. We hope that our study will enhance our current understanding of the disease and deliver potential ways to recover the tissue to its normal biology.
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Mesenchymal stem cell heterogeneity regulates incisor growth in vivo

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Objectives The study investigates molecular heterogeneity within an MSC (mesenchymal stem cells) niche in vivo. MSC sub-populations of the dental pulp and their origins are studied using genetic lineage tracing. Specifically, the role of a Thy1 (CD90) sub-population is studied in development, homeostasis and following simulation of increased growth.

Methods Contribution of Thy-1 to dental pulp stem cells was studied with single, double and multicolour lineage tracing reporter mice. Tissue sections were immunostained and imaged using confocal microscopy. Detection and quantification of Thy-1 expressing MSCs was done using flow cytometry. Clipping of incisors was used to monitor growth rate and changes in contribution of MSCs to dental pulp cells and odontoblasts.

Results Thy1-positive MSCs contribute to about a third of dental pulp cells and odontoblasts during development. In adulthood, when tissue homeostasis is established, the numbers of Thy1-derived cells significantly decrease. When incisors are clipped, their growth accelerates to re-establish tooth length, the number of proliferating cells doubles compared to intact incisors and mitotic cells are found in the most proximal, quiescent-cell residing area of the incisor, resulting in expansion of Thy1-positive MSCs and increased contribution to cell differentiation.

Conclusions Thy1-positive MSCs are a sub-population specific for rapid growth which replenishes by mobilisation of a quiescent cell population. These results provide insights for understanding behaviour of MSCs within the niche and have implications for developing clinical regenerative solutions harnessing potential of endogenous stem cells by targeting specific stem cell populations to accelerate growth and repair.
Objectives Human dental pulp progenitor cells (DPPCs) are considered viable mesenchymal stem cell source for regenerative medicine, being accessible with multi-lineage differentiation potential. However, distinct variations exist in their proliferative and regenerative capabilities (>80PDs vs <40PDs), as a consequence of contrasting telomere lengths (>18kb vs 5-13kb). DPPCs are negative for human telomerase which implies that other mechanisms maintain telomere lengths in highly proliferative DPPCs. As oxidative stress is well-established to induce cellular senescence, this study examined whether proliferative/regenerative differences are due to contrasting oxidative stress susceptibilities between DPPC populations.

Methods DPPCs were isolated from human wisdom tooth pulp tissue by collagenase/dispase digestion and fibronectin adhesion; and maintained in sublethal H₂O₂ (0-200µM) throughout their proliferative lifespans. PDs and stem cell marker expression were assessed. Cellular senescence was confirmed by senescence associated-β-galactosidase staining, senescence marker (p53, p21^waf1, p16^INK4a) expression; and telomere restriction fragment length analysis. The extent of oxidative stress-induced DNA, protein and lipid damage in DPPC populations were assessed by immunocytochemistry.

Results Distinct differences in oxidative stress-induced senescence were identified between individual DPPC populations. Low proliferative DPPCs underwent accelerated senescence in a dose-dependent manner (<40PDs). In contrast, highly proliferative DPPCs exhibited resistance to H₂O₂-induced senescence, reaching 80PDs (0-50µM H₂O₂) or 60-70PDs (100-200µM H₂O₂). Findings were confirmed by senescence marker analysis, although few changes in stem cell marker expression were identified. Susceptibility of low proliferative DPPCs to early-onset senescence was accompanied by increased oxidative stress-induced biomarker detection especially at 100-200µM H₂O₂; whilst highly proliferative DPPCs only exhibited equivalent oxidative damage at much later PDs.

Conclusions Significant variations exist in the susceptibilities of DPPCs to oxidative stress-induced senescence and biomolecular damage, suggesting potential differences in antioxidant status between DPPC populations. Future investigations will assess antioxidant activities within these populations.
Comparison of Secretomes Derived from Periodontal Ligament and Bone Marrow Mesenchymal Stem Cells
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Objectives The secretome comprises a broad spectrum of molecules secreted by cells and plays a pivotal role in autocrine and paracrine cell-cell signalling and regulation of tissue responses. This study aimed at investigating the effect of culture conditions on production and bioactivity of secretomes from periodontal ligament stem cells (PDLSCs) and bone marrow mesenchymal stem cells (BMSCs) as well as the influence of timing of collection and filtration.

Methods Rat PDLSCs and BMSCs at passages 3-4 were cultured in hypoxia (2% oxygen) or normoxia (21% oxygen) for 2 or 3 days in serum-free α-MEM media. The conditioned media (CM) were collected and centrifuged at 200g to remove cellular debris. Half of the samples were filtered (0.22µm pore) and all samples were stored in -80°C before analysis. The bioactivity of the CM was analysed for alkaline phosphatase (ALP) stimulatory activity in pre-osteoblasts (MC3T3) following treatment with the CMs. CM growth factor levels, including VEGF, TGF-β1 and IGF-1, were determined using commercially available ELISA kits.

Results ALP activity was enhanced when pre-osteoblast cells were incubated with unfiltered CM from cells cultured under hypoxia. Hypoxic incubation resulted in significantly increased production of VEGF and TGF-β1 by both PDLSCs and BMSCs especially on day 3 of CM collection. Filtration reduced the level of TGF-β1, VEGF and IGF-1 in PDLSC CMs and TGF-β1 in BMSC CMs compared with unfiltered samples. In general, BMSCs produced significantly higher levels of VEGF and TGF-β1 compared with PDLSCs.

Conclusions Data indicate differences in secretome composition derived from BMSCs and PDLSCs. Moreover, the different culture conditions and filtration approaches affected content of the MSC secretomes. Further work is warranted to determine detailed protein and bioactivity profiles of the different secretomes and to establish optimal, biologically effective secretomes which may be harnessed therapeutically to promote tissue repair.
Mechanical strain affects mesenchymal stem cell fate
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Objectives Mesenchymal stem cells (MSCs) are able to differentiate into a multitude of cell types in adult tissue, including the osteoblasts of bone. The activation and differentiation of these stem cells is controlled by specific cues which may be molecular or mechanical. Cells are subjected to mechanical strain as a part of normal biological processes as well as by external intervention, such as in tooth movement for orthodontic purposes. However, much is still unknown of the mechanisms involved in MSC activation following exposure to mechanical strain. This study aimed to elucidate the molecular mechanisms involved in MSCs differentiation down the osteogenic lineage, on exposure to mechanical strain.

Methods Rat mandible sections at various stages of tooth movement were analysed for their expression of osteogenesis and autophagy marker genes using immunofluorescence analysis. In vitro, MSCs derived from human bone marrow were exposed to constant tensile strain at different time points and analysed for the expression of molecules involved in osteogenesis and autophagy, using real time RT-PCR and western blotting. The autophagy status was chemically modulated using specific inhibitors or activators. Key autophagy genes were silenced using a tetracycline controlled system.

Results Osteogenesis marker genes, RUNX2 and DMP1, were expressed around the periodontal ligament and alveolar bone in the area of the teeth exposed to tensile strain, where LC3 positive autophagosomes also accumulated. The osteogenic marker expression in MSCs exposed to strain is controlled by the autophagy pathway, and linked with intracellular autophagosome status.

Conclusions Our data suggests that constant tensile strain can cause MSC activation and osteogenic differentiation, when autophagy is modulated.
DPSC Derived Neurons Functionally Express Sensory Neuron Specific Receptor (MRGX1).
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Objectives
To use human dental pulp stem cells (hDPSCs) to derive functionally active nerve cells as an alternative, more directly human relevant in vitro model system. This system will be used to determine functional expression of sensory neuron specific receptor MRGX1.

Methods
Neurons were characterised by expression of specific neuronal markers using immunohistochemistry (IHC) and functionally with patch clamp recordings. Protein and gene expression of TRP channels and MRGX1 in neurons were determined using IHC and quantitative polymerase chain reaction (qPCR) respectively. Receptor-channel functionality was assessed using calcium imaging.

Results
IHC showed that both TRP channels and MRGX1 co-localise at protein level. qPCR confirmed gene expression of both TRP channels and MRGX1 in neurons, although MRGX1 expression was relatively low. Calcium imaging demonstrated TRP channels to be functionally active in neurons in response to full agonists. MRGX1 was also shown to be functional in response to enkephalin fragment – bovine adrenal medulla (BAM8-22).

Conclusions
TRP channels and MRGX1 are expressed and functional in neurons derived from hDPSCs at a molecular level. Future work will determine if their expression and function are affected by injury and inflammation.
What are the reasons why patients may consult a general medical practitioner when experiencing a dental problem? A systematic review.

Cope, A. L., Butt, K. G., Chestnutt, I.

Objectives To describe barriers to accessing dental care and factors influencing patients’ choice of healthcare provider for dental problems in the United Kingdom.

Methods A systematic literature search was performed in Embase, MEDLINE, PsycINFO and OpenGrey databases. Quantitative, qualitative, and mixed-methods studies of dental service users were eligible for inclusion, as was evidence from the grey literature. Only UK studies were eligible and the search was limited to English language articles. One author assessed the search results and selected eligible studies. Two authors then independently extracted data, one also appraising the study quality. Findings from papers were grouped into the themes according to the conceptual framework of access to health care proposed by Levesque et al. (2013).

Results The evidence synthesis included 27 observational, 17 qualitative, and 3 mixed-methods studies. Most identified one or more barriers to accessing dental care, whilst a minority highlighted factors influencing patients’ choice of healthcare provider for dental problems. The themes regarding access to dental care and factors affecting care seeking behaviours that emerged most frequently were: availability and accommodation in primary dental care; appropriateness of care provided; and patients’ ability to engage with care. Many studies had weaknesses with regard to either their conduct or reporting.

Conclusions The process of seeking care for dental problems is influenced by both the beliefs and attitudes of the patient, and the organisation and attributes of those providing care. There is a substantial body of research relating to the barriers patients encounter when attempting to access dental care. However, whilst there are indications that willingness to pay and perception of clinicians’ scope of practice may influence choice of practitioner for orofacial symptoms, there are few studies that have specifically addressed the reasons why patients may consult a general medical practitioner rather than a dentist when experiencing dental problems.
Dental Decision Making Influencing Factors. A Systematic Map.
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Objectives Clinical decision making is a complex phenomenon. Studies have shown variation in decision making amongst dentists. The aim of this systematic mapping review was to a) categorise studies describing dental decision making, b) identify decision making models in dentistry and c) classify decision making factors explored in empirical research.

Methods A systematic search of the healthcare, psychological and grey literature was performed across multiple electronic databases. Citations were screened for relevance by two independent reviewers. Classification of the included studies was performed by two reviewers after discussion and consensus. The extraction of the explored factors was performed by a single reviewer and checked by another. Any disagreements were resolved by discussion. A third of reviewer was consulted when consensus was not reached.

Results The searches retrieved 15,819 citations. After de-duplication, 12,677 articles were assessed for relevance. 259 studies were included in the systematic map. The included studies were categorised in the following four broad categories: a) Theoretical papers. b) Experimental studies, c) Studies on dentists’ perception and d) Real-life studies. From those, the experimental studies (b) which used a clinical scenario or case (vignette or clinical radiograph or photograph) were read in full and the factors which were evaluated were extracted. These were subsequently classified as i) dentist related factors, ii) patient related factors, iii) health related factors and iv) system/environmental related factors. The same strategy was followed for studies which explored the dentists’ self-perceived factors (c). Commonalities and discrepancies between data from b and c studies were noted.

Conclusions This review, adopting a systematic approach identified factors that perceived as influential in dentists’ decisions but they have not been evaluated in empirical research. This mapping review will inform the conduct of future empirical studies in this field.
Leadership, Management and Dentists – A Systematic Narrative Review
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Objectives This study aimed to synthesise current understanding of ‘management & leadership’ for dentists in General Dental Practice from the existing literature.

Methods A three-stage narrative review methodology was adopted in order to incorporate the breadth and depth of literature across the multiple domains used for publication – academic, policy and business.

Stage 1: Scoping and policy review

Stage 2: Review of reviews in healthcare

Stage 3: focussed review in dentistry

Searches were conducted across academic and grey literature; results filtered using a SPICE framework and specific inclusion and exclusion criteria applied. Selected articles underwent ancestry searching for additional relevant inclusions. Articles were quality rated, and a post review sensitivity analysis conducted to gauge the impact of including studies of varying quality

Results 77 studies were included overall across the 3 stages (21, 33 and 23 respectively). There is a dearth of literature regarding management and leadership in General Dental Practice, and much of this stems from reports, instruction based articles and/or extrapolated from hospital or NHS organisational contexts, rather than peer-reviewed articles and empirical studies. There is no clear single definition or aim, nor one theory or model of leadership that is agreed within or across contexts. Leadership is best conceptualised as a process comprising multiple moderating variables. Variables exhibit reciprocal influence on one another to impact outcome or effectiveness. Leadership effectiveness is correlated with multiple areas of organisation, team performance & outcomes and is needed at all levels of healthcare: system, organisational (strategic), team (operational), dyadic (tactical/relational) and individual. There is currently little existing research completed at team/operational level

Conclusions Greater conceptual clarity, which is appropriate to the specific General Dental Practice setting, is required to provide a rigorous evidence base against which relevant theories can be considered and to enable development of assessment and education. Further work is also required to explore causality relationships between quality and efficacy of patient care and leadership practices.
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Objectives To determine how specialists in paediatric dentistry and endodontics manage non-vital, immature teeth and to investigate factors that influence their decision-making practice.

