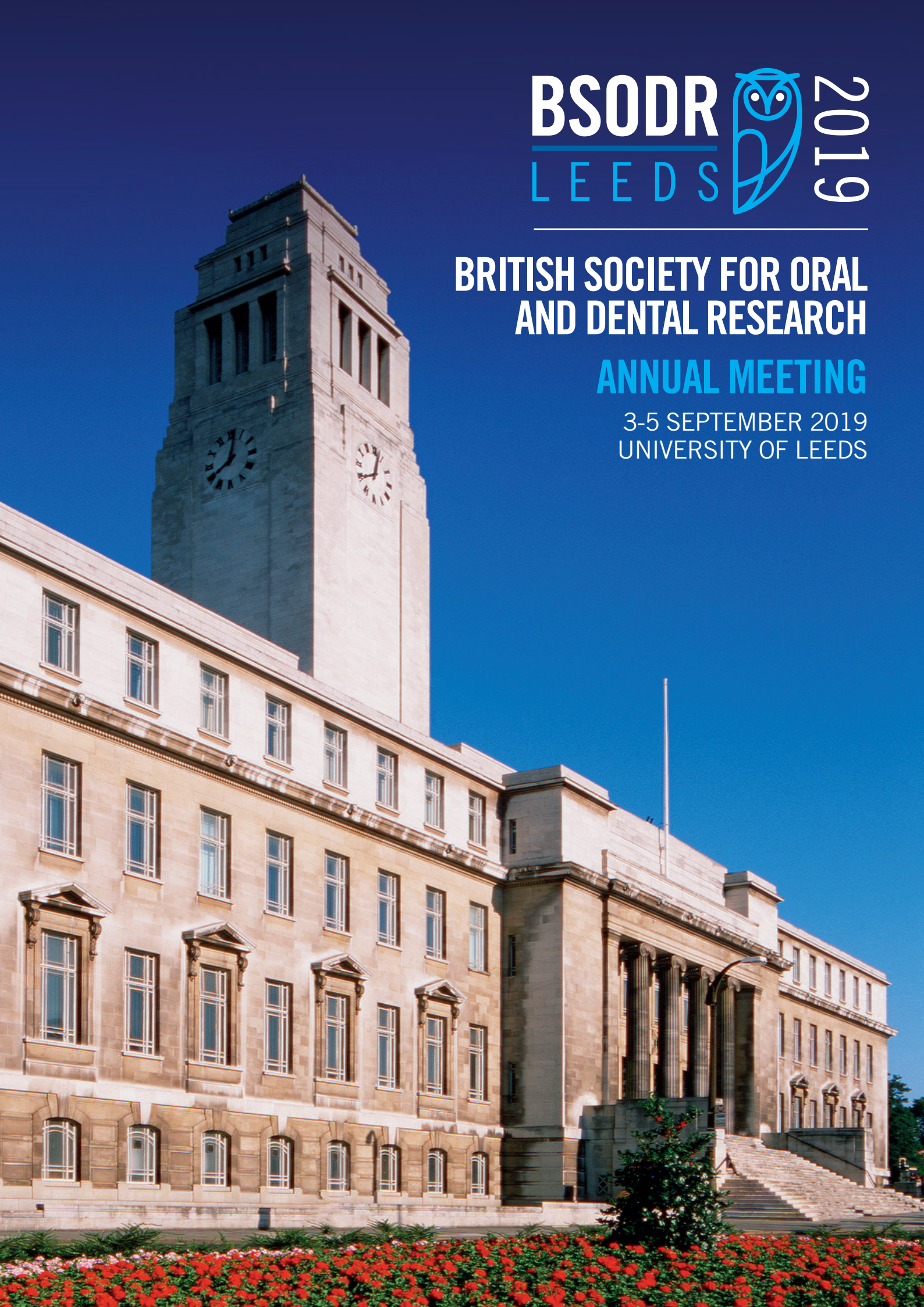

BSODR LEEDS 2019

BRITISH SOCIETY FOR ORAL AND DENTAL RESEARCH

ANNUAL MEETING

3-5 SEPTEMBER 2019
UNIVERSITY OF LEEDS

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†Significant reductions in plaque and gum problems at 6 months vs non-antibacterial fluoride toothpaste; $p<0.001$.

References: 1. Prasad K et al, *J Clin Dent*, 2018;29 (Spec Iss A) **2.** Delgado E et al, *J Clin Dent*, 2018;29 (Spec Iss A).

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Welcome to BSODR Leeds 2019

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Welcome to the *magnificent* city of Leeds!

Leeds is a modern city with a rich industrial past. Compact and accessible you can walk everywhere and experience culture at its best. Delegates can unwind and continue networking in a vibrant city centre famous for an eclectic and fast growing independent food and drink scene.

The city boasts an exciting venue portfolio, from world-class academic Universities, historic civic venues such as Leeds Town Hall and unique experiences such as at Headingley Rugby and Cricket Stadium.

Centrally located in the heart of the UK, the city is attractive to both national and international delegates. Leeds is only a two hour train journey from London or one hour by air. Leeds Bradford Airport also offers excellent transport links with national and international flights to over 70 international destinations and eight UK destinations.

The city has also become a retail powerhouse, now ranked 3rd in the UK for its overall retail offer with over 1,000 shops in a wide array of outlets ranging from the Corn Exchange packed with independent retailers and the cutting-edge Trinity Leeds, which opened in 2013 to accompany other high street and high end names around Briggate, Victoria Quarter and now Victoria Gate.

Popular with its large student population it has a wealth of evening entertainment with an array of bars and nightclubs and a great live music scene.

Leeds is also the only city in England outside the capital with its own repertory theatre, opera house and ballet companies. Other notable city attractions include the West Yorkshire Playhouse, Royal Armouries Museum and 13,500 capacity First Direct Arena.

Welcome to BSODR Leeds 2019

It is our great pleasure to welcome you to the 2019 British Society for Oral and Dental Research (BSODR) scientific meeting hosted by the University of Leeds.

2019 marks a significant milestone for BSODR as we commemorate the 60th anniversary of the Senior Colgate awards; it is an achievement worth noting and celebrating. Accordingly, in addition to our keynote, Graham Embery and TC White lectures, this year we will host an additional invited speaker to help celebrate this partnership.

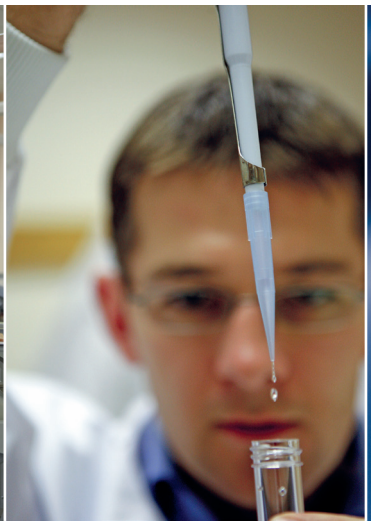
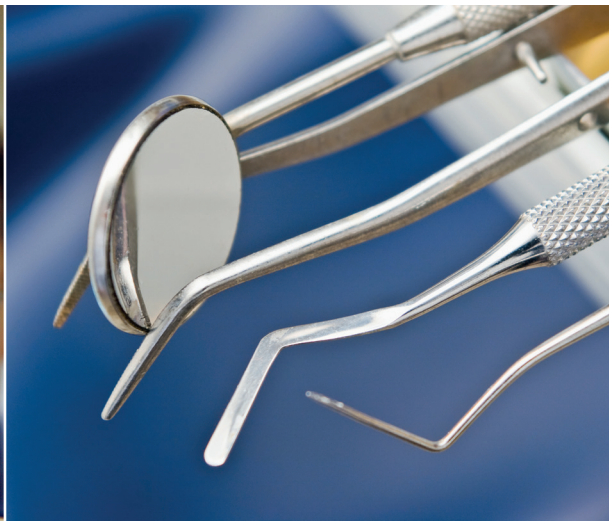
As well as celebrating our past, BSODR is looking forward; supporting early career researchers (ECRs) on their journeys to becoming the next generation of clinical and non-clinical academics. In addition to our established ECR networking breakfast, this year marks the introduction of a new award, the BSODR President's Prize for ECRs. In addition, the Oral and Dental Research Trust have organised a workshop for ECRs the day before BSODR commences.

Another new initiative at this year's meeting is the attendance, supported by BSODR, of representatives from a local Patient and Public Involvement and Engagement (PPIE) group who I'm sure will provide a unique perspective on the research presented at our meeting.

I am grateful to Mrs. Ruth Kayman, Research & Innovation manager at the School of Dentistry and the MEETinLEEDS team for their hard work in bringing this event together. I thank our sponsors and exhibitors for their support.

We hope you have a productive and enjoyable meeting and look forward to welcoming you to the beautiful and vibrant city of Leeds.

David Wood, Chair of the Local Organising Committee

The British Society for Oral and Dental Research (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 also a member of a federation of European research societies - Pan European Region (PER). The members of the PER are the 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.

Now, the BSODR meets on an annual basis. Meetings alternate between the UK and a joint meeting with our PER partners.
Recent meetings have been held in Bath (2013), PER/IADR-Dubrovnik (2014), Cardiff (2015), PER/IADR-Jerusalem (2016), Plymouth (2017) and PER/IADR-London (2018).

Membership

For more information regarding membership of BSODR please visit our website:

https://www.bsodr.org.uk/

BRITISH SOCIETY FOR
Oral and Dental
RESEARCH

Management Committee

Professor Peter Robinson

Honorary President

Bristol Dental School, University of Bristol

Dr Marcello Riggio

Honorary Secretary, Webmaster & President Elect

Dental School, University of Glasgow

Professor Paul Anderson

Assistant Honorary Secretary

Institute of Dentistry, QMUL

Dr Vehid Salih

Honorary Editor

Peninsula Dental School, Plymouth University

Professor David Bartlett

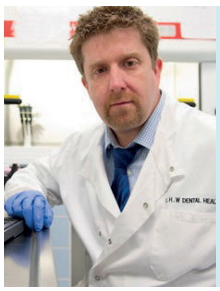
Immediate Past President

King's College London, Dental Institute

Dr Rebecca Moazzez

Honorary Treasurer

King's College London, Dental Institute



Professor Alastair Sloan

Assistant Honorary Treasurer

School of Dentistry, University of Cardiff

Professor Rachel Waddington

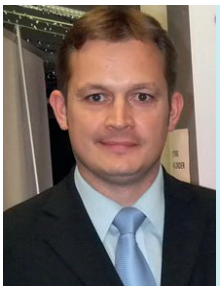
Chair of Awards Committee

School of Dentistry, University of Cardiff

Professor David Wood

Councillor (2016-2019)

School of Dentistry, University of Leeds



Dr Chris Hope

Councillor (2016-2019)

Dr Louise Belfield

Councillor (2017-2020)

Peninsula Dental School, Plymouth University

Mr Praveen Sharma

Councillor - Early Career Researcher (2018-2021)

School of Dentistry, University of Birmingham

Dr Josette Camilleri

Councillor (2018-2021)

School of Dentistry, University of Birmingham

Professor Paul Cooper

Councillor (2018-2021)

School of Dentistry, University of Birmingham

Dr Steve Mason

Councillor - Industry (2018-2021)

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UNIVERSITY OF LEEDS

The School of Dentistry is one of the country's leading centres for dental study and research. We're proud of our international reputation for the proficiency of our alumni, the insight of our research and the quality of facilities available to students and collaborators. We combine expert teaching with innovative research work, producing both the highest calibre of dental practitioners and research which will shape the discipline they work in

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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.

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Sponsors

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.

The Wrigley Oral Healthcare Programme aims to provide information and practical resources to help dental professionals promote healthy oral care to their patients. It's our mission to help patients improve their regular oral healthcare routine between brushing through one additional simple and enjoyable step: chewing sugarfree gum after eating and drinking.

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.

The School of Clinical Dentistry at the University of Sheffield has an international reputation for excellence in education and research. Our research is highly multi-disciplinary, ranging from investigation of fundamental disease processes through translation to develop innovative drugs, devices and other interventions, ultimately leading to clinical trials and studying the impacts of oral health and disease on individuals and society. Sheffield's world class research informs education in the School at undergraduate and postgraduate levels throughout all of our non-clinical, hygiene therapy, and clinical programmes.

The School of Dentistry at The University of Birmingham, UK is currently 13th in the world QS rankings, (2019). It is the oldest dental hospital service and provider of accredited dental education globally and the oldest dental degree in the UK. Our new state-of-the-art facilities host internationally leading and cross-disciplinary research groups, which provide fantastic opportunities for postgraduate study; either taught or research programmes. Please join us in 2021 when we host the BSODR conference in Birmingham.

The University of Plymouth Peninsula Dental School is among the newest UK Dental Schools and has featured in the top 3 of a variety of University/ NSS tables in recent years. Plymouth became the first dental school to gain Royal College of Surgeons' centre accreditation in 2018. A novel curriculum is delivered and supported by dedicated staff, combining state-of-the-art clinical facilities with a strong sense of community engagement and provision of primary dental healthcare to the southwest. Along with an expanding postgraduate programme and excellent research, the school continues to strive for excellence, innovation and quality.

The campus is approximately ½ a mile from the city centre on Woodhouse Lane, on the A660. Leeds is linked to the M1 and M62 and is very easily accessible.

For satellite navigation

University of Leeds,
Woodhouse Lane,
Leeds,
LS2 9JT
(street listing can appear as Cavendish Road on some navigation systems)

Bus

There are number of bus services in Leeds. The number 1 bus leaves from Infirmary Street, near the City railway station in City Square, to the campus every ten minutes during the day and every half hour in the evening. There are frequent buses from the central bus station including numbers 28, 56, 96, 97. You should get off the bus at the main entrance adjacent to the Parkinson Building.

Visit **www.wymetro.com** for timetables and general information.

The National Express Coach Station is adjacent to the Bus Station: **www.nationalexpress.com**

Rail

For rail travel details visit: **www.nationalrail.co.uk**

Taxi companies

Streamline Telecabs - **0113 244 3322**
Amber Cars - **0113 231 1366**
Arrow - **0113 258 5888** (Arrow taxis are the official Leeds/Bradford Airport taxi company)

Parking

Where possible we suggest the use of public transport to travel to the University, as parking spaces are limited. Parking on campus is chargeable at £7.00 per day. This should have been booked during registration. If you have not booked and wish to do so, please modify your registration here: **https://eu.eventscloud.com/ereg/newreg.php?eventid=200183448**

Any changes to parking after Thursday 29th August, please contact Tom Throssel: **t.g.throssel@leeds.ac.uk** or **0113 343 5723**

The closest public car park is Woodhouse Moor Multi-Storey which is open 24 hours a day.

For more information and prices on alternative car parks in Leeds please visit: **www.parkopedia.co.uk**

Conference registration is in Parkinson Court located in the Parkinson Building. **Registration will be open Tuesday 3rd September from 12.00am**.

Oral sessions are being held in the Michael Sadler Building, with posters, refreshments and exhibition in the Parkinson Building.

Cloakroom

Cloakroom facilities will be available in room LG16 in the Michael Sadler Building.

Conference Refreshments

To enhance networking opportunities, drinks, snacks and buffet lunches will be provided in the Parkinson Building. Refreshment breaks will consist of tea, coffee and water.

Lunch will include a finger buffet including sandwiches, savoury items and a mixture of cake and fruit served with mineral water and juice.

Banks & Shops

Cash points - Located within the Student Union building situated adjacent to the Refectory on the University campus.

Banks - There is a Santander located in the basement floor of the Students Union. There are also several major banks and further cash points opposite Parkinson Court at the University's main entrance on Woodhouse Lane.

Post Office - The nearest is located in the St John's Centre in the City Centre.

Shops - The main University Refectory serves sandwiches, healthy options plus freshly cooked hot food. Essentials which is a mini-supermarket selling newspapers, magazines, stationery, drinks, sandwiches, snack and confectionery items.

City Centre shops generally open between 9.00am and 6.00pm Monday to Saturday.

Please note, the Coffee Bars, Refectory, and Student Union shops are open weekdays only.

Health & First Aid

If first aid is required on campus please contact a member of staff in the building or for emergencies call Security via an internal telephone on **x32222** or externally on **+44(0)113 343 2222** - available 24-hours.

Hospital - The nearest emergency department is at the Leeds General Infirmary, telephone **0113 2432799**, which is situated adjacent to the University.

Chemists - Lloyds Chemist is situated on Woodhouse Lane across from the Parkinson Building. Boots late night pharmacy (open until midnight) is located at Leeds City Train Station.

Oral Presentations

Please provide an electronic copy of your talk to a member of the AV team in the relevant room in the Michael Sadler Building at least 60 minutes before the start of the session in which you are speaking.

You will be able to upload your talks:

From 12.00 to 16.00 on Tuesday 3rd September
From 08.30 to 13.45 on Wednesday 4th September
From 08.00 to 11.00 on Thursday 5th September

The slide preview room (room LG17 in the Michael Sadler Building) will be open at the same times.

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 in Parkinson Court in the Parkinson Building. Velcro will be provided. Poster set-up commences at 12:00 on Tuesday 3rd September and all posters must be set up by 09:30 on Wednesday 4th on their designated numbered board. Presenters participating in the BSODR poster prize presentations must mount their posters by 09.00 on Wednesday 4th September on their designated numbered board. 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.

Highlight Sessions

MINTIG Symposium – **Hard tissue repair and regeneration – the interface between materials and biology**

Tuesday 3rd September, Michael Sadler Building, Rupert Beckett Lecture Theatre, 14.00-15.30

Launch Symposium – **Dental Primary Care (DENTPRIME) National Research Clinical Studies Group & Alliance**

Tuesday 3rd Sept 2019; Michael Sadler Building, Rupert Beckett Lecture Theatre, 15.45-17.15

Early Career Researcher Breakfast

Wednesday 4th September, University House, St. George Room, 08:00-09:00

The session will provide a relaxed atmosphere for ECRs to network and 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.

TC White Lecture – **Dr Deepshikha Kumar**

Wednesday 4th September, Michael Sadler Building, Rupert Beckett Lecture Theatre, 12:00-13:00

"Post-operative complication rates in lower third molar coronectomies."

Summary: This lecture will review current literature on and the practice of lower 3rd molar coronectomies, and associated post-operative complications. Post-operative IAN and lingual nerve damage from lower third molar surgery is of medicolegal and clinical concern. The study discussed in this lecture looks at post-operative complication rates of coronectomies carried out at a district general hospital over the last 3 years. Coronectomies have been discussed across literature to be a safe, less invasive alternative to complete extraction with significantly reduced risk of IAN damage in high risk cases. Whilst coronectomies may be indicated in relevant cases to patients, there is a paucity of high-level evidence with regards to its complication rates. I will discuss the role of coronectomies in management of impacted lower 3rd molars and how we may develop relevant guidance.

About Deepshikha Kumar: I graduated from Sheffield Dental School in 2015 and am currently a 3rd year medical student at University of Liverpool. I am passionate about pursuing a career within Oral and Maxillofacial Surgery as I consider it to be an exciting and rapidly evolving specialism that combines unique surgical skills with medical knowledge. Having completed one year of Dental Foundation training in Holmfirth, I completed 2 years of Dental Core Training (DCT) in OMFS at Sheffield and Rotherham and a final DCT year in oral and maxillofacial pathology, oral medicine and Quality Improvement in Dundee with SDCEP.

In my post graduate training years, I have presented nationally and internationally at BAOS, BAOMS, ASIT and BSOM. I most recently presented at the International Conference of Oral and Maxillofacial Surgeons in Rio de Janeiro, for which I was grateful to receive the Royal College of Physicians and Surgeons of Glasgow TC white Travel Grant. I also won a BAOS poster prize for work carried out under supervision of Mr O.Hussain (Oral and Maxillofacial Consultant) at Montague Hospital. This was entitled 'Management of Craniofacial deformities associated with Proteus Syndrome'. A keen educator, alongside my DCT posts I ran successful interview prep workshops for BDS students, raising over £300 for the Norman Rowe International Education Foundation in association with BAOMS, and was also a teaching programme co-ordinator for fellow DCTs. Through my recent DCT post in Quality improvement at Dundee, I am currently involved in analysis of Scottish Patent Safety Programme (SPSP) in Primary dental care. SPSP is a unique national initiative that aims to improve the safety and reliability of health and social care and reduce harm, whenever care is delivered.

Colgate Anniversary Lecture – **Dr. Barry Cockcroft**

Wednesday 4th September, Michael Sadler Building, Rupert Beckett Lecture Theatre 13:45-14:45

"60 years of prevention, it is simple but it is not easy! From extension for prevention to minimal intervention."

Summary: In celebration of 60 years of the Colgate Senior Prize for postgraduate students or postdoctoral researchers, Dr Cockcroft will present his reflections on the changing face of prevention and the improvement in oral health over the last 60 years. Dr Cockcroft will also explore how oral and dental research has to develop in order to be relevant to the changing demography, needs and wants of the population. He will also explore the challenges in disseminating and translating this research into practice.

About Barry Cockcroft: Barry Cockcroft qualified from Birmingham Dental School in 1973. After one year working in hospital he pursued a career in mainly NHS general dental practice. He joined his local LDC in 1980 and represented Coventry, Warwickshire and Solihull on the General Dental Services Committee of the BDA from 1990 until he joined the Department of Health in 2002. At the time of his move to the DH he was the vice chairman of the GDSC and had just written the section of the Options for Change policy document on how NHS dental services should be reformed. Barry initially joined the DH as Deputy CDO and was appointed CDO in 2006. He retired as CDO in February 2015.

Barry is proud of the fact that he was the first (and to this day only) general dental practitioner to hold the CDO post

He has been awarded honorary fellowships by the University of Central Lancashire, the Faculty of Dental Surgery of England and the Faculty of General Dental Practice (UK). He was also awarded an honorary Doctorate in Dental Surgery by the University of Plymouth.
He was awarded a CBE in the New Year's Honours list in 2010.

Barry has long been an advocate for making greater use of the whole dental team as a way of improving the health of the nation and instigated the production of the evidence based guide to prevention in primary care, Delivering Better Oral Health, the first edition of which was published in 2007.
He joined Mydentist as a Non-Executive Director in June 2015 and is a member of the Alumni Leadership mentoring programme at Birmingham University.

Graham Embery Lecture – **Professor Sue Pavitt**

Wednesday 4th September, Michael Sadler Building, Rupert Beckett Lecture Theatre, 14:45-15:45

"Making Every Day Count –Driving research innovation - Working as a community and with the community to tackle multimorbidity and increase research impact"

PROSPECT Oral and Dental Research
Periodontal Research on Multi-morbidity and Systemic Health CSG & ConsorTium

Summary: This lecture will update on the PROSpECT Initiative and describe how the UK dental community is coming together as the first BSODR endorsed Clinical Studies group and Research Consortium to tackle multi-morbidity and the role or oral health in combating systemic health. It will also describe the RAISED in Yorkshire initiative where we are taking our research dissemination out to the community of vulnerable teenagers using arts-based project to inspire, raise aspirations and innovate a new sustainable dental approach. I will show the co-developed film "Don't Smile" and describe its local impact and vision for its next steps.