Methods A 13 item, self-administered postal survey was designed according to Dillman’s principles, and distributed to all paediatric dentists and endodontists on the General Dental Council Specialist lists. Closed-ended questions included binary dichotomous, ordinal-polytomous, and nominal-polytomous response formats, which were exhaustive and mutually exclusive. A single open-ended question was included. Confidentiality without anonymity enabled repeat contact to non-responders. Incentive for completion and a non-response postcard were included. Subgroup analyses were performed. Thematic analysis and word frequency query were completed.

Results Response rate was 62% (n=290). Paediatric dentists are more likely than endodontists to manage non-vital, immature teeth. 83.8% of all responders are influenced by the available evidence base, and 70.0% by their previous clinical experience when planning the endodontic management of immature apices. 88.9% (n=258) of responders agreed that young people have difficulty accessing good quality management of immature teeth in primary care. 64.4% (n=96) of paediatric dentists and 66.6% (n=94) of endodontists reported no experience of regenerative endodontic procedures. There was a significant effect of specialty in relation to type of practice (p<0.001), geographical location (p<0.001), experience (p<0.001), use of an endodontic microscope (p<0.001), and disinfection protocols (p<0.001). There was also a significant effect of specialty in relation to factors that influence the decision-making practices of specialists, in relation to the endodontic management of immature teeth (see table).

Conclusions There is little consistency in protocol for regenerative endodontic procedures. Most responders would choose to manage apical closure with a mineral trioxide aggregate apexification procedure. There is variation in factors that influence decision-making practice; material cost no longer appears to be a substantial concern.
Income Inequality Influences Adolescent's Oral Health-Related Quality of Life
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Objectives The aim of this research was to test the association of contextual and individual factors with oral health-related quality of life (OHRQoL) in Brazilian adolescents.

Methods Individual data of 3,854 adolescents aged 15-19 years from the Brazilian Oral Health Survey (SBBrazil 2010) and contextual data were analysed. OHRQoL was assessed using the Oral Impacts on Daily Performance (OIDP) questionnaire and examined as a discrete variable. The individual variables were demographic factors, socioeconomic characteristics, and clinical oral measures. Contextual determinants at the city level were income inequality (Gini Index) and social development (Human Development Index (HDI)). Multivariable multilevel Poisson regression was used to test the association of contextual determinants and individual characteristics with OIDP extent.

Results The prevalence of at least one impact on OHRQoL in the last six months was 34.5%. Eating and cleaning teeth were the most common performances influenced by oral health. In the adjusted analysis, income inequality (Gini Index high-level RR 1.57 95%CI 1.13-2.18) was statistically associated with OIDP extent. Females, older participants, skin colour, were associated with OIDP extent. Lower family income, low schooling, lower number of goods and poor clinical measures were also associated with greater OIDP extent.

Conclusions Income inequality was a contextual determinant of OHRQoL among Brazilian adolescents even after controlling for individual demographic, socioeconomic and clinical conditions.
Exploring the relationships between knowledge- and skills-based assessment performance in Dental Therapy and Hygiene students as a function of prior qualifications

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Objectives
To explore the relationships between knowledge and skills based assessments within a 3-year Dental Therapy and Hygiene (DTH) programme, and assess differences in performance as a function of prior qualifications.

Methods
Relationships between assessments were explored with correlational analyses, whilst the impact of demographic factors and prior qualifications on performance was evaluated using linear regression. The assessments compared were MCQ-based dental science assessments (Integrated Dental Science; IDS), MCQ-based dental therapy knowledge progress tests (ADTK), and students’ clinical assessments. Prior qualification categories were based on data collected at application, and cover qualifications such as A-levels, BTEC, Access, and prior degrees.

Results
Performance on all assessments within each type (ADTK, IDS, and Clinical) were standardised within each Stage of study (first, second, and third year students) and averaged across assessments of the same type. Initial exploration of the data reveals strong positive correlations between ADTK and IDS knowledge-based assessments. ADTK also shows a positive correlation with clinical performance, particularly in Stage 2, but also to a lesser degree in Stage 3. Prior-qualifications show some impact on performance in IDS, ADTK, and clinical assessments, with access courses to Health and HE being associated with better performance than BTEC or general science qualifications.

Conclusions
Knowledge-based assessments appear to have good convergent and discriminant validity in relation to Stage 2 and 3 DTH clinical assessments. Health and HE focussed prior qualifications are associated with better performance in both knowledge tests and clinical assessments than BTEC or general science-focussed qualifications.
Screening for chronic, non-communicable diseases (NCDs) in applied healthcare practice
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Objectives Non-communicable diseases (NCD) account for two-thirds of deaths worldwide. NCD screening in general medical practice can be challenging and UK primary-care dentists and pharmacists may have contact with patients less likely to access these services. Additionally periodontitis, which is routinely screened for in dental practices has been associated with several NCD including diabetes and cardiovascular disease. This study aimed to determine the views of patients attending UK allied healthcare practices (dental and pharmacy) regarding provision of screening for NCDs.

Methods Questionnaires were administered to 533 patients attending community pharmacies, 515 patients attending NHS dental practices and 500 patients attending private dental practices, within the U.K. questions were aimed at establishing opinions regarding potential for screening NCDs within these settings. Views on screening for diabetes, hypertension, chronic kidney disease, respiratory disease and vitamin D insufficiency were explored.

Results Thirteen-percent of patients reported not being screened for NCDs within the last 5 years, 31% within the last year, and 10% reported never having been screened in general medical practice. Fifty-two percent “agreed” or “strongly-agreed” that screening for NCDs in dental settings was a good idea, and over 70% felt screening in pharmacies was a good idea. Patients were most supportive of screening for hypertension and diabetes in both dental and pharmacy settings.

Conclusions Results indicate that 54% of patients accessing allied healthcare services reported having not been screened for NCDs in a medical-setting within the previous year. 52.2% and 74.4% of respondents reported they would be amenable to screening within dental practices and pharmacies respectively. This may provide an opportunity for early identification of NCDs and development of new care pathways for prevention and screening. Given that NCD management accounts for a significant proportion of the UK healthcare budget, there may be benefit to patients, in terms of early identification, resulting in more straightforward management of the condition.
Enamel Erosion Protection and Repair in vitro by Fluoride Dentifrices
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Objectives To compare two commercial dentifrices for human enamel erosion protection and repair in vitro. Rehardening of erosive lesions, fluoride uptake and mineral density changes were measured along with a comparison of dentifrice abrasivity.

Methods Specimens were divided into three treatment groups: i) Sensodyne Pronamel (SP), ii) Colgate® Enamel Strength (CES) iii) Fluoride-free Control. For rehardening and fluoride uptake experiments, polished enamel was immersed in 1.0% citric acid, pH 3.8 to create artificial erosive lesions. Specimens were then incubated in a dentifrice slurry (2 min., 1:3 w/w dentifrice in deionised water), washed with water and immersed in artificial saliva for 48 hrs. Vickers microhardness was performed at 24 and 48 hrs during saliva immersion. For fluoride uptake, DSIMS cross-sectional imaging was used to generate linescans of fluoride depth distribution. Mineral density analysis (BSE-SEM) was performed on enamel following a 2 minute slurry treatment and subsequent immersion in 1.0% citric acid, pH 3.8 for 5 minutes. For the abrasivity comparison of dentifrices (RDA), the ISO / ADA recommended procedure was undertaken on dentin.

Results Microhardness showed SP to be statistically superior at re-hardening erosive lesions at both 24hr and 48hr saliva incubation time points. Mineral density depth distribution showed significantly higher resistance to erosive lesion formation after SP-treated enamel. Measurements of mean lesion depths after citric acid immersion yielded values of 9.6µm for SP compared to 19.8µm for CES. DSIMS revealed significantly higher fluoride uptake into the upper ~30µm of the enamel surface for SP-treated specimens cf. CES. Finally, a lower RDA value of 36.5 was obtained for SP compared to 103.7 for CES.

Conclusions This in vitro investigation has shown that SP provides superior protection against erosion and greater ability to repair eroded enamel, compared to CES. This has been confirmed by the combination of physical and chemical measurement techniques.
Improved Temperature Stability for Accurate In-Vitro De/Remineralisation ISE Studies.
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Objectives Ion selective electrode (ISE) measurement methods can be used to measure calcium ion gain or loss during in-vitro de- and remineralisation studies. Using computer controlled ISE systems, real time changes in calcium ion concentration can used as a proxy for mineral change in enamel and/or hydroxyapatite analogues, in order to obtain kinetic information. However, ISE measurements can often be unstable, especially over periods of time, primarily resulting from thermal instability of the solutions. The aim was to develop a thermally stable ISE measurement system for real time in vitro de- and remineralisation studies at 37°C using a water bath rather than a hotplate, and to develop standardised calibration methods for ISE at 37°C.

Methods ISE experiments were conducted in a thermally regulated water bath rather than on a hotplate. The apparatus was designed so that several different ISE experiments could be carried out simultaneously. Further, 3D printing was used to produce bespoke laboratory equipment in order to reduce heat-loss from standardised laboratory equipment.

Results Temperature stability from water bath reduced thermal noise in ISE measurements, resulting in better temperature control, stably controlled to ±0.1°C (hotplate control ±1°C) over a 48 hour period. The 3D printed lids make experiments faster and standardised and reduce evaporation loss from the experiment. Calibrations were faster and easier to perform; one point calibration enables more frequent calibration of the ISE leading to less errors during experiments. Up to four simultaneous experiments or repeats were possible, allowing for comparison experiments.

Conclusions A new water bath thermally regulated ISE procedure has been developed for ISE systems, which allows for more accurate and precise temperature control, and simultaneous experiments to be carried out, and thus increase throughput hence improve statistics from this real-time technique.
Cariostatic Effect of Riva Star vs Conventional Silver Diammine Fluoride
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Objectives In contrast to conventional silver diamine fluoride (SDF), Riva Star (SDI, Australia) contains saturated potassium iodide solution (SSKI) to prevent black staining due to photoreduction of silver. This study investigated the effects of application of SSKI following SDF application on demineralisation of human enamel, dentine and cementum.

Methods A human permanent molar was sectioned to provide enamel, dentine and cementum samples (n=2 each), which were allocated into SDF Tx (3.16 M SDF) and Riva Star Tx groups (SDF + SSKI). Each sample was coated with nail varnish, leaving a 3mmX4mm window exposed. Protocol of each group was as follows. Firstly, sample was immersed into 50 mL, pH 4.0, buffered acetic acid at 37°C for 4h demineralisation. Next, sample was taken out to be topically treated with SDF Tx or Riva Star Tx using a micro-brush. Thereafter, treated sample was put back into pH 4.0 solution for further 4h demineralisation. Throughout 8h demineralisation, Ca\(^{2+}\), Ag\(^{+}\) and F\(^{-}\) ion selective electrodes (ISEs) were used to monitor changes of ion concentrations at 1 min intervals. Cariostatic effects of treatments were based on decrease of Ca\(^{2+}\) releases before and after Tx.

Results The inhibitory abilities of treatments were shown in Table 1. Relative to conventional SDF, Riva Star Tx showed enhanced cariostatic effect on enamel and cementum. Furthermore, there was less staining of samples treated with Riva Star as compared to conventional SDF.

Conclusions Addition of SSKI could enhance cariostatic effects of Riva Star. SSKI application could eliminate the excessive Ag\(^{+}\) in the solution and decrease the blackening due to photoreduction of silver.
Autofluorescent properties of bovine teeth during demineralisation – A Pilot Study
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\textsuperscript{1}Inspektor Research Systems BV, \textsuperscript{2}University of Liverpool, \textsuperscript{3}University of Liverpool, \textsuperscript{4}University of Liverpool, \textsuperscript{5}Universite de Lille II

Objectives
The aim of this study was to explore the relationship between the mineral and organic components of mineralised tissue and their role in autofluorescence.

Methods
Twelve specimens were prepared from bovine teeth and immersed in 10% nitric acid for a total of eight 1 hour cycles. Data was acquired at baseline and every hour until demineralisation was complete. Each sample was illuminated with a 405nm exciting light. Fluorescent images were captured using a QLF-D Biluminator\textsuperscript{TM} (Inspektor, Amsterdam, Netherlands). Also, the spectra of the fluorescence was acquired with the Nuance\textsuperscript{TM} Multispectral Imaging System, (CRi, Woburn, USA), between 420 - 720 nm. The percentage of fluorescence loss (\(\Delta F\)) was calculated using QA2 image analysis software (Inspektor, Amsterdam, Netherlands), and statistically tested for correlation with the Nuance\textsuperscript{TM} data using the Pearson correlation coefficient (\(r\)). The means of both methods of fluorescence detection were calculated at each cycle. Complete demineralisation was assessed by radiography. Then the specimens were analysed using Raman spectrometry.

Results
Both methods detected and quantified loss of fluorescence. The Pearson coefficients (\(r\)) QLF-D/ Nuance\textsuperscript{TM} was 0.902 (95\%CI 0.851 to 0.936). The Nuance\textsuperscript{TM} detected higher and more specific \(\Delta F\) values than QLF-D. At the last demineralisation cycle, Nuance\textsuperscript{TM} mean value was -80.89 (± 9.45), QLF-D mean -65.65, (± 18.04). At the complete demineralisation stage the remaining fluorescence is related to the presence of collagen as shown by Raman spectrometry.