About Sue Pavitt: Sue is Professor in Translational & Applied Health Research, School of Dentistry, University of Leeds. Her PhD was in Human Cancer Genetics and she had a high profile career working with Prof Sir Walter Bodmer mapping the first colorectal cancer gene. She worked on the Human Genome Project at UCL, Oxford and UCSF, USA. In 1998 she returned to the UK and changed career direction to work in Applied Health Research, Clinical Trials and Translational research. In 2007 she became a Division Director at Leeds Clinical Trials Research Unit and in 2012 was appointed Director of the Dental Translation and Clinical Research Unit, University of Leeds.

Sue is the NIHR Clinical Research Network Oral and Dental Health National Specialty lead. She has an international renowned research portfolio (>£32M). This spans several disease areas and is characterized by forging effective, multi-disciplinary research partnerships between clinicians, academics, industry and patients ; developing methodological sound projects that are patient-centric with research questions tailored to clinical priorities to maximize impact and patient benefit. She was the founding Chair of the Multiple Sclerosis Society's (MSS) Clinical Trials Network, forging an effective partnership between the charity and NIHR delivering several national trials. She is an MSS Research Ambassador supporting the £100M fund-raising initiative to deliver an adaptive clinical trials platform; her goal is to knowledge transfer this approach to PROSpECT.
Sue is passionate about collaborative research and strives to provide strong mentorship for the next

generation of researchers. She is an ambassador and advocate for patient public involvement and engagement (PPIE) in research with >30 years' experience. She has established the SMILE AIDER PPIE Forum that brings their lived experience to shape research. She led the theatre and film co-production "Don't Smile" that won the National Coordinating Centre for Public Engagement 2016 national award for PPIE.

President's Prize Lecture – **Dr. Caroline Harrison**

Wednesday 4th September, Michael Sadler Building,Rupert Beckett Lecture Theatre, 16:00-16:30

"Nanoscale Medical Ceramics"

Summary: The consistent healing of bone defects remains a significant challenge in dental, craniofacial, and orthopaedic surgery. Furthermore, the development of a bone infection is a serious complication that often results in the deterioration of a patient's quality of life due to long-term treatments that have substantial associated costs. Few materials are available which inhibit bacterial growth whilst promoting bone regeneration. For example, nanoscale hydroxyapatite (nHA) has a history of effective clinical use for bone regeneration but has no inherent antibacterial properties. nHA pastes are particularly advantageous for bone regeneration purposes due to their injectability assisting minimally invasive surgical techniques, as well as their biocompatibility and osteoconductive properties. However, the modification of nHA is complicated due to complex chemistry, and the properties of the nHA produced are highly dependent on the method and conditions employed. Furthermore, published methods of nHA production are time consuming and may require expensive equipment. Therefore, this body of research commenced with the evaluation of published nHA preparation methods [1]. One early goal was to identify which method would be most suitable for ionic modifications to stimulate bone tissue regeneration whilst inhibiting bacterial attachment and growth, at the same time considering the potential for industrial scale up. The most promising method was further optimised [2] and used to produce a proof of concept silver-doped nHA with potent antibacterial properties [3]. Our research is now focussed on the translation of a dual action paste with both osteogenic and antibacterial properties with our industrial partner, Ceramisys Ltd. A patent application [4] has been filed to protect the novel device, and this work is continuing in order to translate this research into a medical device for use in dental and orthopaedic applications. This device is particularly beneficial for use in compromised patients who are at greater risk of bone infections and slower rates of bone regeneration, thereby providing a stratified approach for surgeons. This innovation has the potential to generate significant cost savings for the NHS while improving the quality of life for very many patients and underpinning the commercialisation of a new medical device for domestic and international markets.

[1] Gentile P et al. (2015). Materials 8 (5), 2297-2310.
[2] Wilcock CJ et al. (2017). Journal of Visualized Experiments (120), e55343.
[3] Wilcock CJ et al. (2017). Journal of Biomedical Nanotechnology 13 (9), 1168–1176.
[4] Patent application GB1813928.7, priority date 28/08/18.

About Caroline Harrison: Dr Harrison's main research focus is in novel biomaterial development to address healthcare challenges. After graduating from Biomedical Engineering with MEng(hons) in 2011, she started a PhD at the School of Clinical Dentistry, The University of Sheffield supervised by Prof Paul Hatton and Dr Cheryl Miller. The PhD entitled 'Nanostructured Medical Ceramics for Bone Tissue Regeneration' was an EPSRC CASE studentship in collaboration with Ceramisys Ltd., a leading international manufacturer of synthetic bone regeneration materials. After completion in 2015 she continued multidisciplinary research at the School of Clinical Dentistry with Ceramisys Ltd. to develop materials with enhanced functionality including the stimulation of bone tissue regeneration in combination with antibacterial activity. Dr Harrison is currently engaged in medical device translation to progress laboratory research for clinical use.

OMIG Symposium **Oral health and Alzheimer's Disease.**

Thursday 5th September, Michael Sadler Building, Rupert Beckett Lecture Theatre, 09.00-10.30

Keynote Lecture – **Professor John Wright**

Thursday 5th September, Michael Sadler Building, Rupert Beckett Lecture Theatre, 10:30-11:15

"Born in Bradford: can a research study change a city?"

Summary: Born in Bradford is a longitudinal birth cohort study following 14,000 children and their parents as they grow up, exploring why some children have good health and well-being and others do not. It has grown into one of the largest health research programmes in the world, producing cutting edge science but also translating this into policy and practice. BiB has grown up with new experimental and genetic cohort studies and most recently the creation of a City Collaboratory to explore whole system, upstream approaches to preventing ill-health.

About John Wright: John Wright is a clinician and epidemiologist with a background in hospital medicine and public health in the UK and in Africa. He established and leads the Bradford Institute for Health Research and Wolfson Centre for Applied Health Research, working to speed up translation of medical research into practice and policy. In 2007 he set up the Born in Bradford (BiB) cohort study to follow the lives of over 13,000 families as their children grow up. Evidence from BiB has had national and international impact and provided a catalyst for the development of Bradford as a City of Research. In 2016 he set up Born in Bradford's Better Start cohort to test new approaches to providing the best support in the crucial period of early life. He has worked to develop sustainable public health programmes in Africa for over 25 years and in 2015 was awarded the West Africa medal by the Prime Minister for his work in the Ebola epidemic. He is Visiting Professor in Clinical Epidemiology at the Universities of York, Leeds and Bradford

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Conference Programme 'Day by day'

Tuesday 3rd September

Parkinson Building

09.00 -	Trade Set-up, Parkinson Court
11.00 - 13.00	BSODR Management Committee Meeting, Room B.08
12.00 - 17.00	Conference Registration and Poster Set-up, Parkinson Court
13.00 - 14.00	Tea & Coffee, Trade stands open
15.30 - 15.45	Tea & Coffee

Michael Sadler Building

12.00 - 17.30	Cloakroom/luggage drop, Room LG16
12.00 - 16.00	Slide Preview (Room LG17) and presentation upload in session rooms
14.00 - 15.30	MINTIG Symposium, Rupert Beckett Lecture Theatre
14.00 - 15.45	Senior Colgate Award, Room LG10
14.00 - 15.30	Junior Colgate Award (I), Room LG15
15.45 - 16.45	Junior Colgate Award (II), Room LG15
15.45 - 17.15	Primary Care Research Network Launch Event, Rupert Beckett Lecture Theatre
15.45 - 17.30	Scientific Session 1 - Behavioural, Epidemiologic and Health Services Research, Room LG10
15.45 - 17.00	Scientific Session 2 – Caries and Salivary Research, Room LG19

Leeds Art Gallery

18.45 - 21.00	Welcome Reception, Tiled Hall

Wednesday 4th September

University House

08.00 - 09.00	ECR networking breakfast, St George's Room

Parkinson Building

09.00 -	Conference Registration, Parkinson Court
Before 09.00	Posters set up for BSODR Poster Competition, Parkinson Court
Before 09.30	General posters set up, Parkinson Court
09.30 - 11.30	BSODR Poster Competition Judging, Parkinson Court
11.00 - 11.30	Tea & Coffee, Trade Exhibition and General Poster Session (presenters to stand by their posters), Parkinson Court
13.00 - 13.45	Lunch and Trade Exhibition, Parkinson Court
13.00 - 13.45	OMIG Group Lunch, Room B.08
13.00 - 13.45	MINTIG Group Lunch, Room B.11
13.00 - 13.45	Oral Medicine and Pathology Group Lunch, Room B.10
15.45 - 16.00	Tea & Coffee, Trade Exhibition, Parkinson Court

Wednesday 4th September, continued

Michael Sadler Building

08.00 - 17.30	Cloakroom/luggage drop, Room LG16
08.30 - 13.45	Slide Preview (Room LG17) and presentation upload in session rooms
09.15 - 09.30	Welcome and Opening Ceremony, Rupert Beckett Lecture Theatre
09.30 - 11.15	Scientific Session 3 – Dental Materials 1, Room LG.10
09.30 - 11.00	Scientific Session 4 – Microbiology and Immunology, Room LG.15
09.30 - 10.30	Scientific Session 5 – Stem Cells and Pulp Biology, Room LG.19
11.30 - 13.00	Dental Materials VOCO Prize Presentations, Room LG.15
11.30 - 13.15	PER GSK MINTIG Prize presentations, Room LG.19
12.00 - 13.00	TC White Lecture, Rupert Beckett Lecture Theatre
13.45 - 14.45	Colgate Anniversary Lecture, Rupert Beckett Lecture Theatre
14.45 - 15.45	Graham Embery Lecture, Rupert Beckett Lecture Theatre
16.00 - 16.30	President's Prize Lecture, Rupert Beckett Lecture Theatre
16.30 - 16.45	NIHR James Lind Alliance Partnership Update, Rupert Beckett Lecture Theatre
16.45 - 17.15	BSODR Annual Business Meeting, Rupert Beckett Lecture Theatre

Royal Armouries

19.00 - 22.30	Conference Dinner. Coaches start to depart for Royal Armouries from Storm Jameson Halls of Residence at 18.30

Thursday 5th September

Parkinson Building

09.00 -	Conference Registration, Parkinson Court
09.00 - 13.00	General Posters on display
11.15 - 11.30	Tea & Coffee, Trade Exhibition, Parkinson Court
11.30 -	Trade Take down

Michael Sadler Building

08.00 - 11.00	Slide Preview (Room LG17) and presentation upload in session rooms
08.00 - 13.00	Cloakroom, Room LG.16
09.00 - 10.30	OMIG Symposium, Rupert Beckett Lecture Theatre
10.30 - 11.15	KEYNOTE lecture, Rupert Beckett Lecture Theatre
11.30 - 13.00	Scientific Session 6 - Dental Materials II & Caries Research II, Rupert Beckett Lecture Theatre
11.30 - 13.00	Scientific Session 7 – Paediatric and Oral Health Research, Room LG.10
11.30 - 12.45	Scientific Session 8 – Implantology, Orthodontics & Prosthodontics, Room LG.15
11.30 - 13.00	Scientific Session 9 – Periodontology Research & Oral Medicine/Pathology, Room LG.19
13.00 - 13.40	Tour of Dental School, convene in Room LG10

Social Programme

Welcome drinks reception

The Tiled Hall, Leeds Art Gallery

Tuesday 3rd September

18.45-21.00

Delegates at the BSODR Conference 2019 are invited to join us for an evening drinks & canapés reception at the Tiled Hall, Leeds. The venue will be open from 18.45, with a welcome address to begin at 19.00.

Located in Leeds city centre on The Headrow, and recently re-opened after extensive refurbishment, Leeds Art Gallery holds a remarkable collection of British 20th century art which was voted by John Russell-Taylor in The Times as 'probably the best outside London'.

Within the Art Gallery, is the awe-inspiring Tiled Hall. Now lovingly restored, The Tiled Hall reveals colourful Victorian tiles, marble columns and an oak, ebony and walnut parquet floor.
Guests will have the opportunity to visit some of the galleries outside of general public hours, providing a chance to experience the exhibits in a more intimate setting.

Conference Dinner

The Royal Armouries

Wednesday 4th September

19.00 - 22.30

The Conference Dinner will be held at the magnificent Royal Armouries Hall, located in the Royal Armouries Museum in Leeds. The museum holds the national collection for arms and armour.

Guests are invited to a drinks reception where they will have the opportunity to visit some of the galleries before sitting down to a 3 course dinner in the Wellington Suite within the fabulous surroundings of the Royal Armouries.

A shuttle coach service will run from Storm Jameson to The Royal Armouries at 18.30, 18.45 and 19.00. Coaches back will depart at 22.30, 22.45 & 23.00 with a drop off in town before arriving at Storm Jameson.

Notes

Notes

SCIENTIFIC PROGRAMME

BSODR 2019

POSTER ABSTRACTS ARE NUMBERED FROM 30 - 113

Tuesday 3rd September 2019

ORAL PRESENTATIONS

MINTIG Symposium *– Hard tissue repair and regeneration – the interface between materials and biology.*

Tuesday 3rd September, Michael Sadler Building, Rupert Beckett Lecture Theatre, 14.00 - 15.30

Hosted by Maisoon Al-Jawad & Paul Cooper.

Fundamental to hard tissue regeneration are interactions at inorganic-organic interfaces of biomaterials and organic matrices, and matrices and cells. Understanding and controlling interactions at these interfaces is key to developing guided hard tissue regeneration. The symposium will highlight recent research in advancing our understanding of the link between materials and biology needed to enable hard tissue repair and regeneration. We aim to showcase international research from highly interdisciplinary researchers working across a range of clinical, scientific and engineering disciplines for clinical translational benefit. 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.

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Welcome and Introduction.
Professor Maisoon Al-Jawad, School of Dentistry, University of Leeds.

Bioactive glasses for hard and soft tissue regeneration.
Dr Gowsihan Poologasundarampillai, School of Dentistry, Birmingham.

Harnessing Protein Disorder to Generate Functional Hierarchical Materials.
Dr Sherif Elsharkawy, Faculty of Dentistry, Oral & Craniofacial Sciences, King's College London.

A long-lasting UV-cured atelocollagen system for guided bone regeneration.
Dr Giuseppe Tronci, School of Dentistry, Leeds.

An update on the origin and molecular control of tooth mesenchymal stem cells.
Dr Bing Hu, Peninsula Dental School, Plymouth.

SENIOR COLGATE PRIZE SESSION

Tuesday 3rd Sept 2019; Michael Sadler Building, Room LG10; 14.00 - 15.45

001 *Development of a method to clinically identify the position of the lingual nerve relative to the third molar region.*

S. Aljamani[1], F. O'Neill[2], C. Youngson[1], F. Jarad[1],
[1]Restorative Dentistry, University of Liverpool, UK; [2]Oral surgery, Dental School, University of Liverpool, UK.

002 *Intracellular interleukin 1 receptor antagonist type 1 regulates the senescence-associated secretory phenotype (SASP) in oral keratinocytes.*

S. Niklander[1, 2], H. Crane[1], D. W. Lambert[1], K. D. Hunter[1],
[1] Unit of Oral and Maxillofacial Pathology, School of Clinical Dentistry, University of Sheffield, UK;
[2] Department of Oral Pathology and Oral Surgery, Dentistry Faculty, Universidad Andres Bello, Viña del Mar, Chile.

003 *Senescent fibroblasts contribute to bone invasion in oral squamous cell carcinoma: a novel opportunity for therapeutic intervention.*

A. Elmusrati, S. Khurram, D. W. Lambert,
School of Clinical Dentistry, University of Sheffield, UK.

004 *Defining a Craniofacial Phenotype and Prediction Model for Obstructive Sleep Apnoea: A 3-D Evaluation.*

B. Agha[1, 2], L. Zou[1], A. Johal[1],
[1]Centre for Oral Bioengineering, Institute of Dentistry, Queen Mary University of London, UK;
[2]Orthodontic Department, Al-Mustansiriya University, College of Dentistry, Baghdad, Iraq.

005 *Intensity Modulated Radiation therapy related to salivary protein content in oral cancer.*

M. Gonzalez, M. Burke, F. Warburton, S. Bozorgi, G. Carpenter, G. Koller, A. Banerjee,
Faculty of Dentistry Oral & Craniofacial Sciences, King's College London, UK.

006 *Incorporation, Differentiation, and Polarisation of THP-1 Cells within Tissue-engineered Oral mucosa.*

S. J. Gould, L. Belfield, M. Upton, V. Salih,
Peninsula Dental School, University of Plymouth, Devon, UK.

007 *Enhancing Sodium Hypochlorite Penetration into Root Dentine with Irrigant Activation.*

S. S. Virdee[1], D. Farnell[2], M. Silva1, J. Camilleri[1], P. Cooper[1], P.L. Tomson[1],
[1]Restorative Dentistry, University of Birmingham, UK; [2]Restorative Dentistry, Cardiff University Dental Hospital, Cardiff, UK.

JUNIOR COLGATE I PRIZE SESSION

Tuesday 3rd Sept 2019; Michael Sadler Building, Room LG15; 14.00 - 15.30

008 *Instructional Video Impact on Self-confidence in Luxator Use amongst Dental Undergraduates: a Mixed-Methods study.*

Z. Awad, R. Moore, T. Zoltie,
School of Dentistry, University of Leeds, UK.

009 *Extracellular vesicles isolated from oropharyngeal cancer cells elicit a pro-inflammatory macrophage phenotype in vitro.*

A. Rigby, H. E. Colley, C. Murdoch, S. Hunt,
School of Clinical Dentistry, University of Sheffield, UK.

010 *The Role of Fusobacterium nucleatum in Oral Carcinogenesis.*

E. McIlvanna[1], S. Craig[2], S. McQuaid[2], F. Lundy[3], J. James[2],
[1]School of Dentistry , Queen's University Belfast, Dungannon, UK, [2]Centre for Cell Research and Cell Biology, Queen's University, Belfast, UK, [3]Centre for Experimental Medicine, Queen's University, Belfast, UK.

011 *Augmented Reality as a Novel Method for Denture Tooth Selection.*

N. Jiwan, S. Rasaiah, A. Ark, D. Rebecca, M. Roy,
School of Dentistry, University of Leeds, Leeds, UK.

012 *The Effect of Craft Beer on Enamel Erosion.*

J. Hunter,
School of Dentistry, Cardiff University, Cardiff, UK.

013 *High Speed Imaging of Biofilm Removal from Dental Implants in a Subgingival Model.*

M. Grewal, N. Vyas, K. Manmi, Q. Wang, S. Kuehne, R. Sammons, D. Walmsley,
University of Birmingham, UK.

JUNIOR COLGATE II PRIZE SESSION

Tuesday 3rd Sept 2019; Michael Sadler Building, Room LG15; 15.45 - 16.45

014 *Enhancing the chelating potential of citrate solutions by increasing pH does not offset the benefit of reduced titratable acidity achieved.*

Z. Bahzad[1], A. Saleh[1], S. Brookes[2],
[1]Restorative Dentistry, University of Leeds, UK, [2]Oral Biology, School of Dentistry,
University of Leeds, UK.

016 *Characterisation of Human Salivary Gland Cell Cultures.*

R. L. Furmidge[1, 2], C. Bingle[4], L. Bingle[3],
[1]Clinical Dentistry, University of Sheffield, Sheffield, South Yorkshire, UK, 2 Biology,University of York, York, UK, [3]School of Clinical Dentistry, University of Sheffield, Sheffield, UK, [4]Infection, Immunity & Cardiovascular Disease, Sheffield, UK.

017 *A Digital Diagnostic Test for Oral Cancer.*

J. Yeung, A. Waseem, M. Teh,
Barts and the London School of Medicine and Dentistry, Queen Mary University of London, UK.

018 *Porphyromonas gingivalis modulates OSCC mediated angiogenesis in vitro.*

W. Nasterska, L. Ferarris, Z. Brookes, L. Belfield,
Peninsula Dental School, University of Plymouth, Devon, UK.

SCIENTIFIC SESSION 1 – BEHAVIOURAL, EPIDEMIOLOGIC AND HEALTH SERVICES RESEARCH

Tuesday 3rd Sept 2019; Michael Sadler Building, Room LG10, 15.45 - 17.30

015 *RAISED in Yorkshire - An innovative community-based collaborative approach to sustainable peer-led oral health education in areas of high oral health inequality.*

A. Turner[1], F. Heffron[1], L. Dell'Amico[1], E. Grange[1], L. Mercer[1], U. Hassanali[1], G. McCormack[1], S. Barber[1], K. Kenny[1], R. Jablonski[1], C. Granger[1], S. Milnes[2], S. H. Pavitt[1],
[1]University of Leeds, UK, [2]Batley Girls High School, Leeds, UK.

019 *Disabled Children: Including their Voices in Oral Health Research.*

M. Alwadi, S. Baker, J. Owens,
Dental Public Health, University of Sheffield, UK.

020 *Development of the Gum Health Experience Questionnaire (GHEQ). The University of Sheffield; GlaxoSmithKline Consumer Healthcare.*

*T. Broomhead[1], B. Gibson[1], M. Vettore[3], C. Parkinson[2], S. Baker[1], *On behalf of Sarah Baker,
[1]School of Clinical Dentistry, The University of Sheffield, UK, [2] GlaxoSmithKline Consumer Healthcare, Weybridge, UK, [3] Dental School, Federal University of Minas Gerais, Belo Horizonte, Brazil.

021 *The demand and provision of cosmetic dentistry in the UK.*

R. Lala[1], P. G. Robinson[2], B. Gibson[1],
[1]The University of Sheffield, Sheffield, UK, [2]Bristol Dental School, University of Bristol, UK.

022 *Validation of a classification system for a paediatric caries-specific utility measure.*

H.J. Rogers, Z. Marshman, F. Gilchrist, H.D. Rodd, D. Rowen,
University of Sheffield, UK.

023 *Analysis of Hospital Admissions for Extractions Using Geographically Weighted Regression.*

T. Broomhead[1], H. D. Rodd[1], S. Baker[1], K. Jones[2], G. Davies[3], S.White4, Z. Marshman[1],
[1]School of Clinical Dentistry, The University of Sheffield, UK, [2]Public Health England, Sheffield, UK, [3]Public Health England, Manchester, UK, [4]Public Health England, London, UK.

024 *Developing a training intervention to improve oral health behaviour change with parents of young children.*

L. M. Rutter[1], F. Heffron[1], T. Zoltie[1], K. Gray-Burrows[1], A. Bhatti[1], Z. Marshman[2], S. Hearnshaw[3], P. Day[1],
[1]School of Dentistry, University of Leeds, Leeds, West Yorkshire, UK, [2]School of Dentistry, University of Sheffield, Sheffield, UK, [3]Yorkshire and Humber Region, Health Education England, Leeds, UK.

SCIENTIFIC SESSION 2 – CARIES RESEARCH & SALIVARY RESEARCH

Tuesday 3rd Sept 2019; Michael Sadler Building, Room LG19; 15.45 - 17.00

025 *Heritability of DMFS Scores in a National Twin Registry.*

S. Haworth[1], P. Holgerson[2], A. Esberg[2], P. K. Magnusson[3], I.Johansson[2],
[1]University of Bristol, UK, [2]Umeå University, Umeå, SWEDEN, [3]Karolinska Institute, Stockholm, Sweden.

026 *Effect of Strontium on Remineralisation of hydroxyapatite.*

T. Shoaib[1], P. Anderson[2], S. Shahid[2],
[1]Queen Mary University of London, UK, [2]Institute of Dentistry, QMUL, London, UK.

027 *Crystallinity Comparison between Hydroxyapatite-Like Layers Formed By Five Hypersensitivity Toothpastes.*

B. Mahmoodi, R. Wood, R. Cook,
Faculty of Engineering and Physical Sciences, University of Southampton, UK.

028 D*evelopment of an in-vitro model to investigate dental erosion.*

H. Matabdin,
Department of Periodontology, Eastman Dental Institute, University College London, UK.

029 *A new mechanism for the perception of thirst.*

G. Carpenter, N. Hasbullah,
King's College London, London, UK.

NIHR | National Institute for Health Research

Launch Symposium at BSODR – NIHR Clinical Research Network strategic initative DENTPRIME-National CSG & Research Alliance [DENTal PRIMary carE National Clinical Studies Group & Research Alliance]

Tuesday 3rd Sept 2019; Michael Sadler Building, Rupert Beckett Lecture Theatre, 15.45 - 17.15

Chaired by Professor Sue Pavitt and Wendy Thompson.

The Symposium will launch an exciting new initiative to bring together primary care dental stakeholders in an inclusive approach to encourage, develop, deliver and disseminate robust dental research in the primary care setting to aid evidence-based practice. The research will be of relevance to primary care practitioners and their patients. It will align to wider primary care networks and fulfil the Making Every Contact Count (MECC) agenda and the principle of Putting the Mouth Back in the Body. The aim is to produce high quality research evidence that will maximise patient benefits and improve health and NHS care.

DENTPRIME National is seeking BSODR endorsement and support – be there at its launch and be part of shaping the future of dental research in the UK.

The Vision of a DENTPRIME NATIONAL.
Professor Sue Pavitt, University of Leeds; NIHR Clinical Research Network (CRN) National Speciality lead for Oral and Dental Health.

The challenges of delivering research in primary care.
Bhupinder Dawett, GDP NIHR CRN East Midland Oral & Dental Health Speciality Lead.

Supporting Early Career Research involvement.
Professor Brian Nattress, Yorkshire & Humber Health Education England

Learning from regional initiatives - Lancashire Dental Network.
An example that is linking to the wider primary care network – Wendy Thompson GDP, NIHR Doctoral Research Fellow & supported by NIHR CRN Yorkshire & Humber.

Learning from regional initiatives - Northern Dental Practice Based Research Network.
An example that is supporting a "bottom-up" approach - Hosted at Newcastle Universities Centre for Oral Health Research and supported by the NIHR CRN North East and North Cumbria.
Dr Chris Vernazza, Clinical Senior lecturer/ Dr Richard Holliday, NIHR Clinical Lecturer, School of Dental Sciences, University of Newcastle.

Amalgam phase down – Strengthening the development of a primary care trial proposed by DENTPRIME-NORTHERN using qualitative research.
Dr Vishal Aggarwal, University of Leeds.

Incentivising practices by resourcing primary care research
Simon Hearnshaw, LDN Chair North Yorkshire and Humber.

Panel discussion - What next? – Towards a national primary care trial.
Led by Shamaila Anwar, Specialty Cluster Manager, NIHR CRN and presenters.

Wednesday 4th September 2019

Poster Display All day (incl. BSODR Poster Prize judging 09.30 - 11.30) – Parkinson Building

Presenters to stand by their posters 11.00 - 11.30

POSTERS

030 *The Effect of Sugar-Sweetened Beverages on Oral Health: A Systematic Review and Dose-Response Meta-Analysis.*

M. J. Valenzuela[1], B. Waterhouse[1], V. R. Aggarwal[2], T. Doran[1], K.Bloor[1],
[1]Health Sciences, University of York, UK, [2]School of Dentistry, University of Leeds, UK.

031 *Association between oral health-related quality of life and family impact. Findings from the Children's Dental Health Survey 2013.*

J. Nazal[2], A. Heilmann[1], R. Venturelli[1], G. Tsakos[1],
[1]Epidemiology and Public Health, University College London, UK, [2]Oral Health, SEREMI Salud Biobio, Concepcion, 8th Region, Chile.

032 *Oral health to enhance elite athlete performanc*e.

J. Gallagher, P. Ashley, I. Needleman,
Centre for Oral Health and Performance, University College London, Eastman Dental Institute, UK.

033 O*ral health of older people living in care homes: The REACH study.*

E. Gupta[1], J. Iloya[2],
[1]Institute of Dentistry, University of Aberdeen, UK, [2]NHS Grampian, Aberdeen, UK.

034 *HABIT: An Oral Health Intervention for Infants - Quantitative Findings.*

K. Gray-Burrows[1], A. Bhatti[1], F. Wray[1], J. Owen[1], I. Eskyte[1], R. West[1], S. H. Pavitt[1], Z. Marshman[2], P. Day[1],
[1]University of Leeds, Bradford, West Yorkshire, UK, [2]University of Sheffield, UK.

035 *The Influence of BioMinF® Toothpaste on Remineralisation of Hydroxyapatite Discs.*

A. S. Alqarni[1], P. Anderson[2], R. Hill[1], J. Davies[1], B. Ferizoli[3],
[1]Centre for Oral Bioengineering, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, UK, [2]Institute of Dentistry, QMUL, London, UK, [3]Queen Mary University, London, UK.

036 *Preliminary results of intra-oral scanning in measuring tooth wear.*

P. Charalambous, R. Austin, D. Bartlett,
Faculty of Dentistry, Oral, and Craniofacial Sciences, King's College, London, UK.

037 *A Novel Fluoride Dental Composite Coating Containing Ca2+ LDH.*

A. Hoxha[1], D. G. Gillam[2], A. Agha[1], A. J. Bushby[3], M. Patel[1],
[1]Oral Bioengineering , Queen Mary University of London, London, UK, [2]Barts and the London, Institute of Dentistry, Queen Mary University of London, UK, [3]A.J. Bushby, School of Engineering and Materials Science, Queen Mary University of London, UK.

038 *A Novel ex-vivo Model to Study Oral Malodour.*

M. Saji, A. Dasgupta, J. Raut, S. Srinivasan,
Unilever Oral Care, Bagalore, India.

039 *Antimicrobial Efficacy of Industrial Sweet Orange Waste Extracts against S. mutans & L. casei.*

S. Saha[1, 2], S. Wood[2], C. Bösch[1], T. Do[2], J. Maycock[1],
[1]School of Food Science and Nutrition, University of Leeds, UK, [2]Division of Oral Biology,
School of Dentistry, University of Leeds, UK.

040 *Remote Clinical Consultations in Restorative Dentistry.*

S. Shahrbaf[1], C. A. Storey[3], N. Martin[2],
[1]Academic Unit of Restorative Dentistry, The University of Sheffield, UK, [2]School of Clinical Dentistry,
University of Sheffield, UK, [3]Restorative Dentistry, Charles Clifford Dental Services - Sheffield STH
NHS Trust, Sheffield, UK.

041 *Throat Packs: In or Out? A survey of Current Practice in using Throat Packs in Dental General Anaesthetics across England.*

D. Tailor,
Northamptonshire Healthcare Foundation Trust, Leicester, UK.

042 *Development of Silver-and Copper-Doped Bioactive Glasses with Antimicrobial Properties.*

R. Binduhayyim, J. Shepherd, C. Miller, P. Hatton,
School of Clinical Dentistry, University of Sheffield, Sheffield, UK

043 *Polymer based inhibition of Quorum sensing in Gram-negative bacteria.*

R. Alshalan[1], J. Shepherd[1], W. Martin[2,] T. Swift[2], S. Rimmer[2], G.Stafford[1],
[1]School of Dentistry, University of Sheffield, UK, [2]School of Chemistry and Biosciences,
the University of Bradford, UK.

044 *Gravimetric Evaluation of the Swelling Index of Polymeric Mucoadhesive Films.*

M. Alhallak, M. Patel, N. Karpukhina,
Dental Physical Science, Institute of Dentistry; Barts and The London School of Medicine and
Dentistry, Queen Mary University of London, UK.

045 *Hydrophobic and Hydrophilic coating materials on protein adsorption and retention of oral biofilm formation*

G. Gempita,
Oral Diagnostic - Biomaterials, University at Buffalo SUNY, Buffalo, New York, USA.

046 *Characterisation of Hybrid Calcium Aluminate-Glass Ionomer Cement.*

A. Al Ghwainem[1, 2], N. Karpukhina[2], S. Shahid[2],
[1]Prince Sattam Bin Abdulaziz University, Alkarj, Saudi Arabia; [2]Barts and The London School of
Medicine and Dentistry, Queen Mary University of London, UK.

047 *WITHDRAWN Coating on Composite-Zirconia Bonding and Residual Stress Analysis.*

P. Thammajaruk[2], S. Buranadham[2], Y. Wang[1], M. Guazzato[3],
[1]Mark Wainwright Analytical Centre, The University of New South Wales, Sydney, Australia,
[2]Department of Prosthetic Dentistry, Prince of Songkla University, HatYai, Songkhla, Thailand,
[3]Discipline of Prosthodontics, The University of Sydney, New South Wales, Australia.

048 *Physical Approaches to Adhesive Interface Visualization in Clinical Dentistry.*

V. Senkin[1, 2], N. B. Bessudnova[1, 2],
[1]SSU, Saratov, Russian Federation, [2]Dental Clinic "Denta", Saratov, Russian Federation.

049 *Sealing Ability of Biodentine and MTA in Teeth with Open Apices.*

S. El-khatib, K. Moharamzadeh, N. Martin,
University of Sheffield, Sheffield, UK.

050 *Bioactivity of Novel Strontium Substituted BAGs Containing CaCl2/CaF2.*

S. Prutthithaworn[1, 2], R. Hill [2], F. Wong[2],
[1]Pediatric Dentistry, Faculty of Dentistry, Mahidol University, Bangkok, Thailand; [2]Centre for Bioengineering, Queen Mary University of London, UK.

051 *Novel Thiolated Chitosan-Silica Hybrid Hydrogel for Bone.*

S.N. Jayash, P. Cooper, R. Shelton, G. Poologasundarampillai,
Birmingham Dental Hospital & School of Dentistry, Birmingham, UK.

052 *Cytotoxicity and Biocompatibility of a Fluoride containing Bioactive Glass Composite.*

F. Mohammed[1], S. Rawlinson[2], F. Wong[2],
[1]Queen Mary University of London, UK, [2]Centre for Bioengineering, Queen Mary University of London, UK.

053 *Elution of Resin-based Composite Monomers into Groundwater.*

N. Martin, S. Mulligan, S. Thornton, G. Kakonyi, K. Moharamzadeh,
University of Sheffield, UK.

054 *Assessment of microparticles and monomer elution following clinical operative grinding of resin-based composite restorations.*

S. Mulligan[1], N. Martin[1], S.Thornton[1], G.Kakonyi1, K.Moharamzadeh[1], J. Ojeda Ladedo[2],
[1]University of Sheffield, UK, [2]Swansea University, UK.

055 *Characterisation of interfacial area formed between calcium silicate based materials and root dentine.*

B. Özel[1], P. Anderson[2],
[1]Endodontics, Istanbul University, Istanbul, Turkey; [2]Institute of Dentistry, QMUL, London, UK.

056 *Evaluation of the Light Curing Units in Primary and Secondary Dental Care.*

A. Al-Taie,
Restorative Dentistry, School of Dentistry, University of Leeds, UK.

057 *Assessment of Tooth Yellowness.*

C. Sullivan[1], S. Westland[1], R. Ellwood[2], Q. Pan[1],
[1]School of Design, University of Leeds, UK, [2]Colgate-Palmolive Dental Health Unit, Manchester University, UK.

058 *WITHDRAWN What are undergraduate dental students career plans, and why?*

Y. Lee,
Foundation Dentist, Wirral, UK.

059 *Effects of Herbal Mouthwashes for Patients with Gingivitis.*

H. Cai[1, 2], Y. Du[3], N. K. Panagodage Perera[2,] X. Liang[1], J. Chen[1, 2],
[1]Department of Prosthodontics, West China College of Stomatology, Sichuan University, Chengdu, China; [2] Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, UK; [3]Department of Endodontics, West China College of Stomatology, Sichuan University, Chengdu, China.

060 *A 3-dimensional accuracy assessment of digital impression in a single implant-supported prosthesis.*

P. Petchmedyai, F. Wong, L. Zou,
Barts and The London School of Medicine and Dentistry, Queen Mary University of London, UK.

061 *Fluorapatite and Hydroxyapatite Dental Implant Coatings: Interfacial Properties and Degradation.*

A. Marie[1, 3], T. Do[1], M. Katsikogianni[2], D. Wood[1],
[1]School of Dentistry, University of Leeds, Leeds; UK, [2]School of Chemistry and Biosciences, University of Bradford, Bradford, UK; [3]College of Dentistry, University of Mosul, Mosul, Iraq.

062 *Novel inhibitors of proteolytic activity in oral bacterial biofilms.*

L. Cleaver[1], R. Moazzez[2], G. Carpenter[1],
[1]Centre for Host Microbiome Interactions, King's College London, UK; [2]Centre for Oral Clinical & Translational Science, King's College London, UK.

063 *Electronic cigarettes for smoking cessation in patients with periodontitis: the response of the subgingival microbiota.*

R. Holliday[1], P. M. Preshaw[1,3], A. Nelson[2], C. J. Stewart[2], N.Jakubovics[2],
[1]Newcastle University, Newcastle upon Tyne, UK, [2]Northumbria University, Newcastle upon Tyne, UK, [3]National University of Singapore.

064 *Antimicrobial and osteoconductive properties of copper-bearing implant materials.*

J. Khalid, R. Yuan, S. Rawlinson, A. Stephen, R. Allaker,
Institute of Dentistry, Queen Mary University of London, UK.

065 *Investigating the role of periodontitis-associated organisms as novel mediators of chronic kidney disease.*

N. Hickey, K.A. Whitehead, L. Shalamanova, N. Dempsey-Hibbert, C.J. van der Gast,
R.L. Taylor. Manchester Metropolitan University, Manchester, UK.

066 *Generating Tissue-engineered Oral Mucosal Equivalents Containing an Immune Component.*

B. Ollington, H.E. Colley, C. Murdoch,
School of Clinical Dentistry, University of Sheffield, UK.

067 *Development of a Murine Oral Microbiome Database (MOMD).*

S. Joseph, J. Aduse-Opoku, W. Wade, M. Curtis,
Centre for Host-Microbiome Interactions, King's College London, UK.

068 *Modelling diabetes and periodontitis interplay via in vitro biofilm model.*

F. Nadat[2], M. Naginyte1, D. Devine[1], T. Do[3], J. L. Meade[1],
[1]Oral Biology, University of Leeds Dental School, Leeds, W Yorkshire, UK, [2]University of Leeds, UK,[3]Oral Biology, University of Leeds, UK.

069 *Environmental influences on periodontitis-associated biofilm communities.*

M. Naginyte, P.D. Marsh, D. Devine, J.L. Meade, T. Do,
Oral Biology, University of Leeds Dental School, Leeds, W Yorkshire, UK.

070 *Micro-computed Tomography Study of Sound Enamel in Extracted Human Premolar Teeth.*

A. Yahya[1], A. Alqareer[2], M. Swain[3],
[1]Developmental and Preventive Sciences, Kuwait University/Faculty of Dentistry, Jabriya, Kuwait.
[2]Developmental and Preventive Sciences, Kuwait University, Safat, Kuwait.
[3] Biomedical Engineering/ Faculty of Engineering, The University of Sydney, New South Wales, Australia.

071 *Electric Toothbrush Heads Design Influences in vitro Stain Removal Efficacy.*

C. Wang, A. Smith, P. Cooper,
Oral Biology, School of Dentistry, University of Birmingham, UK.

072 *Synthetic mouse ameloblastin and amelogenin genes for overexpression studies.*

Y. Ko[1], I. Khalid[1], G. A. Feichtinger[2],
[1]Division of Oral Biology, School of Dentistry, Faculty of Medicine and Health, University of Leeds, UK;
[2] Division of Oral Biology, School of Dentistry, University of Leeds, UK.

073 *Investigating the Timing of Tooth brushing In Relation To Acid Challenges.*

A.H. Almatrafi, S. Mukar, D. Bartlett, S. O'Toole,
Prosthodontics, King's College London, UK.

074 *Anisotropic Agarose Scaffolds as Novel Gene Activated Matrices for Mineralised Tissues.*

D. D. White[1], M. Sullivan[1], N. Thomson[2], G. A. Feichtinger[3],
[1]Division of Oral Biology, University of Leeds, UK, [2] School of Dentistry, University of Leeds, UK,
[3]Division of Oral Biology, School of Dentistry, University of Leeds, UK.

075 *Changes in Tooth Yellowness wiith Age in a UK Practice-Based Population.*

K. McKenzie[1], I. Pretty[1], M. Goodwin[1], N. Boothman[1], R. S. Singh[1,2],
[1]School of Dentistry, University of Manchester, UK, [2]Windsor Dental Practice, Salford, UK.

076 *Instruments measuring oral health and orofacial pain in dependent adults.*

F. BaHammam, G. McCracken, B. Abdulmohsen,
Newcastle University, Newcastle upon Tyne, UK.

077 *Validity and reliability of the Mouth Handicap in Systemic Sclerosis (MHISS) questionnaire in a UK population.*

I. Abdouh[1, 2] S. Porter[1, 3], S. Fedele[1, 3], R. Ni Riordain[1],
[1]Oral Medicine, UCL - Eastman Dental Institute, London, UK, [2] Oral Medicine, Taibah University - College of Dentistry, Madinah, SAUDI ARABIA, [3]Oral theme UCLH/UCL NIHR, Biomedical Research Centre, London, UK.

078 *Interventions Addressing Non-traumatic Dental Condition Presentations at A&E: Systematic Review.*

O. Bassey, J. Csikar, J. Hallam, J. Sandoe, G. Douglas,
University of Leeds, UK.

079 *WITHDRAWN Audit Assessing Smoking Cessation Advice Provided on Emergency Dental Clinic.*

A. Graham, R. Suffern,
Oral Surgery, Kings College Hospital, London, UK.

080 *Implementation of a Supported Self-management Intervention for Chronic Orofacial Pain.*

V. R. Aggarwal[1], A. Mighell[1], F. Fox[1], E. Bradley[1], A. House[2], E. Guthrie[2], J. Wu[3],
[1]Dentistry, University of Leeds, UK; [2]Leeds Institute of Health Sciences, University of Leeds, UK;
[3]School of Dentistry, University of Leeds, UK.

081 *Longitudinal Effect of Rituximab on Salivary Gland Histopathology in Primary Sjögren's Syndrome.*

F. Chowdhury[1], E. Pontarini[4], S. Grigoriadou[4], K. Goldmann[4], D.Lucchesi[4], C. Pitzalis[4], P. Emery[2], W. Ng[3], N. Sutcliffe[5], C. Everett[6], C. Fernandez[6], S. Bowman[7], M. Bombardieri[4], A. Tappuni[1],
[1]Institute of Dentistry, Queen Mary University of London, UK, [2]Leeds Institute of Rheumatic and Musculoskeletal Medicine, Leeds, UK, [3]Institute of Cellular Medicine, Newcastle,UK,[4]Experimental Medicine and Rheumatology, William Harvey Research Institute, London, UK, [5]Royal London Hospital, London, UK, [6]Leeds Institute for Clinical Trials Research, Leeds, UK, [7]Rheumatology, University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK.

082 *Agreement in Clinical Decisions Regarding Root Angulation Based on Panoramic versus Cone-Beam CT Images.*

A. Alqareer[1], R. Nada[1], A. Ghayyath[2], M. Baghdady[2],
[1]Developmental and Preventive Sciences, Kuwait University, Safat, KUWAIT. [2]Diagnostic Sciences, Kuwait University, Safat, Kuwait.

083 *Changes in the gingival margin after intrusion of supraerupted molars.*

W. Lim, S. Noh,
Seoul National University, Seoul, The Republic of Korea.

084 *Effectiveness of intervention to promote oral hygiene behaviour of children during hospital stay and on discharge from hospital to home: a systematic review.*

D. Almutairi[1], M. Hosey[2], V. Muirhead[1], P. Adair [3], C. Pine[1]
[1]Dental Public Health, Queen Mary University of London, UK, [2]King's College London, UK, [3]Psychology, Queen's University Belfast, Belfast, UK.

085 *Effects of Electronic Cigarette Liquid on Oral Mucosa Wound Healing.*

A. S. Alqahtani[1, 2], T. M. Binaljadm[1, 3], Z. Shaikh1, K. L. Franklin[1], L. Tayebi[4], K. Moharamzadeh[1, 4],
[1]The University of Sheffield, Sheffield, UK; [2] Prince Sattam Bin Abdulaziz University, Riyadh, Saudi Arabia; [3] Taibah University, Madinah, Audi Arabia; [4] Marquette University, Milwaukee, Wisconsin, USA.

086 *Periodontal Pathogens Induce Epithelial-Mesenchymal Transition in A Periodontitis Model.*

S. Shoker[1], M. Milward[1], P. Cooper[1], G. Landini[1], R. Shelton[1], J. Pratten2, M. Ling[2],
[1]School of dentistry, University of Birmingham, UK; [2]GlaxoSmithKline, Weybridge, UK.

087 *Role of PGE2 in the Pathogenesis of Asymptomatic Apical Periodontitis.*

T. G. Karteva[1], T. T. Todorova[2], N. A. Manchorova-Veleva[1], M.Kazakova[2], E. Karteva[1], D. Keskinova[3],
S. Vladimirov[1], V. Sarafian[2],
[1]Operative Dentistry and Endodontics, Medical University - Plovdiv, Plovdiv, BULGARIA, [2]Department of Medical Biology, Medical University - Plovdiv, Plovdiv, Bulgaria; [3]Department of Applied and Institutional Sociology, University of Plovdiv Paisii Hilendarski, Plovdiv, Bulgaria.

088 *Anti-inflammatory effects of cannabidiol to modulate induced inflammation on gingival-keratinocytes.*

S. Kumar[1], E. Raif[1], J. Tahmassebi[2], F. Javid[3],
[1]Oral Biology, Unniversity of Leeds, UK, [2]Pediatric dentistry, University of Leeds, UK; [3]University of Huddersfield, UK.

089 *WITHDRAWN Defining xenobiotic metabolism in the oral mucosa to improve drug delivery.*

K.M. Slowik, C. Murdoch, R. Bolt, H.E. Colley,
The Clinical School of Dentistry, University of Sheffield, UK.