Conclusions
Both methods show a high correlation between the fluorescence intensity and the presence of mineralised tissue. Nuance\textsuperscript{TM} can also detect the autofluorescent properties of collagen. The autofluorescence of mineralised tissues is directly related to the presence of collagen and the intensity of the autofluorescence is linked to the degree of mineralisation. However, further work is required to fully understand the exact origin and its properties.
Hydrothermal Synthesis and Physicochemical Analysis of Fluoroapatite and Hydroxyapatite Coatings

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Objectives Hydroxyapatite (HA) coated dental implants have reported to fail due to high HA dissolution and delamination. Fluorapatite (FA), is more stable, with proven ability to enhance osseointegration and promising antibacterial effects against pathogens implicated in peri-implantitis. The aim of this study was to perform detailed physicochemical surface analysis of FA and HA coatings to explore and compare the role of surface properties in the antibacterial performance of these coatings.

Methods FA or HA coatings were deposited onto in-house prepared cpTi discs’ (12mm diameter, 1mm thick) surfaces using a mild hydrothermal method (121°C, 10 hours, 2 atm). Half of the coated discs were sintered at 800°C for 180min, to give 4 groups of 5 samples which were examined before and after sintering. A morphological and chemical characterisation of these coatings was performed using Scanning Electron Microscopy and Energy Dispersive Spectroscopy (SEM-EDS). Coatings crystallinity was investigated by X-ray Diffraction (XRD). Surface roughness (Sa) and thickness were analysed using a Laser Profilometry. Water contact angle (WCA) and surface energy were calculated for all groups before and after sintering.

Results The hydrothermal method was able to produce ordered FA coatings with well-aligned hexagonal crystals, while HA coating was composed of disordered randomly aligned spindle shape crystals. XRD confirmed the crystallinity of both FA and HA. EDS analysis confirmed Ca/P for FA and HA coatings at 1.78±0.02 and 1.72±0.06 respectively. FA coatings showed less roughness (3.88µm±0.9) and thickness (9.43µm±0.7) compared to HA coatings (13.4µm±1.4) and (340µm±20). Sintering significantly reduced coatings’ roughness and thickness. Both coatings displayed low WCA, which decreased after sintering. Sintered coatings, presented higher polar and electron donor character, in comparison to the uncoated cpTi.

Conclusions The hydrothermal method is able to produce ordered FA and disordered HA coatings. Sintering is effective in bringing about an enhancement in the surface morphology and stability of the coatings. Detailed characterisation of the coatings allows for better prediction of the antimicrobial performance of the ordered FA coatings.
Complications Associated with Full-Arch Implant Supported Prostheses
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Objectives Full-arch fixed implant supported prostheses provide a fixed solution to edentulism, but may be associated with significant biological and mechanical complications. The aim of this study was to investigate the complications associated with the prostheses described in the literature, including screw complications, framework fracture and veneering fracture.

Methods An electronic Medline search of English language publications was completed identifying relevant literature relating to full-arch fixed implant supported prostheses and their complications. The search period extended from 1946 to 2015 and included the search terms: “implant” AND “edentulous,” “implant” AND “fixed prostheses,” “implant” AND “full-arch” and “complete fixed prostheses.” Strict inclusion criteria was employed and required at least ten treated arches to be observed for a period of at least 1 year observation.

Results Screw complication data could be utilised from fifteen studies. The complication incidence per implant ranged from 0 to 25% with a mean of 6% over an observation period of 3.75 to 15 years. Data on framework fracture was provided from 21 studies. The fracture incidence ranged from 0 to 29% with a mean of 4% over an observation period of 1 to 15 years. Veneering fracture data was available for 21 studies. Three types of veneering materials could be observed: Acrylic denture teeth with acrylic resin, ceramic and composite. A mean of 61% of prostheses with acrylic denture teeth and acrylic resin experienced fracture with range from 0-400%. Ceramic fracture ranged from 0-89% with only one study available for composite veneering with a fracture incidence of 128%.

Conclusions Full-arch fixed implant supported prostheses provide a valuable solution to edentulism with many advantages, however complications can occur which may be influenced by framework misfit, degree of distal cantilever and parafunctional habits.
Objectives The clinical parameters currently used to describe the severity and prevalence of chronic adult periodontitis include periodontal pocket depth (PPD), and clinical attachment loss (CAL) measurements. Both PPD and CAL measure periodontal disease sequelae and are currently used for CDC/AAP case definition. Although whole-mouth examination is considered the gold standard for periodontal disease assessment, this is often difficult to be performed, due to lack of time and resources. Therefore, the aim of the present study was to compare half-mouth with whole-mouth examinations, based on CAL and PPD assessments.

Methods This pilot investigation was designed as a cross-sectional, pretreatment study. Twenty-one adult subjects with moderate and severe periodontal disease and no systemic diseases were recruited from a private dental clinic, Bucharest, Romania. The mean age of patients was 40.5 years old. Nine patients were females. All patients had at least 20 teeth. Periodontal full-mouth examinations were conducted by one trained calibrated examiner. A total of 2040 interproximal sites were examined. Obtained data were expressed as number of sites with a specific measurement, per quadrant and per mouth. Finally, based on the percentage of patients, the results were compared between couples of quadrants and full-mouth recordings. Kruskal-Wallis test was used for comparisons.

Results No statistical significant differences between two-quadrant and full-mouth assessments were recorded when comparing patients’ percentages, in terms of PPD and CAL measurements. Minimal misclassifications were observed.

Conclusions In the present study, random half-mouth protocols were considered reliable to reproduce full-mouth examination, giving good estimations for case prevalence.
Effect of an Intensive Weight Loss Programme on Gingival Inflammation
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Objectives Obesity has been reported to be associated with periodontitis. Numerous data exists on the benefits of weight loss on cardiovascular, metabolic, orthopaedic and quality of life outcomes, however there is minimal data on the impact of therapeutic weight loss on periodontal status. The aim of this study was to evaluate the effects of an Intensive Weight Management Programme (IWMP) on gingival inflammation in individuals with obesity.

Methods This was a single centre cohort study with 6 months follow-up from commencement of an IWMP comprised of three stages; weight loss, weight stabilisation, weight loss maintenance. Adults with obesity were recruited from the UCLH Centre for Weight Loss, Metabolic and Endocrine Surgery. Following the weight management baseline examinations, qualifying participants received an oral health assessment prior to commencement of the IWMP, and were then reassessed at 2 and 6 months during the programme follow-up visits. No professional oral health interventions were rendered during the study. Paired t-tests and correlation coefficient were calculated.

Results 47 adults (41 females and 8 males; mean age 41±13 [18-72] years) were enrolled in the study. Mean weight loss from baseline to 2 months and baseline to 6 months was 9.4±0.9 kg (p<0.001), and 11.4±1.3 kg (p<0.001), respectively. Mean reduction in percentage of sites with bleeding on probing from baseline to 8 weeks and baseline to 6 months was 8.1±2.7% (p<0.001), and 25.3±3.1% (p<0.001), respectively. There were no significant changes in mean plaque levels from baseline to 2 months (1.8±2.8%, p=0.53) or baseline to 6 months (3±2.4%, p=0.23). Overall, Pearson Correlation coefficient between bleeding on probing and weight was statistically significant (0.39; p<0.001).

Conclusions These results support the hypothesis of a modifying effect of obesity on periodontal inflammation. Further prospective studies designed to understand the mechanisms of the association between gingival health and obesity are merited.
Characterising early erosive lesions in polished and natural human enamel
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Objectives This study investigated the application of surface profilometry, surface roughness, surface microhardness, optical coherence tomography (OCT) and tandem scanning microscopy (TSM), to characterise the textural and physical changes that occur during early acid erosion of polished and natural human enamel in vitro.

Methods 120 enamel samples, 60 polished and 60 natural, were evenly (n=10) subjected to increasing 0.3% citric acid erosion times (0s, 10s, 30s, 60s, 120s, and 300s) and the change assessed using surface profilometry (3D step height change, μm), surface roughness (μm), and surface microhardness (KHN), and qualitatively using OCT and TSM.

Results Mean (SD) surface roughness (μm) of polished enamel samples after acid immersion increased after 10s (0.270+0.013), 30s (0.300+0.018), 60s (0.510+0.068), 120s (0.950+0.201), 300s (1.280+0.146) and were statistically significant compared to baseline (p<0.05). However, for natural enamel samples, mean surface roughness decreased with increasing immersion time and was only statistically significant (p<0.005) at 120s (0.830+0.125) and 300s (0.800+0.140). Mean (SD) microhardness (KHN) for polished enamel decreased with increasing acid immersion period: 10s (315.9+1.82), 30s (296.0+1.32), 60s (268.7+1.39), 120s (253.6+1.39), 300s (228.5+2.65); which was statistically significant at all time points (p<0.001), and microhardness was not possible to measure for the natural surfaces. Mean (SD) 3D step height change (μm) was measurable and statistically significant for the polished but not for unpolished; measurements for polished at: 60s (0.24+0.1), 120s (1.16+0.71), 300s (2.01+0.47). Qualitative image analysis of both sample types indicated erosive change occurring at the surface level, and progressed with increasing erosion immersion time.

Conclusions The early erosive lesion could only be characterised quantitatively and qualitatively for polished enamel samples using surface roughness, surface microhardness, OCT and TSM. However, it was unquantifiable for natural enamel samples, using existing methods, despite qualitative evidence of enamel structure alteration during early erosion.
Objectives To investigate the adhesion of silver and hydroxyapatite nanocoatings applied to the surface of titanium dental implants; and then to determine the biocompatibility of the coated dental implants with osteoblast cells.

Methods Ti6Al4V discs were polished and coated with silver nanoparticles (Ag), silver and hydroxyapatite nanoparticles (Ag+nHA) or microparticles (Ag+mHA). The silver and HA coatings were applied using the electroplating and sintering techniques respectively and then examined by electron microscopy. The adhesion of these coatings was measured by a pull-off test according to BS EN ISO 4624:2003 using an Instron 5582 series. The biocompatibility of the coatings was tested with primary human osteoblasts in 24-well microplates (n=9). Cell viability was assessed using the alamar blue assay, lactate dehydrogenase (LDH) and alkaline phosphatase (ALP) activities over 7 days. The cell morphology was investigated using scanning electron microscopy (SEM). Ag, Ca, P in the media and cell electrolyte (Na⁺, K⁺) concentrations were measured using inductively coupled plasma atomic emission spectroscopy (ICP-OES).

Results SEM and energy dispersive X-ray spectroscopy (EDS) confirmed that Ti6Al4V discs were successfully coated. Results of pull-off test showed that the adhesion between the coatings and titanium substrate is firm and able to withstand at least 6 Mpa. The findings of the alamar blue assay revealed that all Ag coated discs caused 35% reduction in cell viability, also LDH showed the similar result. ALP activity was below detection limit or slightly higher. SEM images showed that the osteoblast cells on Ag+nHA are healthier and have a better contact than those on Ag and Ag+mHA though less confluent than the control.

Conclusions Coatings were successfully applied to the substrate and demonstrated an acceptable adhesion. All Ag coated discs can reduce cell viability but Ag+nHA exhibited a better biocompatibility than Ag and Ag+mHA ones.
Characterization of a Novel Strontium Containing Bioactive Glass based Calcium Phosphate Cement

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Objectives The aim of this study was to investigate the effect of strontium and immersion media on crystal phase development and properties of a novel bioactive glass based calcium phosphate cement (CPC).

Methods Glasses were produced by progressively substituting strontium for calcium. Cements were prepared by mixing the glass powder and Ca(H₂PO₄)₂ salt with a 2.5% solution of Na₂HPO₄. Samples were immersed in either 10 mL of Tris buffer solution or 10 mL of SBF for 1h, 1d, 7d and 28d. X-Ray Diffraction (XRD) was performed to assess phases formed after immersion. Compressive strength was measured after each time point and the fracture surfaces were studied under SEM. Cytotoxicity studies were performed using MC3T3-E1 osteoblasts. Cells were exposed to cement conditioned media and cell viability was assessed using an MTT assay.

Results XRD showed that the amount of Sr²⁺ in the glass and the immersion media used influenced phases formed and mechanical properties. In Tris buffer a mixture of octacalcium phosphate (OCP) and hydroxyapatite (HA) was present at 1h and 1d, followed by transformation to a strontium-containing hydroxyapatite (SrHA) after 7d and 28d. This process was delayed when cements were immersed in SBF. Compressive strength increased with Sr²⁺ substitution up to Sr25 and decreased for higher Sr²⁺ substitutions in both Tris buffer and SBF. Overall higher values were recorded when SBF was used. Compressive strength was strongly influenced by the interlocking of the crystals and their morphology as seen by SEM. Cements resulted non cytotoxic.

Conclusions A novel method to develop a bone substitute forming in-vitro SrHA as a final product by using a bioactive glass as a precursor was shown. The immersion media influenced phases formed and properties of the CPC. SrHA formed as a final phase of the cement in both Tris and SBF. However SBF delayed transformation of OCP to HA and resulted in higher strength values. Further studies to assess how cements affect ALP activity and cell proliferation are ongoing. These novel injectable bioactive glass cements are promising materials for dental and orthopaedic applications in bone grafting.
In Vitro Oral Biofilm Model to Assess the Efficacy of Antimicrobial Additives to Dental Restorative Materials
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Objectives Our study is aimed at developing a robust in vitro oral biofilm model to determine the effectiveness of enhancing dental restorative materials with antimicrobial additives. It is focused on the antibacterial and mechanical properties of novel silver formulations that have been combined with glass ionomer cement.