090 *Development of a Clinically Relevant Index for Toothwear Treatment Needs.*

Y. Deeban, K. Moharamzadeh, N. Martin,
University of Sheffield, Sheffield, UK.

091 *Effect of denture cleanser ingredients on in vitro stain removal.*

S. P. King[1], D. J. Bradshaw[1], E. Adamska[1], H. K. Rehal[2],
[1]GSK Consumer Healthcare, Weybridge, UK, [2]H.K. Rehal, University of Kent, Canterbury, UK.

092 *Endocrown Restorations: A Systematic Review of Prospective Clinical Studies.*

L. Hassouneh[1], D. Wood[2], M. Ferrari[1, 3],
[1]Restorative department, University of leeds, UK, [2]School of Dentistry, University of Leeds, UK,
[3]Department of Medical Biotechnologies, Division of Fixed Prosthodontics, University of Siena, Italy.

093 *Identifying Internal change in teeth in response to external challenge using X-ray microtomography.*

Y. Jamil, G.R. Davis, D.G. Gillam, D. Mills,
Centre of Oral Bioengineering, Institute Of Dentistry, Queen Mary University Of London, UK.

094 *Correlation of ICP-OES Parotid Saliva Trace Element Concentration with ICDAS-score.*

A. Rovera[1], M. Hector[2], P. Anderson[3],
[1]Queen Mary University, London, UK; [2]Dundee Dental School, Dundee, UK; [3]Institute of Dentistry, QMUL, London, UK.

095 *Conditioned Medium from Dental Pulp Stem Cell Cultures stimulate proliferation and differentiation of PC-12 Neuronal cells.*

N. Sultan[1], A. R. Zaher[2], B. Scheven[1],
[1]Birmingham Dental Hospital, Birmingham, UK; [2]Oral biology, Faculty of Dentistry, Mansoura, Egypt.

096 *Evaluation of Strategies for Human Skin 3D Bio-Printing.*

C. Illsley, Z. Brooks, C. Tredwin, B. Hu,
Peninsula Dental School, University of Plymouth, UK.

097 *Prescribed medication in dental hospital outpatients: Changes over three decades.*

D. Tyler, M. Davies, L. Carter,
Oral & Maxillofacial Surgery, Leeds General Infirmary, Leeds, UK.

098 *WITHDRAWN A clinical audit to improve orthodontic assessment in primary practice.*

Y. Lee,
Foundation Dentist, The Wirral, Liverpool UK.

099 *The Surgical Management Of External Cervical Resorption: A Retrospective Observational Study.*

A. Jebril[1], S. Aljamani[2], F. Jarad[2],
[1]NHS, London, UK; [2] Restorative dentistry, Liverpool, UK.

100 *Variations in fluoride varnish application across England and Wales over the last 6 years.*

J. Bird,
Academic Unit of Primary Care, University of Sheffield, Sheffield, UK.

101 *Erosive changes on dentine by evaluating surface loss.*

S. Almohefer[1], D. Bartlett[2], R. Moazzez[1],
[1]King's College, London, UK, [2]King's College, London, UK.

102 *Provisional before definitive restoration of dental implants: A systematic review.*

A. Daly, G. McCracken, B. Abdulmohsen,
University of Newcastle, UK.

103 *Mechanical assessment of 3D-printed PMMA filament for denture base applications.*

K. Alanazi[1, 2], D. Wood[1], C. Stokes[1], I. Ortega[1],
[1]University of Sheffield, UK, [2]Prince Sattam Bin Abdulaziz University, Alkharj, Saudi Arabia.

104 *Covalent attachment of osteogenic peptides to synthetic calcium phosphate biomaterial surfaces for bone tissue regeneration.*

J. Taylor[1, 2], C. Miller[1, 2], S.G. Spain[1], P. Hatton[2],
[1]University of Sheffield, UK, [2]School of Clinical Dentistry, University of Sheffield, UK.

105 *Parents' and children's decision–making for management of multiple decayed primary teeth.*

S. Prasad[1, 2], L. Timms[3], H. D. Rodd[3, 1], Z. Marshman[3],
[1]Charles Clifford Dental School, University of Sheffield, Nottingham, UK, [2]Dental Services,
Derbyshire Community Health Services, Derbyshire, UK, [3]University of Sheffield, UK.

106 *A multi-variate retrospective analysis of factors influencing completion time of multi-disciplinary clinic care in a cohort of hypodontia patients.*

P. L. Ryan[1], M. Payne[3], F. Wong[2], A. Johal[2], S. Shahdad[2, 4],
[1]Centre for Oral Immunobiology and Regenerative Medicine, Institute of Dentistry, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, UK, [2]Centre for Oral Bioengineering, Institute of Dentistry, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, UK, [3]Centre for Teaching and Innovation, Institute of Dentistry, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, UK, [4]Restorative Dentistry, Barts Health NHS Trust, London, UK.

107 *Preliminary physicochemical characterisation of rationally designed peptide P11-4DL.*

E. Zawia, B. Drummon, R.P. Davies,
School of Dentistry, University of Leeds, UK.

108 *Dimensional stability of gutta-percha with different root canal sealer cements.*

R. Elsherbini, J.M. Whitworth, I. Gharib,
School of Dental Sciences, Newcastle University, Newcastle, UK.

109 *Molecular Dissection Of Human Antibody Responses Against Porphyromonas gingivalis OMVs.*

R. Chance[1], A. Mirza[1], A. Hashim[2], M. Curtis[3], A. Kang[1],
[1]Institute of Dentistry, Queen Mary University of London, UK; [2]College of Dentistry, King Faisal University, Al Hufuf, Saudi Arabia; [3]Faculty of Dentistry, King's College London, UK.

110 *Metatranscriptomic Study of Dental Caries Lesions.*

M. Carda[1], A. López[1], A. Simón[2], A. Mira[1],
[1]Genomics and health, FISABIO, Valencia, Spain;[2]University of Pennsylvania, Philadelphia, USA.

111 *Dying odontoblasts activate an innate reparative inflammatory response.*

B. AL-Natour[2, 1], I. El Karim[2, 1], F. Lundy[2, 1], Y. Dombrowski[2, 1], I. About[3],
[1]School of Medicine, Dentistry and Biomedical Sciences , Queen's University of Belfast , UK; [2]Centre for Experimental Medicine, Queen's University Belfast, UK, [3]Odontology, Université d'Aix-Marseille, France.

112 *Multilevel Principal Component Analysis (mPCA) Age-related Changes in Facial Shape Recognition.*

D. JJ Farnell[1], S. Richmond[1], J. Galloway[1], A. Zurov[1], H. Matthews[2], P.Claes[2],
[1]School of Dentistry, Cardiff University, Wales, UK; [2]Medical Imaging Research Center, Leuven, Belgium.

113 *The Adjunctive Effect of Low Level Laser Therapy and Magnification on Healing in Chronic Periodontitis Patients.*

V. Krishna Naik[1,2], Y.Kadiyam[2], D. Apuukuttan[2],
[1]Restorative Dentistry, School of Dentistry, University of Leeds, UK; [2]Periodontics, SRM Dental College, Chennai, Tamil Nadu, India.

ORAL PRESENTATIONS

SCIENTIFIC SESSION 3 – DENTAL MATERIALS I

Wednesday 4th Sept 2019; Michael Sadler Building, Room LG10, 09.30 - 11.15

114 *WITHDRAWN A Comparative Study of the Mechanical Properties of Some Experimental Resin composites Containing Silver nanoparticles and Bioactive Glass S45S.*

A. Hanif,
Peshawar Dental College, Peshawar, KPK, Pakistan.

115 *Novel Fluoride Rechargeable Dental Composites Containing Ca2+ or Mg2+ LDH.*

A. Hoxha[1], D. G. Gillam[2], A. J. Bushby[3], M. Patel[1],
[1]Oral Bioengineering , Queen Mary University of London, UK; [2]Barts and the London, Institute of Dentistry, Queen Mary University of London, UK; [3]School of Engineering and Materials Science, Queen Mary University of London, UK.

116 *Investigation of RMGICs capability to re-mineralise and form apatite.*

B. Alshehri, M. Patel, N. Karpukhina,
Queen Mary University of London, UK.

117 *Release of bioactive ions by novel Bioglass particles.*

H. Khalid[1], M. Grosjean[1], R. Hill[1], N. Aleesa[1], F. Wong[2], S. Shahid[1],
[1]Barts and the London School of Medicine and Dentistry, Queen Mary University of London, UK,
[2]Centre for Bioengineering, Queen Mary University of London, UK.

118 *Photodynamically Active Electrospun Fibres for Antibiotic-Free Infection Control.*

A Contreras[1], M. Raxworthy[2], S. Wood[1], J. Schiffman[3], G. Tronci[1],
[1]University of Leeds, UK; [2] Neotherix Ltd., York, UK; [3]University of Massachusetts Amherst, Amherst, Massachusetts, USA.

119 *Spatial distribution of lidocaine in oral mucosa ex vivo determined using mass spectrometry imaging following delivery from an electrospun polymer patch.*

K. H. Clitherow[1], C. Murdoch[1], S. G. Spain[2], A. M. Handler[3], H. E. Colley[1], M. B. Stie[3],
H. M. Nielsen[3], C. Janfelt[3], P. Hatton[1], J. Jacobsen[3],
[1]School of Clinical Dentistry, University of Sheffield, UK; [2]Department of Chemistry, University of Sheffield, UK; [3]Department of Pharmacy, University of Copenhagen, Copenhagen, Denmark.

120 *Novel Bioactive-Glass Containing GIC for the Use in Atraumatic Restorative Technique.*

S. Mannaa[1, 2], S. Shahid[1], N. Karpukhina[1],
[1]Queen Mary University of London, UK; [2]School of Dentistry, King Abdul-Aziz University, Jeddah, Saudi Arabia.

SCIENTIFIC SESSION 4 – MICROBIOLOGY/IMMUNOLOGY

Wednesday 4th Sept 2019; Michael Sadler Building, Room LG15, 09.30 - 11.00

121 *Effects of P.gingivalis OMVs and Secreted Proteins on PECAM-1 expression.*

C. Farrugia[1], G. Stafford[2], C. Murdoch[1],
[1]School of Clinical Dentistry, University of Sheffield, UK; [2] School of Clinical Dentistry, University of Sheffield, UK.

122 *Bacteria Associated With Feline Odontoclastic Resorptive Lesion and Oral Health.*

M. Riggio[1], S. Thomas[1], D. Lappin[1], D. Bennett[1], J. Spears[2],
[1]University of Glasgow, UK, [2]Nestle Purina Petcare, St. Louis, Missouri, USA.

123 *Bacteriophage: biological antimicrobials for oral infections in the age of AMR?*

M. Al-Zubidi, M. Widziolek, C. Murdoch, G. Stafford,
School of Clinical Dentistry, University of Sheffield, UK.

124 V*alidating an ex vivo bone marrow model to study cell responses to bacterial infection.*

J. S. Khan[1], S. Jones[2], A. Sloan[1], R. Waddington[1],
[1]Oral and Biomedical Life Sciences, Cardiff University School of Dentistry, Cardiff, South Glamorgan, UK, [2]Cardiff and Vale Orthopaedic Centre, University Hospital Llandough, Cardiff, South Glamorgan, UK.

125 *Effects of Chlorhexidine mouth rinse on the oral microbiome in healthy patients.*

Z. Brookes, L. Belfield, C. Cutler, R. Bescos,
Peninsula Dental School, Plymouth University, Plymouth, UK.

126 *Antibiotic Prescribing: Towards a reducTion in Urgent Dentistry in England (APTiTUDE).*

W. Thompson[1], S. H. Pavitt[1], J. Sandoe[1, 3], R. McEachan[2], G.Douglas[1],
[1]University of Leeds, UK, [2]Bradford Institute for Health Research, Bradford, UK, [3]Leeds Teaching Trust, Leeds, UK.

SCIENTIFIC SESSION 5 – PULP BIOLOGY & STEM CELLS

Wednesday 4th Sept 2019; Michael Sadler Building, Room LG19, 09.30 - 10.30

127 *Neurogenic Differentiation of Dental Pulp Stem Cells.*

A. Al-Maswary, D. Walmsley, P. Cooper, B. Scheven,
Dental School, University of Birmingham, UK.

128 *Comparing the Direct Effect of Residual Double and Triple Antibiotic Paste on the Regenerative Potential of Dental Pulp Stromal Cells.*

R. El-Gendy[1], S. Ravipati[2], N. Aga[2], J. Prichard[3], N. Seoudi[3],
[1]Oral Biology, Leeds School of Dentistry, Leeds, UK, [2]Faculty of Dentistry, School of Health BPP University, London, UK, [3]College of Medicine and Dentistry, BPP University, Birmingham, UK.

129 *Identification of novel biomarkers and therapeutic agents for pulpitis using ssCMAP.*

R. Rankin[1], R. McKenna[1], B. Schock[1], B. AL-Natour[1], X. Kodji[1], I. About[2], F. Lundy[1], I. El Karim[1]
[1]Centre for Experimental Medicine, Queen University Belfast, UK, [2] Aix Marseille Université, Marseille, France.

130 *Mitochondria coordinate mouse incisor tooth epithelial stem cell fate determination.*

W. Kok, D. Singer, H. Zhuang, B. Hu,
Peninsula Dental School, University of Plymouth, UK.

DENTAL MATERIALS VOCO PRESENTATIONS

Wednesday 4th Sept 2019; Michael Sadler Building, Room LG15, 11.30 - 13.00

131 *Investigating the Required Forces to Cut Extracted and Artificial Teeth.*

A. J. Cresswell-Boyes[1], A. H. Barber[2], M. Krishnamoorthy[3], D.Mills[1], G. R. Davis[1],
[1]Dental Physical Sciences Unit, Institute of Dentistry, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, UK [2]School of Engineering, London South Bank University, London, UK [3]Oral Health Innovation, GlaxoSmithKline Consumer Healthcare, Weybridge, UK.

132 *Millable CAD/CAM laboratory composites.*

H.N. Walker,
School of Dentistry, University of Leeds, UK.

133 *The Effect of the particle size on synthesis and crystallization of potassium fluormica glass-ceramics.*

M. Mohamed[1, 2], N. Karpukhina[1], R. Hill[1],
[1]Dental Physical Sciences, Barts and The London, Dental institute, London, UK,
[2] Conservative Dentistry, Faculty of Dentistry, Alexandria University, Egypt.

134 *The Development and Evaluation of an Electrospun Mucoadhesive Device for Transmucosal Delivery of Therapeutic Peptides and Proteins.*

J. Edmans[1], L. S. Madsen[2], C. Murdoch[1], M. E. Santocildes-Romero[2], S. G. Spain[3], P. Hatton[4], H. E. Colley[1],
[1]Clinical Dentistry, University of Sheffield, UK; [2] AFYX Therapeutics, Copenhagen, Denmark;
[3]University of Sheffield, UK,;[4] School of Clinical Dentistry, University of Sheffield, UK.

135 *The Efficacy of Bis[2-(methacryloyloxy)ethyl] Phosphate in Self-Etching Dentine Bonding Systems.*

R. Alkattan,
King's College London, UK.

136 *3D Printing Alginate Hydrogels for Cleft Palate Repair.*

A. Bolger[1], C. Miller[1], R. Moorehead[1], I. Ortega[1], J. Yates[2],
[1] School of Clinical Dentistry, University of Sheffield, UK, [2] School of Clinical Dentistry, University of Manchester, UK.

PER GSK-MINTIG PRIZE PRESENTATIONS
Wednesday 4th Sept 2019; Michael Sadler Building, Room LG19; 11.30 - 13.15

137 *Effect of CPP-ACP and BIOMINF® on Remineralisation of Enamel, Analysed by 19F MAS-NMR.*

S.H. Jan, R. Hill, D.G. Gillam, S. Shahid,
Dental Physical Sciences, Queen Mary University of London, UK.

138 *Assessment of Dentine Tubule Occlusion and Remineralisation Using Serial-Block-Face SEM.*

B. Mahmoodi[1], P. Goggin[2], C. Fowler[3], R. Cook[1],
[1]Faculty of Engineering and Physical Sciences, University of Southampton, UK; [2]Biomedical Imaging Unit, University Hospital Southampton, UK; [3]Oral healthcare, GlaxoSmithKline, Weybridge.

139 *Observing the effect of an in vitro post-eruptive maturation pH-cycling model on acid erosion.*

A. Sharples[1], R. Lynch[2], N. Flannigan[1], T. Preston[1,] S. Higham[1],
[1]Department of Health Services Research, University of Liverpool, UK, [2]Oral Healthcare Category, GlaxoSmithKline, Weybridge, UK.

140 *Reversal of root caries using varnish either containing CPP-ACP and fluoride or fluoride alone in dry-mouth.*

A. S. Mustafa[1, 2], A. Tappuni[3], A. Baysan[3],
[1] Oral Bioengineering, Queen Mary University of London, UK; [2] Restorative, College of Dentistry - Al Mustansiriya University, Baghdad, Iraq; [3]Queen Mary University of London, UK.

141 *Transmission of 405nm light through dentine towards phototherapeutic applications*

S. Abdelsalam Mohamad, M. Hadis, W. Palin, S. Kuehne, M.Milward, P. Cooper,
School of Dentistry, University of Birmingham, Birmingham, UK.

142 *Crystallographic and microstructural studies of developing human deciduous enamel.*

M. Kaur, F. Wong, G.R. Davis, M. Al-Jawad, H. Liversidge,
Centre for Bioengineering, Queen Mary University of London, UK.

143 *Decellularised Bovine Dental Pulp as a Scaffold for Regenerative Endodontics: in vitro and in vivo studies.*

H. A. Alghutaimel[1, 4], H. Nazzal[1], X. Yang[2], B. Drummon[1], M.Duggal[3], E. Raif[2],
[1]Paediatric dentistry department, University of Leeds, UK; [2]Oral biology department, University of Leeds, Leeds, UK; [3]Discipline of Orthodontics and Paediatric Dentistry, National University Health System, Singapore; [4]Paediatric Dentistry Department, King Saud Bin Abdulaziz University for Heath Science, Riyadh, Saudi Arabia.

INVITED LECTURES

Wednesday 4th Sept 2019; Rupert Beckett Lecture Theatre, Michael Sadler Building

TC White Lecture – Dr. Deepshikha Kumar	**12.00 - 13.00**
Colgate Anniversary Lecture – Dr. Barry Cockcroft	**13.45 - 14.45**
Graham Embery Lecture – Professor Sue Pavitt	**14.45 - 15.45**
BSODR President's Prize Lecture – Dr. Caroline Harrison	**16.00 - 16.30**
NIHR James Lind Alliance Oral and Dental Priority Setting Partnership - the Top 10 Priorities – Professor Peter Robinson	**16.30 - 16.45**

Thursday 5th September 2019

ORAL PRESENTATIONS

OMIG Symposium *Oral health and Alzheimer's Disease.*

Thursday 5th September, Michael Sadler Building, Rupert Beckett Lecture Theatre, 09.00 - 10.30

Hosted by Marcello Riggio.

It is well established that oral diseases such as periodontitis are linked to several systemic diseases, including cardiovascular disease, diabetes and rheumatoid arthritis. More recently, attention has turned to the possible role of periodontitis as a causative factor in the development of Alzheimer's disease. The aim of this symposium is to provide an overview for scientists and clinicians of recent advances in research on the link between periodontitis and Alzheimer's disease.

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The link between periodontitis and progression of Alzheimer's Disease.
Professor Jessica Teeling, Biological Sciences, Southampton.

Periodontal infection with Porphyromonas gingivalis and its effect on neurodegenerative changes in the brain.
Dr. Malgorzata Benedyk-Machaczka, Malopolska Centre of Biotechnology, Jagiellonian University, Krakow, Poland.

Investigating overlapping microbiomes of Periodontitis and Alzheimer's Disease.
Dr. David Emery, Bristol Dental School, Bristol.

INVITED LECTURE

Thursday 5th Sept 2019; Rupert Beckett Lecture Theatre, Michael Sadler Building

Keynote Lecture – Prof. John Wright **10.30 - 11.15**

SCIENTIFIC SESSION 6 – DENTAL MATERIALS II & CARIES RESEARCH II
Thursday 5th Sept 2019; Michael Sadler Lecture Theatre, 11.30 - 13.00

144 *"Sweet Tooth" is Associated with Altered Intra-oral Sucrose Metabolism.*

A. Gardner, P. So, G. Carpenter,
King's College London, London, UK.

145 *Novel Bioactive-Glass Containing GIC for the Use in Atraumatic Restorative Technique.*

S. Mannaa[1, 2], S. Shahid[1], N. Karpukhina[11],
Queen Mary University of London, UK, [2]School of Dentistry, King Abdul-Aziz University, Jeddah Saudi Arabia.

146 *The Atomic Force Microscope in Basic Dental Research.*

N. Thomson,
School of Dentistry, University of Leeds, UK.

147 *Characterisation of the Bioactivity of Two Commercial Composites.*

M. Tiskaya[1], N. Aleesa[1], F. Wong[2], R. Hill[1],
[1]Queen Mary University, London, UK; [2]Centre for Bioengineering, Queen Mary University of London, UK.

148 *Dose-Response Cariostatic Effect of Stannous Ions on Demineralisation.*

B. Ferizoli[1], R. Lynch[2], R. Hill[1], P. Anderson[1],
[1]Institute of Dentistry, Queen Mary University, London, UK, [2]GlaxoSmithKline, Weybridge, UK.

149 *Effects of Stannous Fluoride (SnF2) and Sodium Fluoride (NaF) on in vitro Enamel Demineralization Analysed by 19F MAS-NMR.*

R. Hill[1], P. Anderson[1], R. Lynch[2], B. Ferizoli[1],
[1]Institute of Dentistry, Queen Mary University, London, UK, [2]GlaxoSmithKline, Weybridge, UK.

SCIENTIFIC SESSION 7 – PAEDIATRIC & ORAL HEALTH RESEARCH

Thursday 5th Sept 2019; Michael Sadler Building, Room LG10, 11.30 - 13.00

150 *"I am worried something bad will happen": Giving anxious children a voice.*

L. Timms[2], F. Noble[2], S. Bux[3], Z. Marshman[1], H. D. Rodd[1],
[1]University of Sheffield, UK; [2]Sheffield Teaching Hospitals, Sheffield, UK; [3]Clapton Dental Practice, London, UK.

151 *PLATOON: Logistical Challenges, Limitations and Solutions.*

E. Alnuaimi[1], D. Waiblinger[2], S. Smith2, T. Yang[2], P. Day[1],
[1]School of Dentistry, University of Leeds, UK; [2]Bradford Institute for Health Research, Bradford, UK.

152 *WITHDRAWN Child-reported impacts of treatment for caries under general anaesthesia.*

R. Knapp, Z. Marshman, H.D. Rodd, F. Gilchrist, H. Zaitoun,
School of Clinical Dentistry, University of Sheffield, UK.

153 *HABIT: An Oral Health Intervention for Infants- Qualitative Findings.*

A. Bhatti[1], K. Gray-Burrows[1], F. Wray[1], J. Owen[1], I. Eskyte[1], R. West[1], S. H. Pavitt[1], Z. Marshman[2], P. Day[1],
[1]University of Leeds, Bradford, West Yorkshire, UK; [2]University of Sheffield, UK.

154 *The role of patient feedback in undergraduate dental education: A patient participation project.*

A Ranauta,
Education and Innovation, Queen Mary University of London, UK.

155 *Dental EHR system illustrates association between oral and general health.*

F. Fox[1], H. Whelton[2],
[1]School of Dentistry, University of Leeds, UK; [2]College of Medicine and Health, University College Cork, Ireland.

SCIENTIFIC SESSION 8 – IMPLANTOLOGY, ORTHODONTICS AND PROSTHODONTICS

Thursday 5th Sept 2019; Michael Sadler Building, Room LG15, 11.30 - 12.45

156 *WITHDRAWN Studying Enamel Matrix Derivative (EMD) at Molecular and Cellular Level.*

A. Holdar, S. Rawlinson, M. Al-Jawad,
Dental Institute, Queen Mary University of London, London, UK.

157 *Trueness and precision of a novel surgical guide to place implants in an edentulous patient.*

A.B. Nulty, A. Keeling, P. Hyde,
School of Dentistry, University of Leeds, UK.

158 *Complications and patient's experiences during Class II malocclusion treatment. A systematic review.*

M. Moussa Pacha, P. Fleming, A. Johal,
Centre of Bioengineering, Institute of Dentistry, Queen Mary University of London, UK.

159 *Volatile Organic and Volatile Sulphur Compounds in Denture Malodour.*

A. Stephen[1], N. Alsane[1], D. G. Gillam[1], G. R. Burnett[2], D. J. Bradshaw[2], R. Allaker[1],
[1]Institute of Dentistry, Queen Mary University of London, U;, [2]GlaxoSmithKline Consumer Healthcare, London, UK.

160 *Development of "My Retainers" mobile application: Triangulation of two qualitative methods.*

D. Al-Moghrabi[1, 2], F. Colonio-Salazar[2], A. Johal[2], P. Fleming[2],
[1]Princess Nourah bint Abdulrahman University, Riyadh, Saudi Arabia; [2]Queen Mary University of London, UK.

SCIENTIFIC SESSION 9 – PERIODONTOLOGY RESEARCH AND ORAL MEDICINE/PATHOLOGY

Thursday 5th Sept 2019; Michael Sadler Building, Room LG19, 11.30 - 13.00

161 *The CRTC1-MAML2 Fusion Protein- an Innocent Bystander or Tumour Promoter?*

E. B. Amoura[1], K. D. Hunter[1], C. D. Bingle[2], L. Bingle[1],
[1]Oral and Maxillofacial Pathology, School of Clinical Dentistry, Sheffield, UK; [2]Department of Infection, Immunity & Cardiovascular Diseases , Medical School, University of Sheffield, UK.

162 *Targeting Head and Neck Tumours with HSV1716 Oncolytic Virotherapy.*

M. M. Revell[1], C. McGraw[1], A. C. Murdoch[1], J. Conner[3], M. Muthana[2], C. Murdoch[1],
[1]School of Clinical Dentistry, University of Sheffield, UK; [2]Oncology and Metabolism, University of Sheffield, UK; [3]Virttu Biologics, Glasgow, UK.

163 *Chronic periodontitis and air flow limitation in older Swedish adults.*

L. Winning[1], I. Polyzois[1], J. Sanmartin Berglund[3, 4], S. Renvert[2,1],
[1]Trinity College Dublin, Dublin, Ireland; [2]Kristianstad University, Kristianstad, Sweden; [3]Berglund, Lund University, Lund, Sweden; [4]Berglund, Blekinge Institute of Technology, Blekinge, Sweden.

164 *Visualisation and Quantification of Inflammation in 3D Oral Mucosal Models.*

L.AlQobaly[1],Z.Shaikh[1],K.L.Franklin[1],J.Thurlow[1],B.Moghaddam[2], K. Moharamzadeh[1],
[1]University of Sheffield, UK; [2]GlaxoSmithKline, Weybridge, UK.

165 *Development of a Radiographic Index for Periodontitis.*

Z. Shaker[1], A. Parsa[2], K. Moharamzadeh[1],
[1]University of Sheffield, UK; [2]Academic Centre for Dentistry Amsterdam (ACTA), Amsterdam, Netherlands.

166 *High Speed Imaging of Biofilm Removal via Ultrasonic Cavitation at Different Distances.*

N. Vyas, M. Grewal, Q. Wang, K. Manmi, R. Sammons, S. Kuehne, D. Walmsley,
University of Birmingham, UK.


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001

Development of a method to clinically identify the position of the lingual nerve relative to the third molar region

S. Aljamani[1], F. O'Neill[2], C. Youngson[1], F. Jarad[1]

[1]Restorative Dentistry, [2]Oral Surgery, Dental School, Liverpool, UK

Objectives: To develop a method that can clinically identify the position of the lingual nerve within the lingual tissue in the third molar region by electro-stimulation of the nerve.
To test the reliability of the technique and calculate intra-class correlation coefficient. Compare results of this method with measurements from MRI scan images

Methods: A cross-sectional study of 50 healthy participants, an Electric Pulp Tester (EPT, Gentle Pulse™, Parkell, USA) was used intra-orally to identify the vertical position of the lingual nerve. Measurements were taken when subjects felt a tingling sensation in the tongue as the stimulation probe was directly over the lingual nerve. The position of the lingual nerve was investigated in three positions in relation to the third molar A, B, and C (figure 1) in both right and left sides. Both Inter-observer and intra-observer agreement was tested and analysed in 10% of the sample using intra-class correlation coefficient. In a further 10% of the sample, the clinical measurements of the lingual nerve were then compared with nerve position as measured from 3DESS magnetic resonance images (MRI) acquired in the same subjects.

Results: Out of 50 participants, 96 nerves (49= left side/ 47= right side) were included in the study. The lingual nerve was identified in 90% (n=87) of this sample. Inter and intra observer agreement was considered to be good to excellent (ICC=0.8-0.9).
Agreement between EPT measured values and MRI measured values was good (ICC<0.6).

Conclusions: This study demonstrated that EPT can clinically stimulate the lingual nerve within the lingual tissues. This technique showed good to excellent reliability between both intra- and inter-observer agreements. Comparison of both EPT and MRI derived measures is also possible and show good agreement. This technique may be useful for the clinical determination of lingual nerve position prior to third molar surgery.

002

Intracellular interleukin 1 receptor antagonist type 1 regulates the senescence-associated secretory phenotype (SASP) in oral keratinocytes

S. Niklander[1, 2], H. Crane[1], D. W. Lambert[1], K. D. Hunter[1]

[1] Unit of Oral and Maxillofacial Pathology, School of Clinical Dentistry, University of Sheffield, UK; [2] Department of Oral Pathology and Oral Surgery, Dentistry Faculty, Universidad Andres Bello, Viña del Mar, Chile.

Objectives: Replicative senescence is important in ageing and is a potent anti-tumour mechanism, characterized by a permanent cell growth arrest. Senescent cells remain metabolically active and adopt a pro-inflammatory state known as the senescence-associated secretory phenotype (SASP), which paradoxically, can promote cancer development. Two important factors of the SASP are IL-6 and IL-8, induced by the activation of the NFκB pathway. The intracellular form of interleukin 1 receptor antagonist (icIL-1RA) is downregulated early in the oral carcinogenesis process, and has been reported to be involved in the regulation of the SASP in endothelial cells. Thus, we aimed to study the role of icIL-1RA in the oral keratinocyte senescence program, to understand how its downregulation in normal and dysplastic cells can predispose to cancer development.

Methods: Senescence in normal (NOK) and dysplastic oral (OD) keratinocytes was assessed by evaluating γH2AX by immunofluorescence, p16, p21 expression by qPCR and immunoblotting, and β-galactosidase activity. SASP factors were analysed using qPCR, western blot or ELISA. The CRISPR/Cas9 system was used to knock out icIL-1RA type 1 (icIL-1RA1) in primary normal and dysplastic oral keratinocytes.

Results: icIL-1RA expression decreases significantly during normal and dysplastic keratinocyte senescence, with an increase in the expression of established components of the SASP, including IL-6 and IL-8. Knock out of icIL-1RA1 in NOK and OD cells (KO OD) caused a significant increase of IL-6, IL-8 and phospo-P65 (indicator of NFκB activation), and induced premature senescence of OD cells compared to wild-type (WT). No differences in abundance of IL-6, IL-8 or phospho-P65 between senescent WT and senescent KO OD cells were observed.

Conclusions: We have shown that icIL-1RA1 is an important factor in the regulation of the SASP in oral keratinocytes. Downregulation of IL-1RA1 in dysplastic cells can facilitate the development of a premature and de-regulated SASP, which may contribute to malignant transformation.

003

Senescent fibroblasts contribute to bone invasion in oral squamous cell carcinoma: a novel opportunity for therapeutic intervention

A. Elmusrati, S. Khurram, D. W. Lambert

School of Clinical Dentistry, University of Sheffield, UK

Objectives: Bone invasion is a common feature of oral squamous cell carcinoma (OSCC) and is associated with poor prognosis. We have previously reported a novel role for cancer associated fibroblasts (CAF), and recently provided evidence that a subset of CAF, senescent fibroblasts, can promote cancer progression and poor outcome. Here, we sought to extend these findings to further investigate the role of senescent fibroblasts in bone invasion.

Methods: Immunohistochemistry (IHC) for the senescence markers p16INK4a and dipeptidyl peptidase 4 (DPP4) was carried out on OSCC bone resection cases. Senescence of normal oral fibroblasts (NOFs) was induced by culturing to replicative mitotic exhaustion, or exposure of proliferating cells to hydrogen peroxide or cisplatin. Senescence- associated beta-galactosidase (SA-β-gal) activity was monitored to indicate senescence induction. Expression of p16INK4a and a key component of the senescence-associated secretory phenotype (SASP), interkeukin-6 (IL6), as well as Receptor activator of nuclear factor kappa-B ligand (RANKL), were detected using quantitative PCR (qPCR). Conditioned media was collected and an enzyme-linked immunosorbent assay (ELISA) used to detect secreted RANKL. Osteoclastogenesis and pit formation was assessed in response to senescent fibroblast-derived conditioned media. Senolytic agents, HSP90 inhibitor alvespimycin (17-DMAG) and BCL-2 inhibitor navitoclax (ABT-236) were used to selectively induce apoptosis of senescent fibroblasts, and the effect of this on fibroblast-induced osteoclastogenesis assessed.

Results: Prominent p16INK4a and DPP4 staining was seen in fibroblastic stroma adjacent to bone. RANKL expression was elevated, with secretion increasing in a time dependent manner concomitant with the SASP component IL6. Conditioned media from senescent oral fibroblasts significantly stimulated osteoclastogenesis, assessed by an increase in tartrate-resistant acid phosphatase activity and osteoclastic resorption pit formation. Exposure to senolytics resulted in a reduction in the number of senescent fibroblasts with a significant reduction in osteoclastogenesis.

Conclusions: In conclusion, we provide evidence that senescent fibroblasts contribute to bone invasion and that senolytic drugs hold promise as a novel therapeutic agent in bone invasive OSCC.

004

Defining a Craniofacial Phenotype and Prediction Model for Obstructive Sleep Apnoea: A 3-D Evaluation

B. Agha[1, 2], L. Zou[1], A. Johal[1]

[1]Centre for Oral Bioengineering, Institute of Dentistry, Queen Mary University of London, UK; [2]Orthodontic Department, Al-Mustansiriya University, College of Dentistry, Baghdad, Iraq

Objectives: Obstructive sleep apnoea (OSA) is considered as a major healthcare problem in the UK, being the 3rd first common respiratory breathing disorder. The aims of the present study were to explore the existence of a craniofacial phenotype in adults with OSA, the ability to predict the condition from clinical and craniofacial structures, and the presence of a surface facial marker for OSA.

Methods: A case-control study was conducted with 118 middle-aged Caucasian males (56 controls and 62 OSA subjects). Each undergoing a clinical examination, cone beam computed tomography and stereophotography for craniofacial analysis at the surface, skeletal and upper airway levels.

Results: Surface, skeletal and airway craniofacial phenotypes were identified for OSA Caucasian men. The predominant craniofacial characteristics associated with OSA include, an enlarged neck circumference ($p<0.001$), short neck ($p<0.001$), large mandibular width ($p<0.001$), forward head posture ($p<0.001$), inferior positioning of the hyoid bone ($p<0.001$), increased lower and total anterior facial height ($P<0.002$), retropositioning of the mandible ($p<0.047$), narrow retroglossal and retropalatal airway width ($p<0.001$), reduced retroglossal and retropalatal cross-sectional area ($p<0.001$) and forward airway angulation ($p<0.001$). Multiple regression analysis identified a range of prediction models with moderate to high sensitivity and specificity, with an area under the curve (AUC) ranged between 0.74-0.89. Final combination model including surface, skeletal, airway and clinical variables predicted better (AUC=0.89), with a high positive likelihood ratio (LR+5.64), the highest positive post-test odds (OR=6.3), the lowest negative likelihood ratio (LR–0.23) and post-test negative odds (OR=0.3). The surface model not only successfully identified OSA subjects from controls (AUC=0.77) but also presented as a marker.

Conclusions: This case-control study demonstrated the existence of a phenotypic pattern, identified a strong predictive model and marker for OSA in Caucasian men, using 3D-imaging analysis. The simultaneous evaluation of different levels of craniofacial structures provided a comprehensive image for OSA risk factors and predictors.

005

Intensity Modulated Radiation therapy related to salivary protein content in oral cancer

M. Gonzalez, M. Burke, F. Warburton, S. Bozorgi, G. Carpenter, G. Koller, A. Banerjee,

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Objectives: Radiotherapy (RT), the mainstay treatment for head & neck cancer (HNC), is associated with salivary gland dysfunction. Intensity-modulated radiotherapy (IMRT) helps mitigate the severity of side effects. There is insufficient data on how this affects biochemical composition of saliva and its function in oral health. The aim of this study was to correlate radiation-induced changes in salivary proteins with signs and symptoms (caries, mucositis, xerostomia, salivary gland hypofunction).

Methods: Samples were obtained from 40 HNC patients prior to and post- IMRT (f1=6m, f2=12m) together with age- matched controls. Unstimulated whole saliva samples were used to quantify flow rate, total protein concentration (TPC)/secretion (TPS) rate and specific salivary markers that might relate to side effects of treatment. TPC was quantified by BCA assay. PAS-staining determined glycoprotein concentration, including MUC5B and MUC7. ELISA assays quantified IgA, cystatin S, statherin, acidic proline-rich peptides and albumin. α-amylase activity was determined by kinetic assays. Correlations of TPC/TPS were made to clinical parameters including IMRT dose/fraction, mucositis, xerostomia and caries experience. The null hypothesis stated that no difference was expected for any parameter post-RT and compared with healthy controls.

Results: Significant reductions in unstimulated salivary flow rate (USFR) and TPS rate were identified for individuals on IMRT compared to baseline, with >50% USFR recovery at f2 in 6 patients.. Protein concentration for MUC5B, MUC7, CAVI and IgA were significantly elevated, statherin and Cystatin S were statistically decreased post-IMRT ($p<0.05$).α-amylase activity reduction was not significant ($p>0.05$). The null hypothesis was rejected.

Conclusions: In agreement with previous studies using conventional RT, IMRT resulted in decreased saliva flow rate and quantity. Specific changes in salivary proteins and activity were observed and clinical correlates presented with potential implications in the pathophysiology of radiation-induced side effects. Specifically, specific mucin structural alterations were noted, providing insights into radiation-associated changes and potential therapeutic approaches, the subject of ongoing studies.

006

Incorporation, Differentiation, and Polarisation of THP-1 Cells within Tissue-Engineered Oral-mucosa

S. J. Gould, L. Belfield, M. Upton, V. Salih

Peninsula Dental School, University of Plymouth, Devon, UK.

Objectives: Three-dimensional oral mucosal models (3DOMMs) are a suitable alternative for in vitro oral models. They are valuable tools for studying infection, pathology, biocompatibility and testing novel therapeutic agents. Multi layered, gel based 3DOM infection-models have been successfully developed to study tissue invasion and damage, however are lacking a functioning immune component. THP-1 pro-monocyte cells may be differentiated into M1 or M2 like macrophages, in order to study response to infection via recruitment, polarisation, pro/anti-inflammatory cytokine production, and phagocytosis. The 3DOMM microenvironment is complex due to inter and intra-cellular interactions with the other components of the 3D model. This microenvironment leads to an inflammatory state. The aims of this study were to determine the effect of the 3DOMM microenvironment on THP-1 cell survival and polarisation, in order to determine the potential for THP-1-incorporated 3DOMMs to be used to study innate immune response to infection.

Methods: 3DOMMs were created using collagen gel and employing human gingival fibroblast (HGF), pro-monocyte (THP-1) and keratinocyte (HaCaT) cell lines, grown for 14 days. THP-1 cells were differentiated and polarised into M1/M2 like macrophages using PMA/VD3 respectively. Cell surface markers (CD68, CD163, CD206) for determining M1/ M2 macrophage subsets were assessed using flow cytometry. Confocal microscopy was used to assess THP-1 localisation within the 3DOMM.

Results: Expression of cell surface markers (CD68, CD163 and CD206) varied between macrophage subsets. M2 surface marker expression was altered in the presence of 3DOMs. M1 and M2 macrophages appeared present and viable in the 3DOM lamina-propria layer; THP-1 cells and Fibroblasts appeared to be viable, however in relative stasis compared to non-embedded controls.

Conclusions: THP-1 cells were successfully incorporated into 3DOMMs. PMA or VD3 were used to polarise the THP-1 cells into M1 like and M2 like macrophages, polarisation surface marker expression varied when polarised in the presence of 3DOMMs.

007

Enhancing Sodium Hypochlorite Penetration into Root Dentine With Irrigant Activation

S. S. Virdee[1], D. Farnell[2], M. Silva[1], J. Camilleri[1], P. Cooper[1], P.L. Tomson[1]

[1]Restorative Dentistry, University of Birmingham, UK; [2] Restorative Dentistry, Cardiff University Dental Hospital, Cardiff, UK.

Objectives: Evaluate if Manual-Dynamic-Activation (MDA), Passive-Ultrasonic-Irrigation (PUI) and Sonic-Irrigation (SI) improves dentinal tubular penetration of Sodium Hypochlorite (NaOCl) into root dentine when compared to Conventional-Needle-Irrigation (CNI). Secondly, to explore if increasing NaOCl concentration or contact-time potentiates performance of these Irrigant-Activation-Techniques (IAT).

Methods: One-hundred human maxillary permanent canines were decoronated to 15mm and canals instrumented to size 40/.10. Roots were dyed with crystal violet, embedded in silicone and randomly distributed into 16 groups (n=5) according to the IAT, NaOCl concentration (%) and irrigant contact-time (min): 1.CNI/2%/10min, 2.CNI/2%/20min, 3.CNI/5.25%/10min, 4.CNI/5.25%/20min, 5.MDA/2%/10min, 6.MDA/2%/20min, 7.MDA/5.25%/10min, 8.MDA/5.25%/20min, 9.PUI/2%/10min, 10.PUI/2%/20min, 11.PUI/5.25%/10min, 12.PUI/5.25%/20min, 13.SI/2%/10min, 14.SI/2%/20min, 15.SI/5.25%/10min, 16.SI/5.25%/20min. All IATs were used in the last minute of irrigation and CNI acted as control. Specimens were sectioned to produce 4 coronal, 4 middle and 2 apical segments per tooth. These were observed under a light microscope and the average NaOCl penetration depth (μm) determined using ImageJ by measuring the width of bleached dentine. Statistical comparisons were made using one-way ANOVA, post-hoc Tukey and Dunnett's tests with Bonferroni correction and a general linear model ($\alpha<0.05$).

Results: Overall NaOCl penetration ranged from 38.8μm–411.0μm. With exception to group-16, all IATs resulted in greater NaOCl penetration than CNI ($p<0.001$). The deepest NaOCl penetration in coronal, middle and apical segments were measured in group-8 and least in group-1. Significant increases in tubular penetration were measured across all IATs and locations when NaOCl concentration or contact-time increased ($P<0.001$). Additionally, there were significant interaction effects between concentration and contact-time when both increased ($P<0.001$).

Conclusions: Manual-Dynamic-Activation, PUI and SI significantly improved tubular penetration of NaOCl into root dentine throughout the canal when compared to CNI. Increasing irrigant contact-time and concentration further improved NaOCl penetration for all techniques.

008

Instructional Video Impact on Self-confidence in Luxator Use amongst Dental Undergraduates: a Mixed- Methods Study

Z. Awad, R. Moore, T. Zoltie,
School of Dentistry, University of Leeds, UK

Objectives: To investigate the self-reported confidence of fourth- and final-year dental undergraduates in different aspects of luxator use in exodontia, before and after viewing a clinical instructional video.

Methods: Distribution of a pre-video questionnaire allowed fourth- and final-year dental students (N=165) at Leeds University to rate their confidence in different aspects of luxator use on a 4-point scale. After distribution of an instructional video, students again indicated their confidence levels and evaluated the effectiveness of the video through a post-video questionnaire. Student participation (N=12) in focus group interviews provided further insight. A mixed-methods approach to data collection and analysis provided descriptive statistical results and a grounded theory approach to coding identified key themes from focus group discussions.

Results: The response rate of completed questionnaires was 50% pre-video (N=82) and 30% post-video (N=49). The mean percentage of students who reported lower confidence was greater pre-video (73.2%) than post-video (30.6%) in aspects of luxator use. The reasons behind reported confidence levels varied for each individual. The instructional video was considered to be highly effective in allowing visualisation of technique and viewed as a valuable resource for revision. Whilst students perceived that the video had a positive impact on their self-confidence, they still expressed need for small-group practical teaching regarding luxators.

Conclusions: Reasons behind dental students' self-confidence levels are multi-faceted but integration of video resources alongside teaching in a small-group setting could be beneficial to the preparation of students. Further investigation is needed to examine relationships between self-confidence and competence in luxator use.

009

Extracellular vesicles isolated from oropharyngeal cancer cells elicit a pro-inflammatory macrophage phenotype in vitro

A. Rigby, H. E. Colley, C. Murdoch, S. Hunt

School of Clinical Dentistry, University of Sheffield, UK

Objectives: Human papillomavirus positive (HPV+) oropharyngeal cancer (OPC) has an improved prognosis over HPV negative (HPV-) OPC, possibly due to signalling differences in the tumour microenvironment. The current study examined if OPC derived extracellular vesicles (EVs) play a role in the polarisation of tumour associated macrophages. We aimed to isolate and characterise EVs from HPV+ and HPV- OPC cell lines and to determine macrophage phenotype after treatment with OPC conditioned medium or OPC-EVs.

Methods: EVs were isolated from the conditioned medium of HPV+ (SCC2 and SCC90) and HPV- OPC (SCC72 and SCC89) cell lines by differential centrifugation and size exclusion chromatography to produce large and small EV- enriched populations. OPC-EVs were characterised by nanoparticle tracking analysis (NTA), transmission electron microscopy (TEM) and western blotting. Monocyte-derived macrophages (MDM) were isolated from human buffy coats. MDM were polarised to M0/M1/M2 phenotypes using cytokines, treated with OPC conditioned medium or OPC- EVs. The resulting MDM phenotypes were analysed using qPCR and an ELISA was used to detect macrophage- derived cytokines in the resulting conditioned medium.