Methods Three out of nine bacterial species considered to be early colonizers (Streptococcus oralis, Streptococcus mutans, & Neisseria subflava) were inoculated at 0.1 OD\textsubscript{600} into wells containing sterile glass-ionomer discs. The established artificial saliva media DMM (Defined Medium Mucin) was used for 24 hours studies conducted under aerobic & anaerobic conditions. Following incubation the discs were washed with PBS (Phosphate Buffer Saline) in a series of 12 minute up to five steps. The bacterial community within the well, the loosely attached to the well surface and the disc, and finally the intimately attached to the surface were determined using Colony Forming Unit Count (CFUs), MTT metabolic assay, SEM and qPCR.

Two silver solutions were developed with different ionic concentrations, 5mg/ml and 10mg/ml. MIC/MBC and the effect on the ability of the bacterial species to survive and colonize a disc was determined. In addition compressive strength, hardness and adhesive shear bond strength of each glass-ionomer silver disc was assayed and compared with the base line glass-ionomer.

Results The biofilm model favoured survival of S. oralis under aerobic conditions & N. subflava and S. oralis under anaerobic conditions. Silver formulations proved to have effects on strength and antimicrobial activity. Specifically 5mg/ml proved more antibacterial than a 10mg/ml silver. Compressive strength was enhanced for both additive, however bond strength became compromised at the higher concentration.

Conclusions This model proved its efficiency to test the antibacterial activity of restoratives materials in the presence of artificial saliva and the extra washing steps which mimic the sheer force of saliva. Augmentation of glass ionomer cement with silver and having a stable formulation with enhanced antibacterial and strength within our biofilm assay will form the basis for further studies.
Electrospun membranes with osteogenic and antimicrobial properties for orthopaedic and dental surgery.

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Tian, J.

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Objectives Preventing deep bone infections and enhancing bone regeneration reduces the risk of post-surgical complications. To facilitate bone healing, surgeons currently employ nanoscale hydroxyapatite (nHA) pastes to stimulate bone regrowth, however this has no innate antimicrobial properties. Silver has long been used to successfully treat bacterial and fungal infections. We therefore investigated the substitution of silver into nHA, its incorporation into electrospun membranes, and the subsequent effects on bacterial and mammalian cells.

Methods Silver substituted nHA was produced using a modified rapid mixing wet precipitation method at 2, 5, 10 mol % silver. The nHA was added to a PCL solution for electrospinning. Clinically relevant isolates of E. coli and S. aureus were collected and tested against the electrospun scaffolds. MSCs, collected from Wister Rat femurs, were used to study both toxicity and osteogenicity of the membranes using PrestoBlue®, ADH and ALP measurements.

Results SEM, TEM and EDS identified silver nanoparticles within the HA and confirmed the presence of the HA within the fibres. Both diffusion and contact bacteria studies demonstrated reduced bacterial presence, with E. coli and S. aureus undetectable after 48 hours of contact exposure. Toxicity was observed in high silver content materials (10%) but was not observed at lower levels. An increase in MSC activity was observed over the culture period with the cells cultured on samples containing nHA producing increased alkaline phosphatase levels, a key marker for osteogenic differentiation.

Conclusions Innovative silver nHA membranes significantly reduced E. coli and S. aureus bacterial populations while maintaining cytocompatibility with mammalian cells and enhancing the differentiation of MSCs into osteoblasts. Silver nHA containing membranes have the potential to act as an antimicrobial membrane while stimulating bone tissue regeneration. We would like to acknowledge MeDe Innovation (EPSRC EP/K029592/1) for funding this research.
Silver nanoparticles doped carbon nanotube–hydroxyapatite composites: biocompatibility and antibacterial property investigation.

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Objectives To study the antibacterial effect of hydroxyapatite composites reinforced with silver nanoparticles (AgNPs) decorated Carbon nanotubes (CNTs) against Staphylococcus aureus and its biocompatibility with human osteoblast cells.

Methods The reduction of silver nitrate in the presence of pristine and functionalised CNTs produced CNTs decorated with AgNPs. HA was then synthesised in the presence of AgNPs-CNTs following the wet sol-gel technique. The AgNPs-CNTs-HA powders were mixed with Polyvinyl alcohol (1:1 ratio) to obtain the final AgNPs-CNTs-HA composites. Antibacterial activity was investigated by testing the composites- AgNPs-p-CNTs-HA and AgNPs-f-CNTs-HA (n=9/treatment) against S. aureus for 24 h which was assessed in broth and on the surface of the composites by determining lactate production, the percentage of live/ dead cells and SEM observations. Biocompatibility was examined by differentiating human osteoblast cells in the presence of the composites (n=19/treatment) for 21 days. RT-qPCR was performed for genes that code differentiation (ALP, Osteocalcin (OC), RUNX-2) on day 7 and 21. LDH, ALP and protein assay along with SEM observations were also performed.

Results Bacterial growth on the composites was reduced by 70.13 % and 87.37 % for AgNPs-p-CNTs-HA and AgNPs-f-CNTs-HA respectively compared to the control. The genes were expressed on both the days indicating that the osteoblast cells were able to proliferate and differentiate. They were upregulated (5.85 - ALP, 7.80 - OC, 1.04 - RUNX-2 fold change) on day 7 but downregulated (12.78 – ALP, 7.25 – OC, 8.42 - RUNX -2 fold change) on day 21. SEM observations showed mineralized nodule formation of the osteoblasts on the composite surface. Protein content, ALP and LDH was higher on day 21 than day 7. Slow AgNPs release was observed on both the days with a maximum release of 90 nmol/mg cell homogenate protein.

Conclusions The results show that the composites greatly reduce bacterial activity without compromising biocompatibility.
Effects of Chitosan on Remineralisation of Enamel Lesions in vitro

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Objectives Chitosan, a derivative from chitin, can penetrate into enamel, bind with enamel prisms and attracts anions, thus potentially enhancing remineralisation of incipient lesions. The objective of this study is to test the null hypothesis that chitosan treatment has no impact on the remineralisation of artificial incipient enamel white spot lesions (WSLs).

Methods 48 artificial human enamel WSLs were assigned to 6 experimental groups (n = 8): (1) bioactive glass slurry (BG), (2) bioactive glass containing polyacrylic acid (BG+PAA) slurry, (3) chitosan pre-treated WSLs with BG slurry (CS-BG), (4) chitosan pre-treated WSLs with BG+PAA slurry (CS-BG+PAA), (5) “standard” remineralisation solution (RS) and (6) de-ionised water (negative control, NC). All samples went through a 7d pH-cycling. Chitosan pre-treatment was carried out by dropping 40 μL solution (2.5 mg/mL) on lesion surface for 60s. Remineralisation was conducted by applying specific agents on lesion surface and then brushing for 3min. In-situ surface and cross-sectional Raman intensity mapping was performed on 5 samples per group to assess surface and subsurface mineral content. Surface and cross-sectional Knoop microhardness were used to assess the mechanical properties after remineralisation. Data were statistically analysed using one-way ANOVA with Tukey’s test (p < 0.05).

Results BG and CS-BG presented significantly higher surface mineral regain compared to NC after pH-cycling (p < 0.05), while no significant difference was found on subsurface regions. All experimental groups except RS showed greater surface hardness recovery than NC (p < 0.05). CS-BG and CS-BG+PAA presented greater increase than non-chitosan-treated groups. On subsurface sections (20 μm below the surface), both CS-BG and CS-BG+PAA showed greater hardness value compared to NC (p < 0.05).

Conclusions The null hypothesis was rejected. Chitosan pre-treatment enhanced WSL remineralisation with either BG only or with BG/PAA complexes.
Mathematical, Numerical and biomechanical analysis using final element method (FEM) of mandible after treatment with bone substitute materials and loading with implant-supported prostheses

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Objectives The aim of the study was to describe mineralized bone structures of the mandible with use of wavelet application and perform biomechanical analysis with final element method (FEM) in individuals that have been treated with bone substitute materials: Algipore, Bio-Gran, Bio-Oss, Cerasorb, Chron-Os, HA-Biocer and loaded with implant-supported prostheses.

Methods 70 patients were included to the study, 60 were treated using six different bone substitute materials: Algipore (ALG), Bio-Oss (BVB), Bio-Gran (BAG), HA-Biocer (SHA), Cerasorb (CER), Chron-Os (CHR) and 10 patients, where bone regeneration process was followed without using bone substitute material (NON). The control patient group was mandible bone without defect (REF). The structure of mineralized bone of mandible in surgical area was examined on 490 digital radiological images using discrete wavelet transform for mathematical distribution of radiotexture. This method has been applied to estimate the physical properties of bone (e.g. Young’s modulus) during the period of healing (3, 6, 9, 12, 18, 24 months) of the bony lesion following the use of bone substitute material. A three-dimensional FEM of a mandible with a prostheses supported by four implants was developed (Figure 1). The biomechanical analysis of mandible was performed using MD PATRAN.

Results The studies helped to estimate physical properties (Youngs' modulus) during a period of healing of bony lesion following the use of biomaterial. Numerical and biomechanical analysis of mandible after surgical operation with use of six bone substitute materials showed diverse distribution of tension forces compared with control patient group (REF). Bio-Oss (BVB) (Fig. 2) showed already after 3 months (03 M) distribution of forces, which was similar to the one observed in control group (REF). Significant differences in stress, strain, and strain energy densities were found in the comparison of models with bone substitute materials treatment and without (NON). It was observed that loading with implant-supported prostheses leads to high stress concentrations in bone without bone substitute treatment (NON).

Conclusions In conclusion the numerical analysis might be promising alternative method for selection of treatment material and promising tool for planning of surgical procedure.
Hierarchical Biomineralization for Hard Tissue Regeneration
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Objectives A major goal in dental materials science is to develop biomimetic functional materials that can offer precise control of building blocks across multiple length-scales towards dental hard tissue regeneration.

Methods Elastin-like polymers (ELPs) were characterized by circular dichroism and dynamic light scattering to assess their secondary structure, charge, and hydrodynamic radius. The ELP solution was crosslinked to form thin films, which then were mineralized at physiological conditions. We used a comprehensive suite of advanced multi-scale imaging techniques including TEM, FIB-SEM, and FEGSEM to investigate the mechanism of mineralization and its relation to the distinctive structure at multiple length-scales ranging from crystallographic, to nano-, to micro, and up to the macro-scale.

Results Here we report a novel biomineralization system based on a tuneable organic-inorganic bulk environment that controllably nucleates and grows hierarchically-ordered apatite structures as coatings or membranes with remarkable multi-scale organization. The structures exhibit elongated apatite nanocrystals of about 85±22 nm in cross-section that are aligned and organized into approximately 3.8±0.9 μm thick prisms that resemble those found in human dental enamel (Fig. 1). These prisms assemble further into hierarchical structures hundreds of microns in diameter that come together to fill macroscopic areas. The hierarchical structures can be grown as thin mineralized coatings over irregular rough surfaces. The potential of the system towards dental applications has been investigated by growing the hierarchical apatite structures as conforming acid resistant coatings that can conform to dentine while blocking the dentinal tubules. These results demonstrate the potential applicability in early treatment of dental caries, erosion, and dentine hypersensitivity.

Conclusions We report on the discovery of a distinctive physicochemical environment, comprising a tuneable organic matrix with specific molecular composition, conformation, and physical conditions, which promote nucleation and hierarchical growth of apatite structures resembling those found in human dental enamel. The system has a potential for dental applications.
Nanohydroxyapatite Seeded Crystal Growth Determined in a Novel Steady-State Assay.
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Objectives Nano-crystals of hydroxyapatite ("nanohydroxyapatite") are of increasing interest in formulating products targeting dentine sensitivity. We aimed to 1) develop, validate and use a novel in vitro nucleation/crystal growth (IVNCG) assay; 2) identify minimum amounts of nanohydroxyapatite seed crystals required to produce statistically significant mineral accumulation under steady state conditions and 3) identify composition and morphology of mineral formed.

Methods The IVNCG assay equipment comprised of two reservoirs containing 6.5 mM Ca(NO$_3$)$_2$.4H$_2$O and 3.9 mM (NH$_4$)$_2$HPO$_4$ in 20 mM HEPES, 150 mM NaCl respectively, separated by a partition containing multiple sample wells, each covered with dialysis membrane. System validation used positive (poly-glutamate in agarose) and negative (agarose only) controls (n=20 and 16 respectively). Mineral deposition in each well was measured by spectrophotometric determination of phosphate after 5 days at 37 °C. Nanohydroxyapatite was then seeded in agarose at concentrations of 10, 20 and 30 µg/mL (n=10) and compared to controls. Crystals recovered from the wells were analysed by SEM and EDS. Calcium and phosphate levels in the buffers were determined.

Results The IVNCG showed statistically significant differences in mineral accumulation between positive and negative controls (p>0.05). Minimum nanohydroxyapatite seeding density required to produce statistically significant differences compared to the positive control was 30 µg/mL (p>0.05). Analysis of recovered crystals indicated distinct differences in morphological and Ca:P ratios between samples. No depletion in buffer calcium and phosphate concentrations was detected throughout the experiment.