Results: NTA and TEM confirmed the isolation of large (~400 nm) and small EVs (~140 nm) that by immunoblotting were shown to be positive for common EV markers, including the tetraspanins CD63 and CD9. Cytokine polarisation produced M0/M1/M2 baseline MDM phenotypes. Treatment with OPC conditioned medium and OPC-EVs caused phenotypic changes to MDM. Treatment of MDM with large and small OPC-EVs increased the expression of the M1 inflammatory marker CD80, with the increase caused by large EVs being significant ($p<0.01$). In addition, significant increases in CXCL8 secretion from MDM treated with small EVs was also detected ($p<0.05$).

Conclusions: Stimulation of MDM with OPC-EVs elicited a marked change in MDM phenotype marker expression. The differential effect of HPV+ and HPV- OPC-EVs on MDM phenotype might partially explain the HPV status related prognosis of patients with OPC.

010

The Role of Fusobacterium nucleatum in Oral Carcinogenesis

E.McIlvanna[1], S.Craig[2], S.McQuaid[2], F.Lundy[3], J.James[2]

[1]School of Dentistry , Queen's University Belfast, Dungannon, UK, [2] Centre for Cell Research and Cell Biology, Queen's University, Belfast, UK, [3]Centre for Experimental Medicine, Queen's University, Belfast, UK

Objectives: Fusobacterium nucleatum (Fn) is an oral pathogen associated with poor survival in a subset of colorectal cancers (CRCs). Although Fn has been shown to colonise CRCs through binding of its Fap2 adhesin to overexpressed Gal-GalNAc oligosaccharides on tumour tissue, the impact of Fn on head and neck cancers has been less well researched. The aims of the study were: (1) to establish methodology for detection of Fn and Gal-GalNAc in oral cancers and precancer and (2) to evaluate whether presence of Fn impacts on clinical outcome.

Methods: 37 formalin-fixed paraffin-embedded (FFPE) samples of oral and oropharyngeal cancer were analysed for Fn by quantitative-PCR. RNAscope in situ hybridisation was used to visualise Fn in qPCR positive samples. Relative levels of Gal-GalNAc were evaluated using fluorescently-labelled Peanut Agglutinin (PNA) lectin. A subset of oral precancers that progressed to Fn-positive cancer were also tested for Fn by RNAscope.

Results: In the cohort studied 27% of FFPE cancer samples were positive for Fn by qPCR. RNAscope revealed that Fn was localized to superficial surface areas of tumour. Fn-positive tumours trended towards worse prognosis (p=0.07; after adjusting for HPV status p=0.09). Most cancer tissues exhibited co-localisation of Fn and PNA staining, however two Fn-positive samples were PNA-negative. 50% of oral precancerous lesions which progressed to Fn- positive cancer were also positive for Fn using RNAscope.

Conclusions: The methodology for detecting Fn and Gal-GalNAc in FFPE tissues was successfully established. In this study, Fn-positive oral cancer tended to have a worse outcome compared to Fn-negative samples; however, this finding was not significant and should be confirmed in a larger cohort. Fn was detected in matched precancer and cancer samples obtained from the same patient at the same oral site; suggesting Fn may have a role in driving malignant transformation. The role of Gal-GalNAc in the colonisation process requires further investigation.

011

Augmented Reality as a Novel Method for Denture Tooth Selection

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Objectives: The selection of appropriate maxillary anterior denture teeth is a challenging aspect of denture provision. Sadly, many patients are not adequately consulted on this key aesthetic decision, despite evidence suggesting patient involvement is fundamental to treatment success. The literature acknowledges that dentistry lacks the technology to help patients envisage treatment outcomes. This study aimed to investigate the perceived clinical benefits of our novel augmented reality (AR) application (app) for denture tooth selection. Specifically, it evaluates the app's usability and assesses whether it offered patients an improved informed choice through the visualisation of treatment outcomes.

Methods: We developed a virtual library of artificial teeth for use in our own AR software called "ToothPick", which projects upper anterior teeth onto an image of the patient's mouth in real-time, simulating their final denture. Twenty- two alternative setups allowed aesthetic comparisons with a finger swipe. After obtaining NHS REC approval (IRAS 238446), 26 patients and clinicians undergoing denture provision were recruited at Leeds Dental Institute. Inclusion criteria required patients to lack upper anterior teeth and to attend both jaw registration and wax try-in appointments. Clinicians assisted patients to select their denture teeth using both the conventional A4 mould chart and ToothPick. Patients and clinicians then completed Likert-scale questionnaires comparing both methods.

Results: Overall, 86% of clinicians and 77% of patients preferred ToothPick over the conventional method. 92% of clinicians and 62% of patients found ToothPick easy to use. 67% of clinicians reported ToothPick was more time consuming. 92% of clinicians and 77% of patients agreed that Toothpick gave a more informed choice. Complete results are displayed in the attached tables.

Conclusions: There is evidence that the Toothpick AR application for denture tooth selection was preferred by patients and clinicians.

012

The Effect of Craft Beer on Enamel Erosion

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Objectives: Craft beer has recently grown in popularity with 506 million pints being consumed in 2017, representing 6.5% of the UK beer market. Craft beers produced by independent breweries often have extreme characteristics and the dental health effects of these popular beverages have not been fully investigated. Therefore this study aims to assess enamel erosion caused by different styles of craft beer.

Methods: 42 human enamel samples embedded in acrylic and polished were randomly allocated between fourteen test groups (n=3) consisting of: four craft beers, a traditional ale, a water control and a pH3 citric acid control, with 30- minute and 24-hour incubation timepoints. Erosion was assessed using micro-computed tomography (microCT), surface profilometry, Vickers hardness and scanning electron microscopy. Colorimetric analysis was also performed as was correlation analysis between enamel erosion parameters and pH/alcohol content (ABV).

Results: Statistically significant differences in enamel erosion compared with the water control were only observed for the citric acid and American Wild Blonde Ale (AWBA) groups. AWBA caused significant reductions in mean volume loss as measured by microCT after 30-minute ($p=0.0003$) and 24-hour incubations ($p=0.02$) as well as significant reductions in hardness for 30-minute ($p=0.005$) and 24-hour incubations ($p=0.001$). Citric acid and AWBA samples demonstrated a rougher surface topography. No significant colour changes were detected. Strong correlations were observed between pH and mean volume loss for 30-minute ($r=-0.9494$) and the 24-hour incubations ($r=-0.9495$), with weaker correlations with ABV.

Conclusions: Craft beers, with the exception of sour beers, do not cause significant levels of enamel erosion. The erosive effect of sour beers is a function of low pH which is consistent with observations from other studies. The findings of this paper may help advise dental public health, but further research into craft beers, and sour beers in particular, are recommended.

013

High Speed Imaging of Biofilm Removal from Dental Implants in a Subgingival Model

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Objectives: Biofilm removal from dental implants is required to manage peri-implantitis. However, current methods used are not effective at removing all biofilm and further research is required into methods of biofilm removal. In this study an in vitro subgingival implant model was developed to image biofilm removal from around an implant in a confined space in real time using a high speed camera.

Methods: An implant model for high speed imaging was constructed from lab putty and a Thermanox coverslip to provide a transparent viewing window for imaging with a high speed camera. Streptococcus Sanguinis (ATCC 10556) biofilm was grown on dental implants for 7 days. Biofilm removal was performed using cavitation from an ultrasonic scaler operating at medium or high power, and imaged using a high speed camera (Photron AX200) at 2000 frames per second.

Results: Cavitation bubbles were able to disrupt biofilm on the dental implant at both medium and high power. More biofilm was removed at high power. Biofilm could be removed from most areas of the implant when operating the ultrasonic scaler tip for 2s without moving the tip position.

Conclusions: This preliminary study demonstrates that cavitation bubbles from an ultrasonic scaler are able to disrupt biofilm from a dental implant in a subgingival model, without needing to move the tip of the ultrasonic scaler. This technique would minimise damage to the gingiva and implant. In addition, this model and high speed imaging protocol can be used to test implant debridement methods for other research applications. This will aid in developing an optimal clinical method for treatment of peri-implantitis.

014

Enhancing the chelating potential of citrate solutions by increasing pH does not offset the benefit of reduced titratable acidity achieved

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Objectives: Citrus drinks drive dental erosion due to their inherent titratable acidity. Modifying citrus drinks by increasing their pH reduces titratable acidity by promoting the conversion of citric acid to mono-, di- or tri-basic citrate ions depending on the final pH achieved. However, di- and tri-basic citrate in particular are able to chelate Ca^{2+} ions and thus may also have the potential to drive erosion (though the literature is unclear on this point). The objective is to investigate the effect of increased pH on the potential of citrate ions to demineralise hydroxyapatite by chelation.

Methods: 0.1M solutions of citric acid and sodium citrate were mixed in varying proportions to give a range of citrate solutions ranging from pH 3.0 - 6.2, Based on pKa values for citrate, the mono-basic ion dominates at ~pH 3 with the di and then the tri-basic forms dominating in turn with increasing pH. The demineralising potential of these solutions was measured in triplicate by adding 1ml of each solution to 5mg of synthetic hydroxyapatite powder with agitation for 30s. Samples were centrifuged and the degree of demineralisation determined by measuring the phosphate released in the supernatants using a spectrophotometric phosphomolybdate assay.

Results: With each stepwise increase in pH (reduced titratable acidity / increased citrate ion concentration) demineralisation was concomitantly reduced such that mineral loss at pH 6.2 was around two thirds that lost at pH 3. Crucially, the appearance of the chelating di and tri-basic forms of citrate ions at the higher pH values did not reverse this downwards trend.

Conclusions: Reducing the titratable acidity of citrus drinks by increasing their pH is an effective way of reducing their erosive potential. The increase in the concentration of chelating citrate ions does not appear to offset the benefit gained by the reduction in titratable acidity achieved by increasing pH.

015

RAISED in Yorkshire-An innovative community-based collaborative approach to sustainable peer-led oral health education in areas of high oral health inequality

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Objectives: Raised in Yorkshire (RiY) is a collaborative project between the University of Leeds and Batley Girls High school (BGHS) and feeder primary schools in an area of high social deprivation and oral health inequalities. This study aimed to improve oral health (OH) knowledge and to reach children in areas of high social deprivation with significant dental inequalities. Specific objectives were:
1-To train students (16-18years) to deliver peer-led oral health instruction to KS2 pupils (7-9years).
2-To evaluate the added impact of regular reinforcement educational interventions compared to single session.
Methods: *Recruitment:* Four KS2 classes across two primary schools local to BGHS in a deprived community were enrolled with 97 pupils consented. Written parental consent was obtained.
Indices: Plaque score, gingival index, brushing score (analysed via video), knowledge quiz. *Control/Intervention:* Both classes received an oral health education programme, reinforcing key messages through interactive demonstrations involving toothbrushing, diet education and raising aspirations. One class per school received further interventions at regular intervals to reinforce key messages and develop manual tooth brushing skills. These sessions were created and delivered by students from BGHS trained by dental professionals and undergraduate students from the University of Leeds. *Analysis:* RiY Feasibility data involved Wilcoxon sign-rank test and t-tests. Late breaking data will evaluate outcome of regular reinforcement sessions.
Results: Previous RiY data has demonstrated that toothbrushing skill, knowledge and plaque scores are improved with peer-led educational sessions. Late breaking results will report the added-value of regular reinforcement intervention sessions on sustainable long term behaviour change.
Conclusions: A collaborative, peer-led approach to oral health education in deprived local areas delivers both effective and necessary oral health education to vulnerable communities. This 'train the trainer' approach is highly sustainable and significantly raises career aspirations, with 9/18 students from this year's cohort applying for further studies within dentistry/STEM. Further work will involve a larger sample group and long term follow-up of oral health behaviour change and exploration of aspirational impact on those trained as oral health educators.

016

Characterisation of Human Salivary Gland Cell Cultures

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Objectives: At present it is not possible to fully investigate the development of a number of salivary gland disorders such as tumour development, Sjogren's syndrome, viral-associated infections or radiation-induced damage. We have isolated cells from major human salivary glands and used these to establish 3D in vitro models. The models contain multiple cell types but these have not previously been fully characterised.

The aim of this project was to determine the phenotypic characteristics of the cells isolated from human tissue and to culture these in isolation and also in multicellular organoids.

Methods: Two major cell types were identified, fibroblast and epithelial, and these were subjected to single cell cloning before characterisation, through RT-PCR, immunohistochemistry and immunofluorescence, to determine the differential expression of cell type-specific markers. The cells were also grown in "mixed" cultures which were similarly investigated for changes in phenotypic characteristics.

Results: The fibroblast cells showed many characteristics of basal (stem) cells when grown in isolation and, with the addition of specific growth factors, were able to differentiate into epithelial cells. The epithelial cells continued to express cytokeratin 5 and the tight junction proteins ZO-1 and claudin. When in mixed cell cultures expression of myoepithelial markers alpha smooth muscle actin (α-SMA), CD10 and p63 were expressed.

Conclusions: This study has allowed us to further characterise cells isolated from human tissue and our results will inform future studies aimed at developing 3D cultures which truly mimic the in vivo tissue.

017

A Digital Diagnostic Test for Oral Cancer

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Objectives: With current techniques it can be notoriously difficult to identify precancerous oral lesions that will transform into cancer. The quantitative Malignancy Index Diagnostic System (qMIDS) is the first FOXM1 oncogene- based diagnostic test developed for quantifying oral squamous cell carcinoma (OSCC). This highly sensitive technique converts gene expression into a digital index to quantify cancer risk. It will reassure those patients with low cancer risk and reduce their need for intensive surveillance, whilst identifying those at high risk and ensuring earlier cancer detection and treatment. The current method takes 4-5 hours to obtain diagnostic results. This project aimed to validate a faster digital diagnostic method (less than 2 hours) for OSCC detection.

Methods: qMIDS compares total expression of 16 genes with median normal gene expression levels in a panel of healthy control samples of oral tissue. Real-time absolute quantitative (RT-PCR) is used for mRNA transcript quantitation. By measuring levels of the 16 genes, and conversion via the diagnostic qMIDS algorithm into a metric 'malignancy index' scoring system, the risk of a given oral biopsy sample becoming cancerous can be quantified.

Results: Testing OSCC patient biopsies from normal margin and tumour cores, results demonstrate a high detection rate (>90%) and low false positive rate (<3%), indicating good test performance at a qMIDS cut-off of 4.0. This project shows that the new version of the qMIDS digital diagnostic method is capable of segregating the malignancy status of OSCC clinical tissue biopsies with a high degree of confidence ($p<0.001$). Molecular tissue topology can also be reconstructed using qMIDS on surgical samples for margin assessment and determination of tumour heterogeneity.

Conclusions: Results reiterate that the qMIDS assay robustly measures a FOXM1-driven oncogenic program in OSCC to quantify malignancy. Benefits of qMIDS is its objectivity as a diagnostic method to quantitatively measure the malignancy of a biopsy tissue sample based on digital molecular profile to avoid misdiagnosis. It is a reproducible, high-throughput and cost-effective test amenable to automation in the clinical workflow.

018

Porphyromonas gingivalis modulates OSCC mediated angiogenesis in vitro

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Objectives: New clinical evidence identifies periodontitis as a risk factor for oral cancer mortality. Gram-negative bacteria such as Porphyromonas gingivalis (Pg), which initiate inflammation (including formation of new blood vessels) during periodontitis, are found at various sites in oral squamous cell carcinomas (OSCCs). However, a mechanistic link between specific bacterial species, angiogenesis, and progression of OSCC has not been established.

We propose that oral bacteria, particularly those associated with periodontal disease, can modulate the interactions between tumour cells and endothelial cells via virulence factors such as LPS, leading to dysregulated angiogenesis and tumour progression. The aim of this study therefore, is to determine whether Pg LPS regulates OSCC-mediated angiogenesis in vitro.

Methods: Human Umbilical Vascular endothelial Cells (HUVECs), were seeded in 96-well plates coated with 100µL of Matrigel and cultured with or without OSCC cell line (H357) or H357 tumour conditioned media, in the presence or absence of Pg or E. coli LPS (n=3 in duplicate, n=24 experiments). Angiogenesis vessel length, branching and density was calculated by quantifying images of tube formation in each well captured at 0,2, 4, 6, 18 and 24 hours on a phase contrast microscope, determined via ImageJ.

Results: Co-culture of HUVECS with H357 OSCC cells increased angiogenesis, indicated by increased tube formation and vessel branching, compared to HUVECS alone ($p<0.05$). The addition of either Pg or E.coli LPS to the HUVECS and H357s co-cultures both further increased angiogenesis ($p<0.05$). Of further interest, addition of either Pg or E.coli LPS to the HUVECS also increased angiogenesis compared to HUVECs alone ($p<0.05$).

Conclusions: These data suggest that Pg LPS enhances oral cancer cell mediated angiogenesis, as it increases the number of new blood vessels recruited by OSCC cells. Bacteria causative for periodontal disease could therefore worsen the progression oral cancer, and their eradication provides a potential target for improving prognosis.

019

Disabled Children: Including their Voices in Oral Health Research

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Objectives: The objectives of this study were to devise and employ a range of methods to enable disabled children to share their perspectives of oral health and oral health services. Sharing their perspectives also enabled their voices to be heard.

Methods: This was an ethnographic study. Using previous guidance in the academic research on methods, interviews used pictures, games, symbols and drawing as facilitators. Guided tours of the environment in which children learnt were also used. Selection of these approaches varied and depended on the abilities and preferences of each child.

Results: Using pictures and games as a prompt enabled the child to talk or use their method of communication to interact and offer their perspectives. The guided tour activity was productive because it facilitated the development of a relationship with the children. It also increased their ability to chat informally and appeared to reduce the power imbalance when interviewing in a more formal or structured way. The children were highly engaged and found the activities interesting and enjoyable. Previous research has used symbols and drawing to enable children to express their feelings. This study found that these methods were less successful and acted as a barrier to participation.

Conclusions: All participants quickly understood the ideas of the activities which enabled them to contribute. Moreover, children enjoyed the process of participation. Involving disabled children in oral health research means designing studies using innovative and pluralistic methods, drawn from different disciplines. This promotes a rights- based approach which aims to reduce the discrimination and disempowerment of disabled children by including them in research that concerns them. Although this research obtained their perspectives, one important caveat is that we also need to act on their views to improve their oral health outcomes.

020

Development of the Gum Health Experience Questionnaire (GHEQ)

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Objectives: Few gum health studies have incorporated oral health-related quality of life assessments. Previously developed measures focused on the more severe end of the gum health-disease continuum, despite evidence that gingivitis and periodontal disease can influence quality of life. This study's aim was to develop a person-centred measure to capture subjective impacts of conditions from mild gingivitis to severe periodontitis on quality of life.

Methods: Purposive sampling was used to select 27 participants in a large organisation in Sheffield (15 females, 12 males; 23-73 years), to ensure a range of ages, occupations, and symptoms across the gum health-disease continuum. Semi-structured interviews were conducted which included symptom history and frequency, responses to symptoms, and limitations experienced. Data were analysed using framework analysis, and mapped onto the Wilson and Cleary health-related quality of life model which was used to derive domains and items. The resulting measure was panel tested with 10 new participants to assess content, readability, and response format.

Results: A range of symptoms, impacts, and emotional and coping responses were reported. These were mapped onto 7 domains based on common themes from the analysis, and included 64 items: gum symptoms (n=17); changes in everyday life (n=13); social impacts (n=5); psychological impacts (n=11); identity (n=5); overall impacts and quality of life (n=7); timeline of symptoms and treatment (n=6). The number of relevant items demonstrates the need for this measure. Panel testing of the draft measure led to a number of important changes and clarifications.

Conclusions: This research demonstrates the breadth of experiences of individuals with varying symptoms and severity. The development of this person-centred gum health measure is the first to cover the entire gum health- disease continuum in relation to quality of life. Further psychometric testing is required to ensure its reliability, validity and responsiveness as an evaluative tool for future research and clinical practice.

021

The demand and provision of cosmetic dentistry in the UK

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Objectives: To describe the influence of dominant cultural discourses in the provision of cosmetic dentistry in the UK.

Methods: Institutional Ethnography: a qualitative multi-site ethnography investigating the social relations of actors involved in cosmetic dentistry. Data collection methods included: participant observation at dental trade shows and national cosmetic dentistry and facial aesthetics conferences, cosmetic dentistry training sessions, and patient treatment sessions; contextual, in-depth and diary interviews and analysis of documents. Observations included 'listening out' for repeating 'texts' such as legislation, policy documents, adverts to analyse the dominant discourses within key texts.

Results: The Dentists Act 1984 emerged as a key or "boss text" in the field of cosmetic dentistry. As well as dental texts, discourses from non-dental texts such as Cosmetic Products Enforcement Regulations 2013, Consumer Protection Act 2015, Committee of Advertising Practice Code indirectly flow into the Dentists Act 1984. This flow has changed the dominant discourses to include crime, professional standards, training, safety, ethical advertising, and consumer choice to influence the uptake of cosmetic dentistry. Whilst the texts and their constituent discourses position dentists as key gatekeepers in the provision of cosmetic dentistry; they do not fully reflect consumer experiences owing to a partial disconnect between dental and non-dental texts. Areas not addressed include the quality of dentists' professional training in non-conventional dentistry such as botox, fillers, and skin care as well as 'influencer' advertising practices adopted by millennial dentists with social media, particularly Instagram. This disconnect has led to a gap between dominant institutional policy approaches and consumer experiences, which has important consequences for patient autonomy and public safety.

Conclusions: Non-dental discourses of advertising and consumerism have flowed into cosmetic dentistry changing local activities, which has consequences for patient autonomy and public safety.

022

Validation of a classification system for a paediatric caries-specific utility measure

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Objectives: Caries Impacts and Experiences Questionnaire for Children (CARIES-QC) is a child-centred caries- specific health-related quality of life measure. A provisional classification system for a preference-based measure based upon CARIES-QC was developed using Rasch analysis, psychometric testing and involvement of patients and the public. Before conducting a valuation survey to allow estimation of Quality Adjusted Life Years (QALYs) for children with caries, the proposed classification system requires validation to ensure its content is appropriate for children. This study aimed to validate, with children, a classification system for a paediatric preference-based measure specific to dental caries, based upon CARIES-QC.

Methods: Qualitative, semi-structured interviews were undertaken with a purposive sample of children with dental caries. Children were asked to 'think aloud' whilst completing questions from the proposed classification system, before answering those that were excluded. The interviewer aimed to identify whether items were considered important and easily understood, whether any were overlapping and if any excluded items should be reintroduced. Interview recordings were transcribed verbatim and thematic analysis conducted using NVivo 12 (©QSR International Pty Ltd).

Results: Interviews were conducted with 20 children aged 5-16 years old. Participants thought the questionnaire was straightforward and covered a range of impacts. Younger children struggled to make decisions about which items they preferred. In terms of specific questions, children considered the words 'hurt' and 'annoy' to be different concepts and felt both items should be retained within the classification system. Children thought a question about difficulty eating certain foods was more relevant than one about having to eat more carefully because of their teeth.

Conclusions: In conclusion, following child-centred modification, the proposed five-item classification system can be considered valid and suitable for use in a valuation survey. This novel piece of work is an important first step towards more appropriate calculation of QALYs for children with caries.

023

Analysis of Hospital Admissions for Extractions Using Geographically Weighted Regression

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Objectives: The number of paediatric hospital admissions for dental related extractions remains a cause for concern, despite dental diseases being largely preventable. While local investigations have taken place, little is known about national trends, and how the relationship between hospital admissions and key predictors vary across England. The aim of this study was to analyse the spatial variation in paediatric hospital admissions for extractions in relation to caries and deprivation data.

Methods: Hospital admissions data (for all dental related reasons) were taken from the Hospital Episode Statistics (HES - 2017/18), for children aged up to 19 years. Additionally, mean dmft data for 5-year-olds were taken from the Dental Public Health Epidemiological Programme for England (2015, 2017), while deprivation data were taken from the Indices of Multiple Deprivation (IMD - 2015). All data were collected at local authority level. Geographically weighted regression was used to analyse the relationships between hospital admissions, mean dmft and deprivation across England, as well as the strength of these relationships, and how these varied spatially.

Results: Mean dmft and IMD scores were found to be significant predictors of paediatric hospital admissions. The analysis demonstrated considerable variation in trends nationally, with some areas exhibiting positive associations between the predictor variables and HES data (as mean dmft scores and deprivation increased, so did the number of hospital admissions), while in other areas the opposite was found (as mean dmft and deprivation scores increased, hospital admissions decreased).

Conclusions: This research is the first to use geographically weighted regression to study national trends in paediatric hospital admissions for dental extractions. The analysis demonstrates considerable variation in the relationship between admissions, caries and deprivation. Due to the use of aggregate data, inferences about causal mechanism are limited. Local case studies may provide additional contextual information that helps to explain why these patterns may be occurring.

024

Developing a training intervention to improve oral health behaviour change with parents of young children.

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Objectives: Previous research has identified that foundation dentists and dental care professionals in England lack the communication skills to support oral health behaviour change with parents of young children. Starting Well is an oral health initiative aimed at 13 areas in England with the highest caries prevalence in children aged 0-5. In order for this initiative to achieve this aim, Health Education England commissioned the development of a training intervention to support dental teams and foundation dentists with the theory and skills in undertaking a behaviour change conversation with parents of young children.

Objectives:

- Undertake a rapid review of digital educational materials including the theory and practice of behaviour change.
- Produce a training intervention including educational film vignettes.

Methods: The rapid review included peer-reviewed and grey literature, plus e-Learning, videos and mobile applications. Gaps in available training modules were identified and a training intervention was developed to address these gaps.

Results: The review of available resources in dentistry and wider health care identified minimal suitable teaching material. Specifically, it identified 1) the lack of a resource on how to support parents who were resistant to behaviour change, and 2) dental team's preferences for realistic video resources which demonstrate different behaviour change skills. Therefore, using real-life stories, scripts were developed. Working with experienced actors, six short films were developed. The films, each showcasing different methods for managing parental resistance during behaviour change conversations.

Conclusions: The findings from this project have resulted in a training intervention developed for Health Education England for inclusion in the Starting Well initiative. This intervention will be freely available to dental teams across England. A mixed-methods study is now evaluating the impact and acceptability of the intervention to dental teams and foundation dentists.

025

Heritability of DMFS Scores in a National Twin Registry

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Objectives: Both genetic and environmental risk factors contribute to the aetiology of dental caries but estimates of the relative importance of each are highly variable. The study aimed to estimate the heritability of DMFS scores and rate of change in DMFS scores.

Methods: Dental records in the Swedish GLIDE database were merged with data from the Swedish Twin Register and used to derive DMFS scores. For twins with dental records from at least 3 occasions spanning at least 2 years of follow-up, repeated measures of DMFS were modelled using the SITAR approach. A derived variable for DMFS velocity was created, representing the rate at which DMFS scores change for an individual compared to the population-average change over the same time period. Heritability of DMFS scores and DMFS velocity were estimated using an ACE model including adjustment for age, sex and birth year.

Results: Cross-sectional analysis included 41,678 twins aged between 7 and 97 years with known zygosity information and DMFS scores available for both twins. Genetic factors explained 51.2% (95% CI 48.9%; 53.4%; $P=2.9x10^{-105}$) of variation in DMFS scores, while shared environmental and unique environmental factors explained 1.8% and 47.0% of variation, respectively. Longitudinal analysis included a subset of 26,414 twins with a mean of 6.2 years of dental follow-up. Genetic factors explained 58.1% of variation in DMFS velocity (95% CI 55.6%; 60.7%; $P=3.2x10^{-77}$), while shared environmental and unique environmental factors explained 3.5% and 38.3% respectively.

Conclusions: The study confirms genetic risk factors as a major part of the aetiology of dental caries and shows that genetic effects strongly influence rate of change in DMFS scores. Further analysis is underway to characterize how the relative importance of genetic and environmental factors changes with age and to estimate the heritability of different patterns of disease presentation.

026

Effect of Strontium on Remineralisation of hydroxyapatite

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Objectives: To use real-time Ion-selective electrode (ISE) to investigate the effect of strontium ions on the remineralisation of hydroxyapatite (HA) discs.

Methods: HA disc (n=10) were immersed in 50ml demineralisation solution (0.1M acetic acid, pH4.0) for 2 hours at 37°C. Ca^{2+} release was measured continuously via Ca^{2+} ISE as a proxy for demineralisation. Thereafter, the discs were rinsed with deionized water and topically treated with 10% and 20% (%w/v) $SrCl_2$ solutions, followed by immersion in 50ml remineralisation solution (2mM $CaCl_2$, 1.2mM KH_2PO_4, 150mM NaCl, pH7.0) for 5 days at 37°C. Changes in Ca^{2+} concentrations were monitored as a proxy for remineralisation. Thereafter, the remineralised $SrCl_2$ treated discs were further demineralised for 2 hours. Each experiment was repeated thrice. For control, the disc was immersed in remineralisation solution without any topical treatment. ATR-FTIR, EDX and SEM analysis of the HA discs were performed to characterise chemical and physical changes.

Results: Application of 10% and 20% $SrCl_2$ on HA did not show any substantial uptake of Ca^{2+} from the remineralization solution. However, remineralisation of control discs, showed a significant decrease in Ca^{2+} concentration. Further demineralisation of $SrCl_2$ treated discs showed a drop in the rate of Ca^{2+} loss compared to the previous demineralisation cycle.

FTIR detected changes in phosphate bonds after the disc were treated with $SrCl_2$. Moreover, EDX findings demonstrated that Sr persisted on the remineralised HA discs, whereas Cl was not detected. SEM scans did not detect any surface changes on the HA disc following treatment with $SrCl_2$.

Conclusions: Topical application of $SrCl_2$ forms a protective acid resistant barrier on the HA surface. Although this barrier inhibits uptake of calcium ions during remineralisation, it protects against acid dissolution.

027

Crystallinity Comparison between Hydroxyapatite-Like Layers Formed by Five Hypersensitivity Toothpastes

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Objectives: To investigate the elemental and structural differences between hydroxyapatite (HA) like layers formed on dentine following brushing with 5 commercially available toothpastes containing chloro-calcium-phosphosilicate, fluoro-calcium-phosphosilicate, calcium-sodium-phosphosilicate, arginine with calcium carbonate, and calcium silicate with sodium phosphate for dentine hypersensitivity treatment.

Methods: Bovine dentine discs were divided into 6 groups and were manually brushed twice a day for two minutes over 7 days with one of the toothpastes or artificial saliva as a control. Scanning electron microscopy (SEM), nuclear magnetic resonance (NMR), x-ray-diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), energy- dispersive x-ray (EDX) and Raman spectroscopy was used to investigate the elemental composition, structure , crystallinity index (CI_{FTIR}) and mineral density of the layers.

Results: SEM images showed all 5 ingredients had deposited a layer over the exposed tubules. EDX and XRD confirmed these layers were chemically and structurally similar to the hydroxyapatite of control dentine. Calcium silicate had the highest grey scale value amongst treatment groups which was in agreement with NMR and Raman microscopy data. However the FTIR and XRD intensities were the lowest and only higher than the control group. CI_{FTIR} data suggests that it was the least crystalline and prone to dissolution under acidic environment. These findings coupled with lower Ca/P ratio from the EDX suggest the formation of Biphasic tricalcium phosphate composite, a mixture of b-tricalcium phosphate and HA. EDX and XRD showed that arginine layer had a significantly higher apatite density and CI_{FTIR}.

Conclusions: The Ca/P ratio and CI_{FTIR} revealed a correlation between apatite density and higher crystallinity. Arginine with calcium carbonate formed the most crystalline layer with highest crystallinity index. Arginine provide a better nucleation site for calcium and phosphate ions due to presence of amino, hydroxyl and carboxyl groups that facilitated the retention and precipitations of these two ions that develop in to crystalline HA with bigger crystal size.

028

Development of an in-vitro model to investigate dental erosion

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Objectives: Our research shows that dental erosion affects almost half of elite athletes and might be caused by intakes of low pH beverages and reduced salivary availability in training. The role of the dental pellicle in dental erosion is not clear and in particular its contribution in elite sport. The aim of this study was therefore to develop a model to investigate the dental pellicle and its role in dental erosion.

Methods: Bovine incisors were exposed to an erosive drink (pH 3.1) at various time points (24, 48 and 72 hours). Fresh human saliva was used to form dental pellicle on the buccal surface. Optical Coherence Tomography (OCT) was used to detect erosive lesions both in the presence and absence of a layer of dental pellicle. ImageJ was used to analyse the images captured by OCT and calculate the average depths of the erosive lesions. X-ray Microtomography (XMT) was also used to detect the erosive lesions and confirm the findings of the OCT.

Results: The average thickness of amorphous enamel before immersion in the erosive medium was 64 μm. A change in the enamel surface was seen as early as one hour and the mean depth of the lesion increased to 240.8 μm ± 32.7 at 72 hours (n=10). In contrast, mean lesion depth in the presence of the dental pellicle was 84.3 μm ± 18.9 (n=10).

XMT images were analysed and the depths were calculated to 180 μm which were used to confirm the findings of the OCT

Conclusions: The model shows a promising method to investigate dental erosion. The in-vitro erosive lesion depth increased with continued exposure to the erosive medium. As expected, erosion appeared to be reduced but not prevented by the presence of the dental pellicle.

029

A new mechanism for the perception of thirst

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Objectives: Thirst is a major driver to drink and is critical to maintaining homeostasis. The perception of thirst is often associated with a dry mouth but it is unclear if any changes occur in the mouth to cause dry mouth. Previously we have shown no change in salivary flow rate occurs with the onset of thirst even in exercise-induced dehydration. In contrast, salivary osmolality closely correlated with thirst and is mostly reflects salivary levels of sodium, potassium and urea. In this study we examined changes in the mucosal pellicle - - the layer of salivary mucins adhered to the mucosa.

Methods: Healthy subjects were assessed for thirst perception using a labelled magnitude scale, salivary flow rates by weight, sodium and potassium levels were measure by ICP-MS, urea by colourmetric assay. Samples of mucosal pellicle were collected using sterile filter paper applied to the mucosa for set time (10 seconds). Filter papers were placed into a tube, 100 ul of water added and eluted by centrifugation (1000g x 3 mins).

Results: Sodium ions, in contrast to potassium or urea, accumulated in the mucosal pellicle. Resting saliva contains low levels of sodium (5-10 mM), which were much higher in the mucosal pellicle (90 mM). In contrast, potassium ions were at a similar level in saliva (50 mM) and the pellicle (65 mM). After a mouthrinse of water the concentrations of urea and potassium decreased whereas sodium remained unchanged. After a mouthrinse of sodium chloride, sodium ions increased in the pellicle.

Conclusions: The mucosal pellicle appears capable of specifically binding and concentrating sodium ions. This is likely to affect the rheological properties of the adhered salivary mucins which would affect the mouthfeel, leading to the perception of dryness or thirst.

030

The Effect of Sugar-Sweetened Beverages on Oral Health: A Systematic Review and Dose-Response Meta- Analysis

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Objectives: The purpose of this review was to assess the association between the consumption of sugar-sweetened beverages (SSB) and dental caries and erosion, and to evaluate the quality of the available evidence.

Methods: Systematic review of observational studies, registered in PROSPERO (CRD42018088720) and carried out following PRISMA guidelines. The search strategy was applied to the following electronic databases: Medline, Embase, The Cochrane library, SciELO, LILACS, Open grey and HMIC, and reference lists. Terms related to SSB and oral health were included. Studies were eligible if they had a general population sample, were written in English or Spanish, and had estimated the relationship between any type and different levels of SSB and caries or erosion. Two researchers screened the studies for inclusion independently. Risk of bias was assessed using the NIH Quality Assessment Tool for Observational Cross-Sectional Studies. Random effects model Meta- and Dose-response analyses were conducted to estimate the relationship between three levels of SSB consumption and dental caries and erosion. Sensitivity, influence and publication bias analyses were also carried out.

Results: A total of 38 studies met the inclusion criteria. Twenty-four presented caries as oral health outcome, 13 erosion and one both. All studies used a cross-sectional design. The majority were assessed as good quality. The biggest effect for caries (OR= 1.95, 95%CI 1.57-2.41; DMFT/dmft WMD=1.91, 95%CI -0.94-4.75) was found between high and low-level consumers, whereas for erosion, the biggest effect (OR=3.09, 95%CI 1.37-6.97) was found between high and moderate consumers. A clear dose-response relationship was found between SSB consumption and risk of caries.

Conclusions: All meta-analyses showed that moderate and high-level SSB consumers have an increased risk of dental caries and erosion compared to low-level consumers. The positive dose-response and strength of association implies that this relationship is likely to be causal.

031

Association between oral health-related quality of life and family impact. Findings from the Children's Dental Health Survey 2013

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Objectives: The main objective of this research was to assess the contribution of oral conditions and oral health- related quality of life (OHRQoL) of the children, and family socio-economic position (SEP) to the impact that children's oral health has on families in England, Wales and Northern Ireland.

Methods: A secondary data analysis was conducted using data from the Children's Dental Health Survey (CDHS) 2013. The outcome, family impact, was used as an overall measure of the prevalence of impacts but the analysis also considered each individual family impact item assessed in the CDHS. The explanatory variables referred to OHRQoL and dental status (decay experience and orthodontic treatment need) of the child, as well as SEP of the family (educational level of the parent/guardian and occupation of the main family provider). Chi-squared tests and correlation analyses were used to evaluate the associations between family impact and exposures. Multivariable logistic regression models determined the contribution of each explanatory variable on family impact, accounting for possible confounding factors.

Results: 1749 parents with children aged 12 and 15 years were included. The most prevalent family impacts were "time out of work", the "parent feeling stressed" and the "child required more attention". Most of the items about OHRQoL and dental status of the child were significantly associated with several of the family impact items in bivariate analysis. However, correlations were weak. In adjusted modes, different explanatory variables accounted for specific family impact items.

Conclusions: Different types of exposures accounted for different family impact items depending on the nature of the impact - parental emotions, family functioning and finances.-. However, the direction of the associations was similar, that is, worse child and family conditions related with more family impacts.

032

Oral health to enhance elite athlete performance

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Objectives: Elite athletes have poor oral health with associated impacts on training or performance in sport. There is good evidence for oral health promotion and prevention outside of sport. However, the challenges to oral health within sport, and those related to implementation of health promotion in this environment, confer unique characteristics that require investigation to identify effective strategies. The aim of this project was to develop, implement and evaluate a pragmatic oral health promotion intervention informed by input from all stakeholders in elite sport.

Methods: This was an interrupted time-series intervention study conducted at three elite athlete-training centres. The intervention was based on contemporary behaviour change theory. We provided the athletes and support team with a short educational presentation, focussing on motivation and capability. This was followed by oral health screening and personalised advice for each athlete, and provision of an oral health toolkit, focussing on capability and opportunity.

We recorded outcome measures of oral health knowledge (8-item questionnaire), impact on performance, oral hygiene routines and oral health at baseline, 4-6 weeks and 12-16 weeks.

Results: We recruited 62 athletes; 44 (71%) male and 58 (93.5%) white British. 55 athletes completed the study with measurements taken at all three time intervals. At baseline, 41 (66.1%) had evidence of caries, and 29 (46.8%) evidence of erosion. Baseline mean bleeding score was 11.57 (8.11). Mean knowledge score improved from 5.69 (1.59) to 6.93 (1.32) $p = <0.001$. Impact on performance score reduced from 8.73 (14.54) to 2.73 (11.31) $p= <0.001$. Athlete-reported use of interdental cleaning aids at least 2-3 x week increased from 10 (16.2%) to 21(34%) $p= 0.013$. Athlete use of prescription strength fluoride toothpaste increased from 8 (12.9%) to 45 (80.4%) $p= <0.001$. Bleeding score remained unchanged.

Conclusions: This intervention was associated with an increase in athlete oral health knowledge and enhanced oral health behaviour.

033

Oral health of older people living in care homes: The REACH study

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Objectives: UK has a rapidly ageing population suggesting that greater number of nursing and care homes will provide accommodation for older people above 65 years of age. Oral health tends to be poor among older people living in care homes. The UK adult dental health surveys (ADHS) exclude older adults living in care homes from sampling. Limited information is available on the oral health of people living in care homes. Therefore, the aim of this study was to assess the oral health status and needs of care home residents in Grampian - Scotland.

Methods: A cross-sectional study of care home residents who are 65 years and over was conducted. Measures of oral health related quality of life (OHIP-14), dependency, dental behaviours and demographic characteristics were collected using a questionnaire together with an oral clinical examination.

Results: In total, 181 randomly selected participants from 27 care homes participated. Only individuals with capacity were included. 53.6% of residents had long standing illnesses or disabilities which limited their ability to attend a dentist. 35.3% reported oral health impacts like the English ADHS 2009. Among the older adults clinically examined, 53.9% were edentulous and of the dentate (N=83), 54% had decayed teeth with only 27.7% having 21 or more teeth. 76.1% had at least one posterior functional contact between their natural or artificial replacement teeth. Residents examined had greater current pain in mouth (11.1% v/s 7.9%), and other morbid conditions (open pulp, ulceration, fistulae, abscess 11.1% vs 7.3%) as compared to ADHS 2009.

Conclusions: Overall, both subjective and clinical findings indicate poor oral health status and complex oral health needs of this population as compared to the general population. This information is valuable and has implications for the health authorities to effectively plan dental services around the needs of this group.

034

HABIT: An Oral Health Intervention for Infants - Quantitative Findings.

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Objectives: Developing good oral health habits for young children is critical for long-term oral health. Health visiting teams undertake mandatory universal home visits for all parents with children aged 9-12 months. HABIT (Health Visitors delivering Advice in Britain on Infant Toothbrushing) is a co-designed complex oral health intervention to support an oral health conversation at this home visit with supporting training for health visitors and resources for parents.

To explore the impact of the HABIT intervention on oral health behaviours of parents with young children over a three-month period.

Methods: An early-phase study was undertaken to explore changes in oral health behaviours over a three-month period. At baseline, the research team collected self-reported dietary and toothbrushing-related behaviours from the parent about their 9-12-month-old child. Further home visits were undertaken at 2 weeks and 3 months after the HABIT intervention. A clinical examination and plaque scores were undertaken at each of the three home visits.

Results: In Bradford, nine health visitors were trained to deliver the HABIT intervention. Thirty-five parents were recruited, 27 receiving baseline home visits and the HABIT intervention, and 25 completing the study. Over the three months positive changes were seen in toothbrushing behaviours, with improvements in the initiation of toothbrushing (88% to 100%), the percentage of parents brushing their child's teeth twice a day (51% to 88%) with a fluoride toothpaste (77% to 92%), and a reduction in plaque score (42% to 19%). Dietary changes were also seen, however, these tended to reflect changes in line with the child's increasing age.

Conclusions: The HABIT intervention supported parents to adopt good oral health behaviours for their child aged 9-12 months over a 3-month period.

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035

The Influence of BioMinF® Toothpaste on Remineralisation of Hydroxyapatite Discs

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Objectives: BioMinF® Toothpaste is formulated by adding of small amounts of calcium fluoride to bioactive glasses. This is thought to enhance the formation of fluoroapatite, enabling remineralisation of early carious lesions. The aim of this study was to measure the remineralisation efficacy of BioMinF® Toothpaste using compressed hydroxyapatite pellets as analogues of enamel. The rate of remineralisation of hydroxyapatite pellets immersed in artificial saliva solutions treated with BioMinF® Toothpaste was measured using scanning microradiography (SMR), and compared to untreated controls.

Methods: Six Hydroxyapatite discs (20% porosity, Plasma Biotal, UK) located in individual SMR cells. For the control group, demineralisation solution (acetic acid, pH 4.0) was flowed through each cell at 10-12ml h^{-1} for 72h. Deionised water was then flowed for 24h to remove the demineralisation solution. Remineralisation solution ($CaCl_2$ +NaCl + KH_2PO_4) was then flowed through the cell for a further 168h. SMR was used to measure the rate of mineral change throughout. For the test group, the process was repeated, except that the disks were treated with BioMinF®toothpaste (diluted 1:3 with deionised water, applied twice daily 10h apart) throughout the remineralisation procedure. The rates of remineralisation of the test BioMinF® toothpaste-treated group were compared with the control group.

Results: The rate of mineral gain during the remineralisation period for the BioMinF® treated test group was 2.41g cm^{-2} $h^{-1,}$ whereas the rate of mineral gain during the remineralisation period for the control of hydroxyapatite disc in control group was 3.74 1.79g cm^{-2} h^{-1} following three days period of demineralisation and subsequent remineralisation. However, the rate of remineralisation was higher in the BioMinF® group 2.41. In addition to this, the rates were also different in BioMinF® group at a different time period in the day and night with remineralisation rates of 3.611.51 and 1.21.16, respectively.

Conclusions: The application of BioMinF® toothpaste twice daily enhanceds the remineralisation efficacy of hydroxyapatite discs when compared with the untreated controls group. The rate of remineralisation noticeably increased after injection of the toothpaste inside the cell.

036

Preliminary results of intra-oral scanning in measuring tooth wear

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Objectives: To compare the agreement of intra-oral scanning (IOS) with red laser confocal surface profilometry (RLP) for erosive tooth wear quantification on polished human enamel in vitro.

Methods: Sixty polished enamel samples were randomised into six groups (n=10/group); each group was exposed to 5-minute cycles of citric acid (0.3%, pH 2.7) erosion, for a total of 0, 5, 10, 15, 20, and 25 mins, respectively. The samples were scanned with a video-based IOS (3M™ True Definition™, St Paul, USA) and an RLP (Xyris3000, TaiCaan Technologies™, UK). A single-blinded examiner calculated 3D step height (3DSH) enamel loss using the ISO 5436-1 standard from both scanning techniques. A novel measurement workflow was developed ensuring compatibility of IOS-produced standard tessellation language (STL) files with surface metrology software (MountainsMap®V7.2, DigitalSurf, France).