Conclusions Our data suggest that dissolution of nanohydroxyapatite during the early, undersaturated phase of the experiment may result in loss of seeds for subsequent crystal growth when seeding is <30 µg/mL. We conclude that the IVNCG assay, which is simple to make and cheap to use, can provide a screen for potential therapeutics aimed towards dentine sensitivity and mineral precipitation.
Understanding the effects of tooth brushing using an abrasive dentifrice on enamel
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**Objectives** Cleaning your teeth comes with a drawback. Toothpastes contain abrasive particles that have the potential to damage tooth enamel, resulting in wear and enamel loss. The aim of this study is to compare the abrasivity of alumina and silica particles in a brushing simulation experiment and to identify the wear mechanisms resulting in removal of enamel.

**Methods** A modified Phoenix TE77 tribometer was used to reciprocate a firm brush head against bovine disks to simulate the tooth brushing action. The tests ran for 6 hours to replicate 3 months of brushing with per stroke friction data collected during testing. Two toothpaste slurries (40% abrasive, 60% artificial saliva) consisting of angular alumina and silica particles (size range: 1-34µm) were drip fed into the contact for the duration of the test. A Talysurf profilometry was used pre-test and at 2 hour intervals to record the sample topography to enable wear depth comparisons. Post-test scanning electron microscopy (SEM) was used to characterise the wear processes on the enamel surface.

**Results** Results revealed that both the friction during brushing and the wear rate was higher with alumina particles. The SEM imaging identified a bi-modal wear process of grooving and polishing, with more grooving evident on the alumina brushed surfaces. The grooving is as a result of a 2-body mechanism where by a single abrasive particle has been lodged beneath a bristle and dragged across the surface, while the polishing results from 3-body rolling of abrasives.

**Conclusions** The wear mechanism is a 2-stage process of grooving which causes pile-up and the subsequent removal of this piled up material by successive brushing cycles. The increased grooving by the alumina particles has resulted in increased friction measured during brushing and the increased wear of the enamel.
Prolonged LPS treatment modulates crosstalk between monocytes and osteoclast progenitors via Hyaluronan

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Objectives The classical pathological feature of chronic periodontal disease is irreversible alveolar bone loss. In the periodontal tissues, monocytes and macrophages are continuously exposed to LPS in the accumulated subgingival plaque. Constant exposure to LPS results in down-regulation of osteoclastogenic factors (endotoxin tolerance) by monocytes / macrophages, yet bone resorption still occurs in the periodontal lesion. Therefore, other simultaneous mechanisms promoting osteoclastogenesis must be present. Hyaluronan (HA) was identified as a potential activator of osteoclastogenic factors in monocytes, via TLR4 / CD44 signaling pathways. The objective of this study was to assess LPS induction of HA synthesis genes in LPS challenged monocytes and the effects of HA protein on osteoclast differentiation.

Methods THP-1 cells were treated continuously with LPS over 1-9 days and expression of Hyaluronan Synthase genes were measured by real time RT-PCR. Osteoclasts were generated by treatment of human primary bone marrow cells (BMCs) with RANKL and M-CSF for 9 days. To assess the effects of HA protein on the differentiation of BMCs into osteoclasts, BMCs were treated with HA (+/- RANKL & M-CSF) for 9 days. Osteoclast differentiation was determined by TRAP and immunofluorescent staining

Results LPS modulated the expression of HAS genes in THP-1 monocytes which could further affect osteoclast differentiation. High molecular weight HA protein increased osteoclast differentiation from BMCs and low molecular weight HA opposed the effects.

Conclusions Prolonged exposure to LPS in the periodontal lesion could lead to increased production of HA, which in turn increases the differentiation of infiltrating monocytes into osteoclasts, leading to increased bone resorption. These data demonstrate a novel mechanism by which LPS can induce osteoclast differentiation, even in typically “tolerogenic” conditions
Differentiation of tongue and periodontal microbiota in health and periodontitis

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Objectives The tongue and periodontium offer specialized niches for the oral microbiota, with dysbiotic changes occurring in the subgingival and supragingival niches during the development of chronic periodontitis. Whilst the microbial ecology of the tongue is generally associated with oral malodour, clinical studies have shown an association between oral malodour and chronic periodontitis. In this study, the microbiota on the tongue of individuals with oral health, chronic periodontitis and gingivitis, was characterized in relation to the periodontal microbiota.

Methods Tongue scrapings, subgingival and interdental plaque were collected and the bacterial 16S rDNA V3-V4 region sequenced using the HOMINGS methodology. Sequences were analyzed using Minimum Entropy Decomposition which enabled determination of sequence variation within oral taxa at 1-nucleotide resolution. Volatile Sulfur Compound (VSC) concentrations were measured in the breath of participants using Oral Chroma™.

Results Breath methanethiol was associated with both clinical indices of periodontitis and the ecological differences observed in subgingival and interdental niches in disease compared to health. Whilst the tongue and subgingival microbiota showed niche specialization in their community composition, disease associated overlaps were observed between the niches in the oligotype distribution of health and disease associated taxa. Clinical indices of gingivitis and periodontitis such as plaque index and probing depth were also associated with changes in tongue ecology.

Conclusions Malodour associated with chronic periodontitis may be due to a dysbiotic tongue ecology as it is influenced by the changes occurring in the periodontal niches. The interdental plaque may act as a reservoir for periodontopathic taxa in health, whereas the tongue may also carry these taxa as transient species.
Microbiomes associated with bovine periodontitis and oral health
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Objectives Bovine periodontitis is a naturally occurring infectious disease whose potential importance has largely been overlooked. The periodontal lesions that develop throughout the productive life of cattle are characterised by the formation of periodontal pockets, gingival recession, attachment loss and premature tooth loss. The complexity of its clinical diagnosis in herds makes it difficult to carry out epidemiological surveys to evaluate its true prevalence. Preliminary studies on the aetiopathogenesis of the disease suggest that, as in other species, Gram-negative anaerobic bacteria may be involved. The aim of this study was to determine the microbiomes associated with bovine periodontitis and oral health.

Methods A swab of the gingival margin was used to collect plaque from 38 orally healthy cattle and subgingival plaque was collected using a curette from the gingival pockets of 40 cattle with periodontitis. DNA was extracted from each sample by digestion with proteinase K, the V3-V4 region of the 16S rRNA gene amplified with primer pair 341F/806R and PCR products sequenced using Illumina MiSeq. Data was processed using USEARCH and QIIME and diversity analyses were performed with PAST v3.02. Linear discriminant analysis effect size was used to determine differences between the groups.

Results A total of 1923 OTUs were identified and classified into 395 genera or higher taxa. Microbial profiles at health differed significantly from periodontitis in their composition (p<0.001, F=5.30; PERMANOVA) but not in microbial diversity. Samples from healthy cattle were dominated by the genera Gastranaerophilus, Burkholderia and Arcobacter, while the periodontitis samples were dominated by the genera Fusoacterium, Wolinella and Porphromonas.

Conclusions The diversity of the bacteria found in the mouths of orally healthy cattle and those with periodontitis were similar. However, the genera observed differed significantly between health and disease, with an increased frequency of fastidious anaerobic bacteria in the mouths of cattle with periodontitis.
Mesenchymal regulation of the Junctional Epithelium
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Objectives Epithelial-mesenchymal interactions may play an important role in the development and maintenance of the dentogingival junction (DGJ). Previously, we identified Sca1 as a key marker which differentiate fibroblast subsets from the superficial connective tissues (SCT, gingival fibroblasts) and deep connective tissues (DCT, periodontal ligament fibroblasts). We hypothesise that fibroblasts from the SCT promote epithelial growth and differentiation whilst those from DCT result in an undifferentiated, immature epithelium similar to the junctional epithelium (JE) phenotype.

Methods 3D Organotypic constructs consisted of an epithelium overlying a connective tissue equivalent. These constructs were made by seeding 1) human periodontal ligament fibroblasts (HPDLF) or 2) human gingival fibroblasts (HGF) into collagen gels. After contraction, the gels were seeded with H400 epithelial cells. Formalin fixed paraffin embedded sections were prepared from the 3-D cultures. Epithelial phenotype was characterised via immunohistochemistry for the expression of Keratins 1, 8, 10, 18, and 19.

Results Organotypic constructs from HGF consistently resulted in the formation of a multilayered epithelium characterised by keratin 1, 8, 10, 18, 19; whereas HPDLF constructs resulted in a monolayered epithelium with little sign of growth or proliferation and showing a particular absence for the expression of Keratin 10.

Conclusions Fibroblast subsets have different influences on the epithelium, with SCT supporting gingival growth and differentiation and DCT preventing epithelial growth and differentiation. The findings are consistent with the hypothesis that the DCT regulates an epithelium similar to the JE phenotype and furthermore supports the role of specific fibroblast populations in the regulation of the gingival and junctional epithelial phenotypes. A dysregulation of the epithelial-mesenchymal signalling in the dentogingival junction may account for the apical migration of this tissue during periodontitis.
Assessing the effects of Hyperglycaemia and Lipopolysaccharide on Osteogenic Differentiation

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Objectives Porphyromonas gingivalis is a key pathogen implicated in mediating periodontitis, via the release of products, such as lipopolysaccharide (Pg-LPS), which perpetuate host immuno-inflammatory reactions, hinder repair processes and promote bone tissue loss. Diabetes mellitus also influences periodontitis, as hyperglycaemia can alter cellular behaviour leading to impaired healing. Bone-marrow, derived-mesenchymal stem cells (MSCs) are essential for these repair responses, existing as heterogeneous populations that vary in their proliferative and differentiation capabilities. This study investigated the respective impact of hyperglycaemia and Pg-LPS on the osteogenic potential of MSCs.

Methods MSCs were isolated from rat femur bone chips and cultured to specific population doubling levels (PDs); PD15, previously characterised to represent a mixed populations of immature and lineage restricted MSCs, and PD50 previously characterised to contain more immature MSCs. Cells were cultured in physiologically normal (5.5mM, NG) or high (25mM, HG) glucose levels for 28 days, in osteogenic media with/without Pg-LPS at sub-lethal concentrations (0-1µL/mL). Osteogenic differentiation was quantified by increase gene expression of osterix, osteopontin and osteocalcin using qPCR, and mineral deposition by Alizarin Red staining.

Results Considering results for all osteogenic markers, MSCs at PD15 demonstrated a greater response to osteogenic stimuli, compared to PD50 cells, confirming previous results that PD15 contained more committed osteoprogenitor cells. In the presence of HG, osteogenic differentiation decreased for PD15 MSCs, but the additional presence of Pg-LPS had no further detrimental effect. For PD50 cells HG exerted no effect on osteogenic markers, but additional presence of Pg-LPS inhibited osteogenic differentiation.

Conclusions Of these two factors, HG appears to exert a more potent effect, especially on the mixed immature/committed MSCs. Pg-LPS had a greater inhibitory effect on osteogenic differentiation by MSCs with a more immature phenotype. These results are valuable in elucidating how immature and committed MSCs respond differently to glucose and pathogenic factors contributing to periodontal tissue destruction.
Objectives The possibility of controlling stem cell behaviour offers great opportunities to enhance the repair of damaged tissues. The highly complex behaviour of stem cells is partly influenced by the physical and chemical properties of the local environment where they reside within tissues, known as the stem cell niche. Hypothetically, ‘synthetic niches’ designed to maintain stem cell populations could be manufactured on implantable devices. An innovative manufacturing platform developed at Sheffield allows for the fabrication of membranes exhibiting well-defined surface features by combining electrospinning and collectors made using selective laser melting (SLM). This technology has been tested successfully in corneal repair [1], and it has great promise for other areas of regenerative medicine. The aim of this research was to investigate the manufacture of electrospun membranes containing ‘synthetic niches’ and evaluate their potential use for bone and cartilage repair.

Methods Patterned stainless steel collectors were designed using CAD software and manufactured using SLM. Poly(caprolactone) was electrospun onto the collectors to produce membranes imprinted with the negative of the collector template. Rat bone marrow and bovine synovial fluid mesenchymal stromal cells (MSCs) were seeded onto the membranes for 7 days and imaged using electron and fluorescent microscopy. Metabolic activity was measured using PrestoBlue.

Results The topography of the collectors was reproduced on the electrospun membranes successfully, producing three types of well-defined surface features. MSCs metabolic activity increased over time, suggesting proliferation and good cellular viability. However, no differences were observed between niches. The cells were observed to colonise the features, with differences in fibre orientation potentially affecting cellular alignment and distribution.

Conclusions Membranes with well-defined surface features were produced successfully. Cellular morphology and distribution were affected by the features, showing that it may be possible to mimic certain physical aspects of the stem cell niche. Thus, this study showed that membranes manufactured using this innovative combination of additive manufacturing and electrospinning are promising candidates for bone and cartilage repair applications.
3D-Printed Bone Scaffold in a Tissue Engineered Human Osteo-Mucosal Model
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Objectives To develop and characterise three-dimensional tissue-engineered models of bone and oral mucosa using 3D printed (3DP) bone scaffolding techniques in comparison with the conventional scaffolding technique.

Methods Two different tricalcium phosphate (TCP) scaffolds (2 mm × 10 mm) (N=15) were fabricated by (A) 3DP technique and (B) foaming technique. Human osteoblasts (HOBs) were harvested from the alveolar bone biopsies, expanded in vitro, seeded into both scaffold types, and the bone constructs were cultured in an osteogenic culture medium using spinner bioreactors for 20 days.

Full-thickness oral mucosa models (OMMs) were simultaneously fabricated through three stages: (1) Preparation and culture of collagen gel-embedded normal human oral fibroblasts; (2) addition of normal human oral keratinocytes onto the engineered connective tissue layer, and (3) air/liquid interface culture in a suitable epithelial differentiation medium. Following the initial culture, OMMs was adhered onto the bone constructs using a tissue adhesive sealant to produce composite osteo-mucosal models. The final reconstructs were kept in culture for additional 5 days after which PrestoBlue (PB) vitality assay, histological examination, enzyme-linked immunosorbent assay (ELISA), and q-PCR analysis were carried out to assess both hard and soft tissue differentiation.

Results PB assay indicated the high cellular vitality in both 3DP and conventional models. The histological sections showed the epithelial, connective tissue, and bony layers which were comparable to the native tissue structure. q-PCR analysis showed the gene expression of bone-specific markers including; osteocalcin, osteonectin, osteopontin, alkaline phosphatase and collagen-1. In addition, the epithelial markers including cytokeratin 10, cytokeratin 13, and Ki-67 were expressed. ELISA detected the secretion of bone proteins; collagen-1, osteonectin, and osteocalcin in both tissue engineered models.

Conclusions Tissue-engineered composite models developed in this study resembled the natural alveolar bone and oral mucosa and have the potential to be used in vivo and as a relevant model for various in vitro applications including biological evaluation of implanted biomaterials and oral disease modelling.
Hardness of Bioactive Glasses
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**Objectives** Hardness of bioactive glasses is an important property that will determine their abrasivity towards enamel during tooth brushing and in air abrasion applications. The objective is to determine if there is a correlation between the glass transition temperature and hardness of bioactive glasses in order to predict the hardness of glasses for dental applications.

**Methods** Twelve bioactive glasses with varying sodium and fluorine contents were synthesised by a melt quench route and cast to form monolithic blocks which were then mounted in resin and ground and polished. The Vickers hardness of each glass was then determined by using a Vickers hardness tester. (Zwick Universal Hardness Test Machine, Roell AG, Germany using a diamond indenter with an angle of 136° and testing load of 3HV. A Stanton Redcroft DSC1500 (Rheometric Scientific, Epsom, UK) with matched pair platinum crucibles was used to determine the glass transition temperatures of the glasses. Fifty milligrams of fine powder (< 38 μm) was run against an alumina reference at a heating rate of 20° C/min in nitrogen gas at 60 mL/min to 1200° C. Tg was determined by the intercept method.

**Results** The glass transition temperature (Tg) reduced with sodium content as did the Vickers Hardness. The highest sodium content glass had a hardness of about 3.4GPa close to enamel whilst the lowest sodium content glass had a hardness greater than 6.6GPa. The 45S5 glass used in commercial toothpastes and air abrasives had a hardness of about 4.6GPa. There was a good correlation between Hardness and the glass transition temperature with a linear regression giving Hardness=0.0089xTg + 0.031 and the Correlation Coefficient was 0.94.<!

**Conclusions** There is a good correlation between Hardness and Tg that enables the Hardness to be calculated from the Tg. This is important because many bioactive glass compositions cannot be cast without crystallisation occurring which would invalidate the hardness measurements. Furthermore various authors have developed models for calculating Tg from the chemical composition of bioactive glasses which can now be used to calculate Hardness.
Analysis of Monomers Released from Resin-Modified Glass Ionomer Cements (RMGICs).
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Objectives To analyse residual monomers in deionised water (DW) and 75:25% ethanol:DW released from commercial and experimental RMGICs.

Methods Two commercial RMGICs were included: Fuji-Plus (GC, Japan) and RelyX-Luting (3M-ESPE, USA). Two additional in-house liquids were prepared based on their formulations. Eight experimental liquid compositions (F1- F4 based on Fuji-Plus; R1- R4 based on RelyX-Luting) were prepared replacing 100% of hydroxyethyl-methacrylate (HEMA) with hydroxypropyl-methacrylate (HPM) in F1 and R1, or 70%/30% HPM/ tetrahydrofurfuryl-methacrylate (THFM) in F2 and R2, 50%/50% THFM/HEMA in F3 and R3 and 30%/70% THFM/HEMA in F4 and R4. Two novel HPLC methods were developed. Twelve discs (10mm-diameter, 1mm-thick) were prepared for each RMGIC and immersed separately in 10 ml of solution (DW or ethanol:DW). 1mL of immersion solution was extracted after 1, 4, 24 and 168-hours. Calibration curves were created using standard solutions containing known amounts of each monomer. Measurements were taken twice for each of the extracted and calibration solutions, and the mean of the peak heights was calculated. Gradient conditions with acetonitrile and DW were used as the mobile phase.

Results Very small amounts (≤0.5 ppm) of residual monomers were identifiable by the two novel HPLC methods. Lower amounts of HEMA were released from F3 and F4 compared to Fuji-Plus after 1 hour (p≤0.0001). F1 showed higher release of monomers (reaching 284.10 ppm) compared to all materials in the same group at all time points in both solutions (p≤0.001). RelyX-Luting released more HEMA than experimental R materials at all time points in DW (p≤0.015), and more than R3 and R4 in ethanol:DW (p≤0.005).

Conclusions Novel HPLC methods were successful in identifying monomers released from RMGICs. Compositions containing THFM showed similar or lower release of monomers compared to commercial and experimental RMGICs in both solutions, thus indicating a higher, or similar degree of polymerisation.
A Novel method for simultaneous caries removal and remineralisation of dentine
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Objectives The objective of this research is to develop a method for the selective removal of caries dentine, with simultaneous deposition of bioactive glass for the promotion of remineralisation in the remaining hard tissues. Successful application of such a method may lead to improved manageability and long term healing of caries affected teeth, minimising the cutting of demineralised but uninfected dentine.

Methods Polymers were chosen based on their microhardness, biocompatibility and ability to incorporate bioactive glass particles. Preliminary dentine cutting tools were fabricated by extruding the polymer/bioactive glass mixture followed by cutting to length and introducing a cutting edge. Knoop hardness tests were carried out before testing the cutting ability on reference materials and caries dentine, as well as artificially created lesions.

Results Polysulfone with a bioactive glass content varying from 10 – 30% was established to have suitable properties for selective removal of caries dentine whilst not affecting sound dentine. Energy-dispersive X-ray spectroscopy (EDX) scanning electron microscopy (SEM) was applied to demonstrate the deposition of the bioactive glass particles on the sound dentine.

Conclusions Selective removal of caries dentine was achieved using a preliminary cutting tool consisting of extruded polysulfone with bioactive glass particles incorporated. Initial tests on reference materials were used as proof of concept, followed by tests on sound and caries dentine. Further to this, EDX SEM was used to investigate the transfer of the bioactive glass particles from the polymer to the sound dentine. Establishing such a method for selective caries removal, combined with remineralisation of the hard tissues could lead to better healing prospects of deep caries lesions as well as to more conservative treatments, reducing the removal of remineralisable dentine.
Cost-effectiveness of fissure sealants versus fluoride varnish in preventing dental caries

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Objectives This work presents an economic analysis of a randomised controlled trial on the relative effectiveness of fissure sealants and fluoride varnish in the prevention of dental caries.

Methods Setting: mobile dental clinics in schools located in deprived communities. Participants: 1016 children, aged 6-7 years at baseline, randomised 1:1 to receive either fissure sealants or fluoride varnish. Interventions: resin-based fissure sealants were applied to caries-free first permanent molars and maintained at six monthly intervals. Fluoride varnish was applied at baseline and at six month intervals. Caries outcome was determined at 36 months. Health economic analysis: the costs associated with the interventions were summarised into the following categories; costs of the interventions; health care utilisation costs associated with travel or caregiving/time of work for families; costs associated with the schools. The CHU-9D (a child-specific generic preference based measure of health related quality of life) was used to generate utility values for each health state to enable the calculation of QALYs.

Results At 36 months 835 (82%) children remained. A smaller proportion of children who received FV (73% [17.5%]) developed caries into dentine on a least one FPM compared with FS (82% [19.6%]) OR = 0.84 (CI 0.59 to 1.21) [p = 0.35]. Costs showed small, but statistically significant differences between arms; NHS costs of FS vs. FV was £500 vs. £432 with a mean difference of £68.13 (95% CI 5.63-130.63, p= 0.033) in favour of FV.

Conclusions In a community oral health programme utilising mobile dental clinics and targeted at children with high caries risk, twice yearly application of fluoride varnish resulted in caries prevention which is not significantly different from that obtained by applying and maintaining fissure sealants after 36 months. Fluoride varnish proved less expensive than fissure sealant.

Registration: EudraCT No: 2010-023476-23 ISRCTN ref: ISRCTN17029222

Funding: This work was funded by the UK NIHR Ref: 08/08/104/04.
Objectives This study aimed to examine the relationship between obesity and dental caries in young English children. A further objective was to determine the impact of neighbourhood-level characteristics on the distribution of the two conditions.

Methods This was a cross-sectional study among children in Plymouth city aged four-to-six years. Anthropometric measurements included weight and height (converted to Body Mass Index). Dental caries was assessed by adding the number of teeth that were decayed, missing or filled. Information on children’s demographic characteristics, oral hygiene and dietary habits were obtained via a pilot-tested questionnaire. The impact of deprivation on obesity and caries was determined using ANOVA and Poisson regression models, respectively. Logistic regression models were used to examine the relationship between obesity and caries and to examine the impact of several demographic and health-related behaviours on the presence of the two conditions. Generalised linear models were used to examine the impact of neighbourhood-level characteristics on obesity and caries rates.

Results The total sample included 347 children aged 5.10 ± 0.31 (mean ± SD). Deprivation had a significant impact on caries and general obesity (p<0.05). Obesity was not significantly associated with dental caries. From the neighbourhood characteristics examined, the percentage of people dependent on benefits was found to have a significant impact on caries (p<0.05). Household’s total income was inversely related to caries risk while parental educational level affected children’s tooth brushing frequency. The consumption of several sweetened items was found to increase caries risk.

Conclusions No association between obesity and caries was found. However, deprivation affected both obesity and caries, thus highlighting the need to prioritise disadvantaged children in future prevention programmes. Dependence on benefits appears to be a useful indicator of increased risk of caries in Plymouth context.
**Intervention to Prevent Oral Disease in High Risk Child Populations**
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Peninsula Schools Medicine and Dentistry

**Objectives** The study seeks to develop an intervention to reduce oral disease in at-risk infants and to evaluate the feasibility and acceptability of the intervention. The objective of the intervention is to support the development of the behaviours as recommended in the DOH document "Delivering Better Oral Health".

**Methods** The intervention works with clients of the Family Nurse Partnership (FNP), an evidence based programme for first time mothers aged 19 and under, designed to support the health and wellbeing of the most vulnerable families in the UK. Phase 1 was the development of the intervention which was informed by interviews with 10 mothers currently enrolled in the FNP programme. In Phase 2 the intervention was delivered, a process evaluation of delivery of the intervention was conducted to test its feasibility and acceptability. This included interviews with 10 of the mothers who had received the intervention and 2 of the FNP nurses.

In Phase 3 of the study the intervention will be reviewed and discussed with a focus group of FNP clients and the results disseminated.

**Results** The intervention consists of up to 3 home visits by an oral health worker. The worker uses a motivational interviewing style to support mothers to build self-efficacy to perform protective behaviours. The intervention was delivered to 15 mothers.

**Conclusions** Initial findings suggest that it is feasible to deliver a home based oral health intervention to this population group, that these first time young mothers are motivated to care for their babies’ teeth and are able to initiate changes in behaviour to protect their child’s dental health. Some young mothers face particular challenges in establishing protective oral health routines because of a lack of stability in their living environment and the conflicting attitudes of significant others towards exposing their babies to sugary drinks and foods.
Don’t Smile – Reaching At-Risk Adolescents - But Did the Message Stick?
Pavitt, S. H.1, Boards, J. A.1, Day, P. F.1, O’Grady, A.2, Collins, R.2, Townsend, N.3, Barber, S.4, Kenny, K.5, Owen, J.6, Ramsdale, M.4, Zoltie, T.7, Thompson, W.1, Cooper, D.8, Patel, M.8, SMILE AIDER PPIE Forum, ..1
1University of Leeds, 2University of Leeds, 3Theatre of Debate, 4University of Leeds, 5University of Leeds, 6University of Leeds, 7University of Leeds, 8Batley Girls High School

Objectives “Don’t Smile” is a national award winning theatre production and debate about oral health – “a love story with a dental theme”! It proved a successful, innovative and popular approach for oral health research dissemination to BME vulnerable adolescents in Schools in areas of high health inequality/deprivation. The play aided immediate oral health awareness; the objective of the current study was to determine if this was long-lasting.

HEALTH NEED: 45% of Yorkshire’s 12-year-olds have rotten teeth, second-worst UK prevalence, correlated with social/health inequality. Whilst largely preventable, reaching those most vulnerable/deprived is challenging. Disadvantaged teenagers intrinsically don’t like to be told what to do. Don’t Smile demonstrated that theatre successfully imparted short-term knowledge non-judgmentally, allow debate and improve oral health awareness but is this knowledge retained?

Methods “Don’t Smile” explored wider implications of poor oral health, social isolation/psychological wellbeing and NHS dental access We have undertaken a questionnaire one year after the performances to see if any oral health messages were retained.

Results Pre & post production questionnaire showed that our embedded oral health message ‘dealing with dental trauma’ was understood by 100% audiences. Don’t Smile was an effective way to communicate research and oral health knowledge. We will present breaking research on whether oral health messages were retained one year post performances. We will also highlight how some pupils became ‘RAISED In Yorkshire’ (ReseArch In Schools Evaluating Dental health) Student Research Fellows and undertook pupil-peer monitoring of oral health &tooth brushing behaviour.

Conclusions Don’t Smile won the National Coordinating Centre for Public Engagement Prize for working with young people. We concluded that theatre is an effective media to impart knowledge that pupils ordinarily had limited access to and described it as a ‘treat’. Determining if the oral health messages were retained one year post-performance is innovative.
Photobiomodulatory Effect of Low Level Light on Oral Fibroblasts
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1University of Birmingham, 2Philips

Objectives Low level light therapy (LLLT) is a non-invasive treatment that utilises light in the near infra-red (NIR) and infra-red (IR) spectrum to promote tissue healing and reduce inflammation. Recently, LLLT has shown some promise in treating the chronic inflammatory oral disease periodontitis. This project aims to investigate the effect of LLLT on one of the most abundant cell types in periodontium: human gingival fibroblasts (HGFs).

Methods Primary HGFs were incubated overnight in 96-well plates (7000 cells/well). Cells were left untreated or stimulated with Escherichia coli Lipopolysaccharide (E.coli LPS, 0.1-1µg/ml) to induce inflammation and subsequently irradiated with a specialised LED array (400nm-830nm, 24mW/cm², 30-480s, 0.72-11.52J/cm²). The effect of light on cell metabolic activity as a marker for tissue healing (3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide (MTT)), inflammation (interlukin-8 (IL-8), enzyme linked immunosorbent assay (ELISA)) and reactive oxygen species (ROS) production were assessed 24hrs post irradiation. Data were then analysed using one way ANOVA followed by a post-hoc Tukey test (Sigma plot).

Results Irradiation for 240s (5.76J/cm²) induced a 12% increase in cell metabolic activity at 400nm relative to the non-irradiated (N-IR) control (p<0.05). Irradiation of untreated HGFs for 240s at 450nm caused a 15% increase in ROS production and a 27% increase in IL-8 secretion relative to the non-irradiated control (p<0.05). Conversely, irradiation of LPS treated cells for 240s at 450nm induced a decrease in IL-8 secretion of 31.8% relative to control (p<0.05). Phototherapy for 240s at 525nm also induced a decrease in ROS production of 8% relative to the non-irradiated control (p<0.05).

Conclusions LLLT has a biomodulatory effect on HGFs where light induces a decrease in ROS and IL-8 production under inflammatory conditions but induces an increase when cells are left unstimulated. This could prove beneficial in reducing inflammation in periodontitis.
Monitoring Salivary LPS Activity for Preventive, Participatory, Point-of-Care Periodontal Therapy
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Objectives Personalised, point-of-care dentistry is a move away from a ‘one size fits all’ approach to the prevention and care of patients with periodontal diseases, to one which uses new approaches to better manage patients’ gingival health and predisposition to the disease. Current diagnostic criteria for gingival diseases leave no opportunity to predict future tissue destruction or to formulate the appropriate treatment plan specific to each individual patient. Lipopolysaccharide (LPS) is the main virulence factor of periopathogenic bacteria and plays a key role in the development of periodontitis. The objectives of this study were to develop and evaluate a new salivary LPS-based, chair-side use biosensor for personalised, point-of-care, periodontal therapy.

Methods Unstimulated whole saliva was collected from 30 healthy individuals and 31 patients with chronic periodontitis. LPS from saliva was extracted by Tri-reagent protocol. Endotoxin activity of extracted LPS was assessed using the recombinant factor C assay and its inflammatory potential was examined in THP-1 cells by measuring TNF-α and IL-8 production (ELISA). Chemical composition of LPS’s lipid-A domain was determined by MALDI-TOF analyses. Osteoclast differentiation potential of salivary LPSs was evaluated in mouse macrophages using TRAP staining.

Results Endotoxin activity of salivary LPS extracted from patients with chronic periodontitis was significantly higher compared to healthy individuals. Production of TNF-α and IL-8 by THP-1 cells challenged by LPS extracts from chronic periodontitis patients was much higher compared to those treated with LPS extracts from healthy individuals. Lipid-A chemical composition analysis showed the predominance of bi-phosphorylated isoforms in chronic periodontitis samples. These samples exhibited significantly higher osteoclast differentiation potential compared to samples collected from patients with healthy gingivae. Conclusions Periodontal pathogens are able to trigger a detrimental hyper-inflammatory host immune response by producing high-potency LPS. Examination of salivary endotoxin activity could be a reliable, bacterially-derived biomarker for progression of periodontal diseases.
Chronic periodontitis and decreased respiratory function: a prospective cross-sectional study.
Winning, L., Patterson, C., Cullen, K. M., Kee, F., Linden, G.
Queen’s University Belfast

Objectives To investigate whether there was an association between chronic periodontitis and decreased respiratory function.
Methods A representative sample of dentate 58-72 year old men in Northern Ireland had a comprehensive periodontal examination. Parallel to the periodontal examination, participants completed questionnaires gathering information on their medical history, social circumstances, demographic background and a lifestyle. A physical examination assessed anthropometric measures. Fasting blood samples were obtained and analysed for high sensitivity C-reactive protein (hs-CRP). Spirometry measures were performed using a wedge bellows spirometer (Vitalograph S Model). The main outcome variable of interest was the percentage predicted score of the forced expiratory volume in one second (% predicted FEV$_1$). This was obtained by comparing FEV$_1$ to a reference value, calculated to age, gender, height, and race. Analysis included multiple linear regression with adjustment for various confounders. Systemic inflammation was investigated as a mediating pathway.
Results A total of 1380 men were included in the analysis. The mean age of the men was 63.7 years (SD 3.0). Men were divided into quartiles based upon their mean clinical attachment level (CAL). Across CAL quartiles significant differences were observed for various measures of respiratory function. Multiple linear regression analysis showed that CAL ($p<0.001$), number of teeth ($p<0.01$), smoking ($p<0.001$), hypertension ($p<0.001$), and education years ($p<0.01$) were all independent predictors of % predicted FEV$_1$. Systemic inflammation, as measured by hs-CRP, only accounted for a minor (14%) mediating pathway effect.
Conclusions In this cohort of 58-72 year old men, chronic periodontitis significantly associated with a decreased respiratory function. This relationship remained significant after adjustment for various known confounders.
Hypertension, Calcium Channel Blockers and Risk of Periodontitis.
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Objectives A number of reports have suggested that hypertension is associated with risk of periodontitis. We have previously presented that calcium channel blocker (CCB) medication is independently associated with risk of periodontitis in the NHANES 2011-12 and PRIME cohorts. Therefore the aim of the study here was to explore this relationship further and to investigate the relative contribution of CCBs and hypertension on risk of periodontitis. Methods We extended our previous analyses of the NHANES data to include all subjects over the age of 40 from the NHANES 2009–2014 cohort. In separate models we investigated the relationship of CCBs and hypertension with periodontitis, and also investigated this in hypertensive subjects who were not taking CCB medication using logistic regression. The outcome variable was moderate–severe periodontitis (Page & Eke 2007). Other explanatory variables included in the models were age, gender, race, education, diabetes mellitus, BMI and smoking. Results Data from a total of 8104 subjects over the age of 40 were available for analysis. Of these, 52% had moderate–severe periodontitis, 34.9% were hypertensive, and 11.5% were taking CCBs. In Univariate analyses both CCBs and hypertension were associated with periodontitis (P<0.001). In fully adjusted models neither CCBs or Hypertension remained significantly associated with periodontitis. Age, race, education, diabetes and smoking were all significantly associated with periodontitis in the fully adjusted models, whereas BMI was not. Conclusions The results for CCBs are in contrast with our previous results from analysis of the NHANES 2011-12 cohort only and from analysis of the PRIME dataset. The results do not support the association of hypertension with periodontitis and do however suggest that CCB medication should be considered a potential confounder for the role of hypertension in periodontitis.
The Effect of Hydration on the Stability of Oral Plaque Morphology and Mechanics
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Objectives Oral plaque biofilms exhibit varying dynamic, de- and re-hydration cycles in the oral cavity, due to intermittent periods of salivary flow, the consumption of drinks and conditions such as sjögrens syndrome. Their state of hydration can influence morphology and mechanical properties, with those that are dry exhibiting flattened structures with greater mechanical properties than those that are hydrated (Powell et al. 2013, Lau et al. 2009). Before the mechanical effects of such hydration cycles on biofilms can be determined, researchers must identify how different biofilms behave through drying and subsequent hydration, in-vitro. This change in structural and mechanical properties has yet to be mapped as a function of hydration time.

Methods Mixed species plaque biofilms (n=12), with low (0.1% w/v) and high (5% w/v) sucrose concentrations were grown on hydroxyapatite (HAP) disks and incubated for 5 days. Optical coherence tomography (OCT) was used to observe biofilm morphology after 1 hour air drying and for 100 minutes at 110s intervals under liquid conditions. Atomic force microscopy was then employed to monitor their mechanical properties in terms of Young’s Modulus (\(E_s\)) and adhesion (\(A_d\)) at 1 minute intervals for 100 minutes under liquid conditions.

Results OCT showed increased biofilm heights with increasing sucrose concentration across the hydration regime. AFM showed significant differences in biofilm \(E_s\) and \(A_d\) at baseline with increased sucrose concentration exhibiting significantly lower \(E_s\) and higher \(A_d\) compared to those with low sucrose. Lower sucrose fed biofilms exhibited a faster stabilization of mechanical properties (60 minutes) compared to those fed with higher sucrose (90 minutes).

Conclusions While most studies use hydration times of approximately 30-60 minutes before monitoring a biofilms mechanical properties, this study has shown that different biofilms exhibit different stages of stabilization. Those with higher sucrose diets have been shown to require longer stabilization times than those with lower sucrose.
The impact of *Fusobacterium nucleatum* sub-species on health and disease
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**Objectives** Oral biofilms are formed of multiple species, and their compositions differ between health and disease. Co-aggregation of the different species is well documented, however their means of communication and in particular the mechanisms of recruitment are less well understood. *Fusobacterium nucleatum* is of particular interest as it has been shown to interact with multiple species in the oral cavity and it seemingly forms a bridge between health and disease. Previously interactions between the three bacteria of the red complex have been studied in detail, however less is known about the contribution made by *F. nucleatum* to disease.

Five different subspecies of *F. nucleatum* have been described to date and currently available data suggest significant differences exist between the subspecies at a genomic level.

Here we aim to compare all five subspecies to establish whether all subspecies can be true or opportunistic pathogens, or whether certain subspecies may be associated with a health promoting or disease-associated biofilm.

**Methods** The five subspecies are being whole genome sequenced (Illumina), genomes assembled and comparative genomics employed to compare the strains. Health and disease-associated biofilms are being grown statically under anaerobic conditions and analysed using quantitative (staining and qPCR) and qualitative (confocal microscopy) methods. Multi-species biofilms will be used to stimulate eukaryotic cells to measure inflammatory markers.

**Results** Differences in planktonic and biofilm growth of the subspecies were observed, which could prove pivotal *in vivo*.

The genomic variation between the strains will be presented and differences correlated to observed phenotypes.

**Conclusions** *Fusobacterium nucleatum* is an opportunistic human pathogen with pivotal importance in the formation of a disease-associated biofilm in periodontitis. Currently five subspecies (*nucleatum, polymorphum, vonventii, animalis* and *fusiforme*) have been described. Here we report the phenotypic and genotypic differences between those and highlight potential implications for health and disease.
Objectives Mucosal macrophages (Mφs) play an important role in immune function; determining responsiveness to pathogenic challenge, effectively driving immune activation or suppression/tolerance-fate decisions. This on/off switch is dependent on pathogen recognition and Mφ subset; dysfunctions in which contribute to mucosal pathology. Prior endotoxin challenge renders Mφs refractory to re-exposure. This endotoxin tolerance (ET) effectively suppresses inflammatory responses resulting in quiescence, characteristic of the relapsing-remitting nature of mucosal inflammatory diseases such as chronic periodontitis and Crohn’s disease. The objective of this study was to characterise Mφ subset-specific ET mechanisms associated with responses to LPS from the enteropathogenic *E.coli* K12 and compare to those driven by LPS from the oral pathogen, *Porphyromonas gingivalis* (PG).

Methods M1- and M2-like Mφs were generated *in vitro* from the THP-1 monocyte cell line by differentiation with PMA and Vitamin D₃, respectively. Sensitivity to ET was measured by cytokine secretion by ELISA and mRNA expression of cytokines, TLR4 and the endogenous TLR signal regulators, IRAK-M and Tollip by RT-PCR.

Results PG-LPS differentially tolerised M1 and M2 subset cytokine responses, where TNFα and IL-1β were suppressed in M2 Mφs and augmented in M1s. In the case of *E.coli* K12-LPS, TNFα and IL-1β were suppressed in both subsets, as was TLR4. Both Tollip and IRAK-M expression were up-regulated in tolerised M1 Mφs and less so in M2s. Only tolerised M2 Mφs however, displayed an augmentation in IRAK-M protein. Finally, IL-10 differentially suppressed TNFα secretion; K12-LPS-induced TNFα was suppressed in both Mφ subsets whereas PG-LPS-induced TNFα was only suppressed in M2 Mφs.

Conclusions PG-LPS and *E. coli* K12-LPS differentially suppress Mφ cytokine production; dependent on subset, sensitivity to IL-10 anti-inflammatory effects and the expression of TLR negative regulators, IRAK-M and Tollip. Manipulation of which may offer future therapeutic regimens for the control of mucosal inflammatory pathology.
Oral cancer stimulated TNFα production and phenotypic transformation in macrophages
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Objectives
Background: The initial stages of cancer development are recognised by immune cells such as M1 type macrophages. During tumour development macrophages become tolerant (M2) to the cancer cells and provide an environment for tumour growth. The mechanism of phenotypic switch from M1 to M2 type during tumorigenesis is not known.

Aims & Objective: The purpose of this study was to investigate the initial response of macrophages to head and neck squamous cell carcinoma (HNSCC) cells in vitro and to identify the molecular and cellular mechanisms that induce macrophage phenotype from M1 to M2.

Methods
2D and 3D models using human macrophage cell line (THP-1) with head & neck squamous carcinoma cell lines (HNSCC) and their conditional medium were used. In some experiments, co-culture THP-1 cells were collected and further stimulated with LPS. Cytokine production was examined by ELISA and RT-qPCR. Cell aggregation and migration was assessed using time lapse microscope.

Results
1) TNFα was transiently produced at 24hrs co-culture and reduced within 48hrs, partially due to the TNFα use by HNSCC cells. 2) Macrophage adherence and migration toward HNSCC occurred immediately after co-culture, but not observed in controls (osteosarcoma cell line MG63). 3) Degrees of cell aggregation were diverse between cell lines; however, macrophage aggregation was not associated with levels of TNFα production. 4) Following prolonged culture of THP-1 with HNSCC, THP-1 lost the ability to produce TNFα in response to LPS stimulation.

Conclusions
HNSCC produce soluble and membrane bound proteins that induce TNFα production in macrophages, which convert macrophages into a tolerogenic phenotype. Blocking the tolerogenic pathway could be a novel therapeutic method to limit the progression of oral cancer.
Activation of Toll-like Receptors by Putative FCGS Pathogens
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Objectives Feline chronic gingivostomatitis (FCGS) is a common and extremely painful disease in cats, with a complex multifactorial aetiology. Several pathogens are putatively involved in the disease, such as T. forsythia, P. circumdentaria and Feline Calicivirus (FCV). Using comparative human and feline models we aimed to investigate the role of these pathogens in the development of this disease by determining whether they stimulate macrophage toll like receptors (TLRs).

Methods Mononuclear phagocytes were challenged with varying multiplicities of infection (MOIs) of putative bacterial pathogens from the literature. Additionally, they were challenged with two bacteria found to be prevalent in FCGS using high throughput sequencing; Pasteurella multocida subsp. multocida and P. multocida subsp. septica. For control purposes cells were also stimulated with a known oral commensal of cats, Bergeyella zoohelcum. The production of the proinflammatory chemokine interleukin-8 (IL-8) by mononuclear phagocytes was analysed using ELISA and RT-PCR. TLR activation was confirmed using the THP1-XBlue cell line, which produces secreted embryonic alkaline phosphatase (SEAP), in response to TLR activation and induction of the NF-κB transcription factor.

Results All the putative pathogenic bacteria were found to stimulate TLRs. Of the bacteria investigated, T. forsythia had the greatest stimulatory effect followed by P. circumdentaria, P. multocida subsp multocida and P. multocida subsp. septica respectively. There was a strong correlation between TLR activation and IL-8 production. The commensal, B. zoohelcum had the smallest stimulatory effect.

Conclusions The commensal B. zoohelcum had a low level stimulatory effect; this low immunological response is congruent with other studies on gut commensals. The putative pathogenic bacteria, particularly T. forsythia, had a strong stimulatory effect on mononuclear phagocytes and induced an innate immune response. In cats, failure to clear this pathogenic threat could result in the chronic activation of the innate immune response and be important in the pathogenesis of FCGS.
The relationship between dietary acid intake, tooth brushing and dentine hypersensitivity

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Objectives To assess the relationship between dietary acid intake and dentine hypersensitivity (DH).

Methods This is a secondary analysis on previously collected data from 600 participants with (n=300) and without (n=300) severe erosive tooth wear. Participants recruited from restorative clinics of King’s College London Dental Institute (REC Ref 14/EM/1171) were questioned on their self-reported DH, frequency and timing of dietary acid intake, habits associated with consumption of dietary acids and tooth brushing habits. Erosive tooth wear was assessed using Basic Erosive Wear Examination (BEWE). Differences in diet between those with self-reported DH and those without were analysed using descriptive and logistic regression in SPSS vers 23.

Results Of those reporting with DH (n=272), 166 participants (61%) had tooth wear and 106 (39%) did not. A greater number of DH participants spent ≥ 10 min per sitting eating fruit (n=46) than those without DH (n=26, p=0.005). When drinking acidic drinks, a greater number of DH participants had a habit of sipping, swishing or holding drinks in the mouth prior to swallowing (n= 72) compared to those without DH (n= 38, p<0.001). More DH participants consumed 3+ dietary acids daily between meals (n=132) compared to those without DH (n=117), p=0.002. In logistic regression, strong associations with DH were observed with drinking habits (OR 2.33, 95% CI 1.40-3.88, p<0.001) and prolonged fruit consumption (OR 3.03, 95% CI 1.64-5.61, p<0.001). No relationship was observed between frequency of dietary acidic drink intake between meals and DH when other factors were controlled for.

Conclusions The strongest associations between an acidic diet and DH were observed when ≥ 10 min was spent consuming fruit and sipping, swishing or holding an acidic drink in the mouth prior to swallowing. Contact time between the tooth and the acid may be a more important risk factor for dentine hypersensitivity compared to frequency of dietary acid intake.
Association between number of teeth and healthier food choices in older men
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Objectives To investigate whether the number of teeth was associated with healthier food choices made by older men in Northern Ireland.

Methods A representative sample of 60-70 year-old dentate men in Northern Ireland underwent a dental examination between 2001-2003. Food choice was assessed in 2015 using a food frequency questionnaire. Logistic regression models were used to investigate associations between number of teeth and frequency of food choice of healthier foods (olive oil, fruit, vegetables, fish, wholegrain foods and nuts). Models were adjusted for possible confounders including age, BMI, diabetes, smoking, education, socio-economic status and periodontitis.

Results A total of 1012 men provided valid dietary information 13.1 years (SD 0.6) after their baseline dental examination (91% response rate). The average age of the men was 77.0 years (SD 2.9). Men with twenty or more teeth were significantly more likely to eat fruit on a daily basis than those with fewer teeth, 68.4% compared with 59.5%, p<0.01; to eat vegetables on a daily basis, 53.0% compared with 42.2%, p<0.001; and to eat wholegrain foods daily, 76.3% compared with 67.3%, p<0.01. Men with twenty or more teeth were significantly more likely to ever eat nuts than those with fewer teeth, 63.3% compared with 36.5%, p<0.0001; adjusted OR=2.58 (1.93-3.45), p<0.0001; to ever use olive oil, 53.0% compared with 38.3%, p<0.0001; adjusted OR= 1.63 (95% confidence interval 1.22-2.18), p<0.01; and to ever eat fish, 88.2% compared with 78.2%, p<0.0001; adjusted OR= 1.87 (1.29-2.70), p<0.001.

Conclusions Diet quality is critically important for healthy ageing and prevention of chronic disease. In this representative sample of older men, greater number of teeth was independently associated with quality of food choice over a decade later.
No Evidence that Vitamin D Causally Prevents Tooth Loss.

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Objectives A recent prospective study showed that participants with elevated vitamin D levels at baseline are at lower risk of tooth loss over a five year period, implying that vitamin D might be a modifiable protective factor for tooth loss. We aimed to examine whether genetically altered vitamin D levels influenced odds of tooth loss in an adult population using a technique termed Mendelian randomization, which uses naturally occurring genetic variation to make causal inference.

Methods We identified 8 single nucleotide polymorphisms (SNPs) which alter serum vitamin D levels in a genome-wide meta-analysis of 42,274 individuals. We investigated the relationship between genetically determined vitamin D levels and denture wearing (as a proxy for tooth loss) in 146,341 adults in the UK Biobank study (aged 40-73 years) with genotype and outcome data available. Effect estimates from each of these 8 SNPs were combined in an inverse variance weighted meta-analysis to quantify the overall causal effect of serum vitamin D levels on tooth loss. Analysis was performed using the TwoSample MR R package.

Results There was no evidence to suggest that vitamin D was protective against tooth loss (odds ratio 1.004 per 1 standard deviation increase in log transformed vitamin D, (95% CI: 0.995:1.013)).

Conclusions Mendelian randomization is more robust to confounding and reverse causality than conventional epidemiological methods and generally yields unbiased causal estimates. The results of this study do not support a causal role of vitamin D in preventing tooth loss in middle aged and older adults. This study may be limited by use of denture wearing as a non-specific endpoint of dental disease. Follow up analysis is planned to examine the effects of vitamin D against a panel of clinically assessed caries traits in both adults and children.
Objectives To gather dental experiences of UK parents of children with autism, highlight challenges the families face along with how the parents and the dental team try to overcome these challenges and explore how they feel primary care dental services can be improved.

Methods Researchers were advised by parents of disabled children. Semi-structured interviews were conducted with 17 parents of children aged between 5 and 13 years with a diagnosis or working diagnosis of autism; data were analysed thematically.

Results Key themes identified were the flexibility of the dental team and environment, confidence of the parents to advocate for their children’s needs, continuity of services and clear referral pathways to specialist services. Cross-cutting all themes was the need for clear communication which influenced dental visit success. The experiences provide greater understanding of issues such as hyper-empathy, the focus of the dental chair, challenges of the waiting room, perceived medical authority and the importance of care before and after a visit. A conceptual model illuminating the linked nature of the key themes was created.

Conclusions In line with previous research about the importance of family-centred care, a strong relationship between parents and the whole dental team, and the continuation of care extending beyond the dental examination, is essential to enable children with autism to access regular dental examinations. Suggestions include providing a system to alert the dental team to the needs of the family without the parent explaining at every visit, and adopting a flexible approach to meeting those needs. Parents need to be confident when advocating for their children. Clear communication and information sharing among members of the dental team and the family is key to improving access to primary care dental services for families of children with autism.
Oral Care of Palliative Care Patients – Carers’ and Relatives’ Experiences.
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Objectives The oral cavity, in palliative care patients, is commonly the first site of discomfort and loss of function. Oral care, however, is often overlooked for palliative care patients. There is a lack of evidence-based guidance regarding how this care should be delivered. Palliative oral care is a poorly researched area and the experiences of patients, their carers and relatives are seldom explored. The aim of this study was to address this gap and explore the oral care experiences of palliative care patients, from the perspective of their carers and/or relatives.

Methods Blogs and discussion forums, on public internet sites, were used to access the data. This approach was chosen to avoid causing additional burden to this population. An electronic search using “Google” and known blog platforms such as “Tumblr” and “Wordpress” was conducted on January 25th, 2017. Data were analysed using thematic analysis.

Results Eight blogs and eight discussion forums fulfilled the inclusion criteria and were analysed. Three main themes were identified: symptoms, procedures and emotions. Oral symptoms that needed to be addressed were mentioned. Authors described symptoms that they could observe themselves. There was an association between oral care procedures and the oral symptoms observed. However routine oral care procedures were described without much detail. When negative events happened there was a much more in-depth and emotionally charged description. The authors’ emotional responses to the oral care delivered and/or lack of oral care delivered, varied from anger, guilt, worry and trauma.

Conclusions The data on oral care provided by the blogs and discussion forums included was scarce. However it provided insight into a poorly researched area and will inform a future qualitative interviews study.
Sustainability in Dental Practice Using an Action Research Approach  
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University of Plymouth

**Objectives** Dental practices use a more extensive variety of materials and instruments than many other health care services, and consume considerable amounts of energy, resulting in substantial environmental impact. We carried out an environmental Action Research project in one dental practice. This study used data from previous waste audits in the same practice and identified areas where behaviour change could potentially reduce the environmental impact of the practice. Staff then decided the actions they could take to increase environmental sustainability and improve efficiency.

**Methods** Action Research is a mechanism that enables a range of possible interventions to be tested. Staff are involved at every stage so behaviour change is embedded by the end of the project. Initial audits identified areas of inefficiency and waste. An option appraisal suggested activities which staff could trial. Practice staff decided to target a reduction in tissue use, wasteful behaviour regarding high level of glove use, and the energy consumption of the building. The research team provided housekeeping ideas to reduce energy costs. After a two-month period, the waste audit was repeated. Utility bills and other running costs were assessed. A process audit tracked the practicality of the interventions proposed.

**Results** The practice created two bins close to each other to ensure selective disposal of tissues and packaging. They reduced the amount of gloves they wore by changing the method of some procedures. The equipment supplier has been investigating sustainable alternatives to a range of items. Solar panels installed which have made savings on energy bills.

**Conclusions** The option appraisal approach allowed staff to determine the feasibility of reducing certain materials from the clinical waste. Change has been embedded in the practice behaviour and staff adopted new ideas resulting in a reduction in the carbon footprint of the practice.
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