Results: After 0, 5, 10, 15, 20, and 25 mins erosion, the mean (SD) 3DSH measurements using RLP were 0.12 (0.06)µm, 2.23 (0.47) µm, 7.50 (0.87) µm, 11.48 (1.26) µm, 16.59 (1.29) µm and 19.09 (2.15), respectively. At 0 and 5 mins erosion, no 3DSH enamel loss could be detected by the IOS. The IOS produced visually detectable 3DSHs at 25 mins [18.40 (1.80) µm. The 3DSHs produced by the IOS at 10, 15, and 20 mins were 7.57 (1.54) µm, 10.88 (0.82) µm and 16.03 (1.63) µm, respectively; however, these were less easily detectable, displayed smoother topography, and therefore the authors treat these preliminary results with caution.

Conclusions: The early results from this novel measurement workflow suggested possible quantification of ≈ 20 µm of 3D step height enamel loss using intra oral scanning technology. However, more research is required to determine the threshold of detection of tooth wear measurements using IOS.

037

A Novel Fluoride Dental Composite Coating Containing Ca^{2+} LDH

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Objectives: To develop calcium (Ca^{2+}) layered double hydroxide (LDH) – polycarboxylic acid (polymer) composite coatings painted on hydroxyapatite (HA) discs and to study their hardness, chemical composition and fluoride (F^-) release. LDH-polymer composite coatings/varnishes may provide a therapeutic level of F^- in the oral environment to prevent early-stage caries.
Methods: Ca-LDH was synthesised incorporating polycarboxylic acid in situ, characterised using powder X-ray diffraction (pXRD), Fourier-transform infrared spectroscopy (FTIR), Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDX). The resulting powders absorbed F^- in 1500ppm sodium fluoride (NaF) and F^- release was measured in de-ionised water (DW)(1g/L), using ion selective electrodes (ISE NICO2000). Readings were taken every 10sec for 13h (n=3). 0.1mL of calcium-LDH-polymer in NaF (solution) was pipetted on to each HA disc surface (n=5), allowed to dry and rinsed in DW, to remove excess LDH-polymer. Control discs (non-coated), and polymer coatings with no LDH were also tested. All discs went through 3-cycles of remineralisation (pH7 artificial saliva, 3h) and demineralisation (pH4 0.1M acetic acid, 3h), with the last remineralisation stage conducted for 15h. The coated surfaces were analysed using SEM/EDX. Vickers hardness (Micromet-4, VHN) was measured at all cycle stages.
Results: Ca-LDH-polycarboxylic acid polymer powders were successfully synthesised and after charging, they released increased amounts of F^- (16.5-9.9±3.8ppm) compared to LDH-control (9.5±2.2; $P>0.05$). Ca-LDH- polymer coatings on HA discs were confirmed using pXRD, FTIR and SEM/EDX. These coatings increased VHN values in comparison to the non-coated and polymer alone discs (Ca-LDH-polymer: ~200±7.8 compared to HA-polymer alone: ~167±3.8 and HA-No treatment: 156±4.8VHN), indicating prevention of demineralisation.
Conclusions: Ca-LDH-polycarboxylic acid composite coatings were successfully attached to HA discs. They released F^- and the hardness of the discs in demineralisation solution was maintained. Therefore, these coatings may have the potential to prevent early stage caries via a controlled release of F^-.

038

A Novel ex-vivo Model to Study Oral Malodour

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Objectives: Currently assessing the effect of anti-malodour actives in toothpastes requires time consuming and expensive clinical studies. There is a clear need to develop rapid model systems that can effectively measure the effect of actives in toothpastes. The objective of this work was to develop an ex-vivo model via measurement of Volatile Sulphur Compounds (VSCs) from salivary bacteria.

Methods: Early morning saliva was collected (with ethical approval) from subjects in good general and oral health. The saliva samples were pooled, oral epithelial cells separated, sterilized and layered on the surface of agarose in a 12 well plate. Mixed salivary bacteria from saliva were then added in the plate. This was followed by treatment with toothpaste samples. Cysteine-HCl was added post treatment as a precursor for VSCs. Lead acetate paper was placed over the plate as an indicator of the VSCs generated. The dark coloration of the lead acetate paper was recorded using a reflectometer as L*a*b* values and the separation between the initial and final L*a*b* values ΔE, was used to quantify the VSCs formation. Here we demonstrate the utility of the model, comparing a toothpaste containing 0.2% zinc sulphate heptahydrate, a control toothpaste and water.

Results: A clear differentiation was observed between the two toothpastes and water control using the above described model. A Toothpaste containing 0.2% zinc sulphate heptahydrate was significantly better in reducing the VSCs over the control toothpaste ($p<0.05$).

Conclusions: We have developed a robust and rapid ex vivo substrate model to evaluate the efficacy of toothpastes in reducing VSCs. This model will help demonstrate the ability to measure efficacy of various actives used in oral care products to reduce salivary thiols.

039

Antimicrobial Efficacy of Industrial Sweet Orange Waste Extracts against S. mutans & L. casei

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Objectives: This study aims to investigate the antimicrobial efficacy of industrial sweet orange waste (SOW) extracts against planktonic cultures of the cariogenic pathogens Streptococcus mutans and Lactobacillus casei.

Methods: The bioactive compounds from SOW were extracted by microwaving at 70 and 90 ^{0}C for 5(A), 10(B), and 15(C) minutes. The extracts were analysed for detection and quantification of flavonoid compounds using LC-MS and HPLC respectively. The antimicrobial properties including the minimum inhibitory and bactericidal concentrations (MIC and MBC respectively), and the incubation time required to achieve bacterial death, of the SOW extract and pure flavonoid compounds have been explored against two model dental cariogenic bacteria. Chlorhexidine (CHX) was used as a positive control for the antimicrobial assays.

Results: The identified flavonoids in the SOW included flavanones, flavonols, and flavones. Among the pure flavonoids, flavones were found to be the most effective antimicrobial compounds against these two pathogens. However, this was not as effective as SOW. The lowest MIC and MBC of the SOW extract against S. mutans were obtained using extraction protocols performed at '70_B' (13±2; 37.66±1.53 mg/ml respectively), and '90_A' (11±1.73; 35 ±353 mg/ml respectively). A similar trend was found against L. casei but at a higher dose compared to S. mutans. The time required to achieve inhibition of S. mutans, and L. casei using SOW extracts obtained with the '70_B' method were 18.43±0.51 and 20.77±0.4 hours respectively, and with the '90_A' method 17.67±0.58 and 20.87±0.51 hours respectively. The time was significantly reduced when extracts were combined with bacteria specific MBC dose of CHX.

Conclusions: Industrial sweet orange waste products have the potential to be used as antimicrobials against cariogenic bacteria. The adaptation of these waste products will help the development of alternative therapies and ease industrial waste management which is a financial liability to juice processing industries.

040

Remote Clinical Consultations in Restorative Dentistry

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Objectives: To conduct a feasibility study to assess the viability and efficiency of conducting remote clinical consultations in restorative dentistry for the management of primary care referrals.

Methods: A simulated remote clinical consultation-scenario was engineered using a simple and accessible social- media networking interface (iPad hardware and FaceTime software, Apple Inc.) with the patient and a GDP in one surgery and the specialist consultant undertaking the RCC in a separate room in close proximity. This allowed the consultant to undertake, first the RCC and this was followed immediately after with a personal encounter consultation that would act both as the control for the study and would ensure the safety and effectiveness of the consultation for which the patient had attended. 25 Patients were randomly selected from the referral list in restorative dentistry.

Results: A quantitative and qualitative analysis of the data was undertaken. The data analysis revealed that in all the cases the consultant was able to conduct an effective clinical consultation, regardless of gender and specialty. In no instances was the outcome of the assessment modified when the consultant and the patient met for the in-person encounter following the RCC.

The GDP, the nurse, and the observer was able to participate effectively in the process and work effectively with the consultant. 100% of the GDPs agreed that there was a scope for having educational experience.

The barriers of the study related mostly to the limitation of using iPad-based-internet-interface connectivity that was not able to support streaming complex multimedia data-channels.

Conclusions: The combined results obtained in this feasibility study from the different stakeholders involved suggests that RCCs are a viable and effective way of delivering specialist guidance and treatment planning advice to GDP colleagues. There is a suggestion that can it improve the quality of care to patients that have difficulty to access in- person consultations and also provides an opportunity to educate the primary care sector, providers. RCC system will require a bespoke, robust and safe, super-fast internet multi-channel video conferencing system.

041

Throat Packs: In or Out? A survey of Current Practice in using Throat Packs in Dental General Anaesthetics across England.

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Objectives: Throat packs are used in general anaesthetics to prevent aspiration of foreign bodies, blood and other fluids. Never Events involving the retention of a throat pack have occurred over time, stipulating the need to reassess the benefits and necessity of placing a throat pack. The current guidelines on general anaesthesia advocate the necessity of throat packs, particularly in endotracheal intubations. Conversely, the evidence-based consensus in the systematic review published by the Association of Anaesthetists recommends that routine insertion of throat packs should be discontinued. This survey aims to evaluate the current practice in placing throat packs and compare findings with the recommendations outlined in current guidelines; taking into consideration the new body of evidence and anaesthetists' preference and rationale.

Methods: A questionnaire consisting of 5 questions was distributed widely across England to anaesthetists performing dental general anaesthetic lists.

Results: There is considerable variation in the use of throat packs amongst the cohort of anaesthetists and between the different dental specialties. 83% of respondents would not use a throat pack routinely and would only consider using it if they suspected a substantially greater risk of aspiration based on the nature of the surgery. However, the number of complications reported by anaesthetists that occurred as a result of using a throat pack (n=9) in comparison to the absence of a throat pack (n=7) are analogous.

Conclusions: It appears that there is a shift in practice towards placing a throat pack after consideration of the nature of the procedure and airway device. Indications and evidence for using a throat pack remains equivocal. Further clarification and quantifiable guidance on the indications for using a throat pack could support greater consistency in practice.

042

Development of Silver- and Copper-Doped Bioactive Glasses with Antimicrobial Properties.

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Objectives: The demand for bone grafts has increased attention toward synthetic biomaterials. Bone graft substitutes support tissue healing but do not alone combat infection. Thus, development of a bone substitute that can enhance bone regeneration and in the same time inhibit the growth of microbial pathogens is an area of great interest. Bioactive glasses have the potential to meet this need by introducing antimicrobial metal ions such as silver (Ag^{+}) and copper (Cu^{2+}). Bioactive glasses with antimicrobial ions have not yet reached the clinic, and the aim of this research was, therefore, to design, fabricate and characterise a range of modified bioactive glasses using the traditional melt-quench route.

Methods: The classical Hench 45S5 composition (SiO_2-P_2O_5-CaO-Na_2O) was modified by a partial substation of CaO with either Ag_2O or CuO at 0.15, 0.25, 0.5, 1.0 or 2.5 mol% and prepared using the melt route. Glasses were characterised using X-ray diffraction, then X-ray fluorescence (XRF) followed by scanning electron microscopy with energy-dispersive X-ray spectroscopy to confirm post-melt compositions, differential scanning calorimetry to determine glass transition temperatures and crystallisation exotherms. Finally, Fourier transform infrared spectroscopy, and X-ray photoelectron spectroscopy was applied to investigate the chemical state of Ag and Cu.

Results: The results showed that, at the higher concentrations, silver in the glass was reduced to form metallic silver. At lower concentrations (up to 0.25 mol%) a more homogenous glass was obtained, with XRF confirming the presence of Ag. More encouragingly, our results showed that CuO was incorporated successfully in the glass system at all concentrations, with thermal analysis suggesting some disruption of the glass network as [CuO] was increased.

Conclusions: It was concluded that bioactive glasses that contained the antimicrobial metal ions Ag^{+} and Cu^{2+}could be prepared using melt route, but under standard conditions, there was a limit to the proportion of silver that could be added. Further work is being directed at testing the antimicrobial properties of these modified compositions.

043

Polymer based inhibition of Quorum sensing in Gram-negative bacteria

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Objectives: Quorum sensing (QS) is a form of cell to cell communication that regulates several bacterial virulence phenotypes as the community reaches a threshold level of cell density. It allows coordination within the bacterial community, and is pivotal in regulating bacterial pathogenesis through factors including biofilm formation, elastase and protease production, and bacterial motility.
This project presents an anti-quorum sensing polymer, HB-PNIPAM-HSL, with uniquely functionalized chain ends that targets the acyl-homoserine lactone (AHL) based QS system found in Gram-negative bacteria. Interfering with QS circuits could present a possible control over several virulence factors and thus limit infection. The objective of this work is to investigate the extent of the circuit disruption via HB-PNIPAM-HL through the use of several Gram negative bacterial virulence factor assays.
Methods: The anti-QS ability of the polymer was first measured in a mutant strain of Chromobacterium violaceum, wild types of which produce a characteristic purple pigment, violacein. The mutant strain of C.violaceum, CV026, has colonies which appear white; violacein production can be restored by the addition of the AHL signalling molecule making it an ideal bioassay for AHL signalling and blocking. Gene expression of receptors involved in AHL-type signalling, in the presence or absence of HB-PNIPAM-HL was investigated using qPCR., In addition, the effect of the polymer on Pseudomonas aeruginosa virulence factors regulated by QS was evaluated via several virulence factors assays.
Results: Initial tests using the CV026 biosensor assay indicated HB-PNIPAM-HSL was able to block AHL signalling in CV026 bacteria. Interference with QS signalling by the polymer was also investigated via its effects on P.aeruginosa phenotypes that are controlled by quorum sensing
Conclusions: Initial results suggest that HB-PNIPAM-HSL can interfere with QS signalling. This novel anti-quorum sensing polymer could limit some Gram-negative infections.

044

Gravimetric Evaluation of the Swelling Index of Polymeric Mucoadhesive Films

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Objectives: The study evaluates the swelling index (SI) of five naturally occurring mucoadhesive polymers for use as local buccal delivery systems.

Methods: Monolayer and bilayer mucoadhesive films were prepared employing the solvent-casting method. Different film-forming polymers [hydroxypropylmethylcellulose (HPMC-K4M, HPMC-K15M), polyvinyl-alcohol (PVA), and polyvinyl-pyrrolidone (PVP)] were used to fabricate the mucoadhesive layer; ethylcellulose (EC) was used as a backing layer. 5%w/v ethanolic solution of EC was prepared, plasticized with castor oil 2%v/v and stirred (magnetically;3h), then cast and stored (30°C;24h). To fabricate the mucoadhesive layer, 2g of each polymer were dissolved in 100ml of deionized water (DI); eight polymeric solutions were prepared (HPMC-K4M;HPMC-K4M+PVA;HPMC-K4M+PVP;HPMCK4M+PVA+PVP;HPMC-K15M;HPMC-K15M+PVA;HPMC-K15M+PVP;HPMC-K15M+PVA+PVP), plasticized with propylene glycol 1%v/v, stirred for 3h, then cast and stored (30°C;72h). The resulting films were cut into disks (1cm x ~0.6mm/0.2mm). The SI was determined gravimetrically in DI. Films were dried for 24h, weighed (w_0) and submerged into 5ml DI at 37°C. At eleven definite time intervals (5-180 mins), each film was removed, reweighed (w_t) immediately after blotting excess water. SI was calculated using the equation: SI% $= [(w_t - w_0)/w_0] \times 100$.

Results: HPMC-K15M showed the highest SI in monolayer and bilayer films (929% and 186%). Adding PVP, PVA, or both to the HPMC films reduced their ability to absorb water. Monolayer films reached their maximum SI within the first 30mins. The bilayer films reached their maximum SI after 1h. Increase in the PVA concentration above 10% led to detachment the mucoadhesive layer from the backing layer and reduced the SI of the monolayer films.

Conclusions: Single and double layer mucoadhesive films for use as a buccal delivery system were successfully fabricated using solvent-casting technique. The ability of HPMC-K15M films to swell was greater than HPMC-K4M films. HPMC-K15M films appear to be the optimum formulation to take forward for improved mucoadhesive properties and increased release of drugs.

045

Hydrophobic and Hydrophilic coating materials on protein adsorption and retention of oral biofilm formation.

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Objectives: To investigate hydrophobic and hydrophilic coating materials on protein adsorption and retention of oral biofilm formation.
Methods: Stearic acid was used as a hydrophobic model material, while 2-methacryloyloxyethyl phosphorylcholine (MPC) was used as hydrophilic mode material. Both of them were coated on a germanium prism separately. Germanium prism was used as an accurate model for saliva-tooth interaction. Contact angle measurement was also done to confirm the hydrophilicity and hydrophobicity of both material coating. The prism with the Stearic Acid or MPC coating was soaked with artificial saliva and incubated for 1 hour at 37^{O} C. The germanium prism, then, was leached and rinsed with distilled water for 15 second. The extent of protein adsorption and retention was determined using Infrared Spectroscopy (IR) and ellipsometry. IR spectroscopy and ellipsometry were used to obtain information on the amount of protein and the thickness of the film formation.
Results: After the soaking of artificial saliva, the IR spectra of MPC and Stearic Acid coating showed different spectra from the initial coating alone. Major peak positions showed protein adsorption peaks. However, most of the peaks decreased after following the distilled water leaching and rinsing treatments. The ellipsometry measurement showed the average thickness of MPC coating after artificial saliva soaking decreased prominently after water leaching treatment, while Stearic Acid coating only decreased slightly.
Conclusions: MPC coating on the germanium prism showed less protein adsorption than Stearic acid coating. However, the main problem with MPC coating was due to its hydrophilic nature, it was hard to immobilize MPC on the materials surfaces in aqueous media.

046

Characterisation of Hybrid Calcium Aluminate-Glass Ionomer Cement

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Objectives: To characterise setting reaction and apatite formation, determine the chemical composition, fluoride release and film thickness of commercial calcium aluminate-glass ionomer cement (CaAl-GIC).

Methods: Two dental luting agents were used for this study, Ceramir Crown & Bridge (Doxa Dental, Uppsala, Sweden) and KetacCem Maxicap (3M ESPE, MN, USA). Each sample type was prepared in triplicate, immersed in 10 ml Tris Buffer (TB) and incubated (37°C) for 1, 7 and 28 days. Solutions collected at each time point were analysed for pH, fluoride release and ICP-OES. Cement powder and aged samples were characterised by MAS-NMR, ATR-FTIR and XRD. The chemical composition of CaAl-GIC was determined by using XRF and film thickness was measured according to the ISO: 9917-1.

Results: CaAl-GIC showed no apatite formation at 24 hours, 7 days and 28 days after immersion in TB. MAS-NMR and XRD results of CaAl-GIC showed crystalline phases of monocalcium aluminate ($CaAl_2O_4$) and demonstrated the presence of strontium fluoride. FTIR and MAS-NMR spectra of CaAl-GIC are characterised by the presence of AlO_4 tetrahedra and AlO_6 octahedra. The chemical analysis showed that CaAl-GIC has low amount of silica, phosphorus and fluorine and higher in aluminium oxide and calcium oxide when compared to GIC. Fluoride release is significantly higher in GIC than CaAl-GIC. The pH values are gradually increased over time reaching a mean value of 8.28 after 28 days.

Conclusions: This study showed that the hybrid CaAl-GIC is predominantly composed of CaAl which could be responsible for high pH and end-product properties. Further work is required to complete characterisation of CaAl-GIC to reveal potential expectations of the material when clinically applied.

047 - WITHDRAWN

Coating on Composite-Zirconia Bonding and Residual Stress Analysis

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048

Physical Approaches to Adhesive Interface Visualization in Clinical Dentistry

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Objectives: The purpose of the present research is to develop new methods for visualization and early- stage non-invasive diagnostics of adhesive interfaces (AI) between hard tooth tissues (HTT) and polymer material (PM).

Methods: In the course of clinical trials 400 AI between HTT and PM were tested by 3 methods. The 1st one was a standard clinical examination including diagnostics, restorative treatment if necessary and further 4-year observation. The state of restorations was examined in accordance with the recommendations of FDI using the USPHS criteria. The 2nd method of AI diagnostics was a high-resolution digital analysis (VD) of tooth photos including the areas of AI. A digital camera Nikon D3 with a set of macro-lens and the system of additional lighting (with power-controlled LEDs) from oral cavity were used in the study. The images of AI were digitally processed using PTC MathCAD Express software. The method made it possible not only visualize AI but also perform quantitative calculations. The 3d method of *in vivo* AI visualisation was based on OCT. To visualize hidden caries lesions and defects in the volume of restoration, the experimental set including Spectral Radar OCT Imaging System OCP 930 SR022 was assembled.

Results: Having extended USPHS criteria so that they might be suitable for analysis of digital data obtained by physical methods of diagnostics, the qualitative and quantitative analyses of AIs were carried out by using VD and OCT in comparison with standard clinical methods. The results of statistical analysis of experimental data given by both the standard method and OCT showed a significant correlation between these two; however, this correlation is much lower than that between the results obtained using standard methods and VD.

Conclusions: To sum up, the results of VD tests are in full agreement with the results of clinical observations, which makes it possible to use this method as a screening one for preventive clinical examinations. The OCT method allows in vivo, in situ, non-invasive monitoring AI quality as well as revealing hidden carious cavities and defects of restorations. It has been shown that the method of OCT is more informative and reliable in comparison with standard clinical diagnostics and with VD when assessing AIs.

049

Sealing Ability of Biodentine and MTA in Teeth with Open Apices

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Objectives: The aim of this in vitro study was to assess the quality of the root apical seal achieved with either mineral trioxide aggregate (MTA®) or Biodentine™ when placed in a moist environment that simulates the various clinical periapical wet conditions using micro-CT and an optical microscope.

Methods: A total of thirty-six freshly extracted human-teeth were randomly allocated to two groups: MTA® and Biodentine™. Each group was subdivided into 3 subgroups containing 6 teeth in each. Materials were inserted and packed while the teeth were immersed in different environmental conditions including dry, simulated body fluid (SBF) and acid, following the standard apical divergence and instrumentation. 3mm of the materials were subsequently scanned and analysed using a micro-CT scan and an optical microscope was used to investigate the integrity of the root-apex at the surface interface seal.

Results: The mean porosity percentage of MTA® and Biodentine™ in the 3 different environments were: 24.08% and 45.42% for dry; 38.28% and 56.03% for SBF; and 46.78% and 50.43% for acid respectively. There was no statistically significant difference between the three environments at a p-value = 0.16.

Conclusions: Moisture and acidic environment did not have a statistically significant effect on the sealing ability of MTA® and Biodentine™ as tested in this study. However, they can generate morphological changes in both materials.

050

Bioactivity of Novel Strontium Substituted BAGs containing $CaCl_2/CaF_2$

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Objectives: Bioactive glasses (BAGs) undergo dissolution in physiologic fluid and have a capability to form apatite. Strontium (Sr) is known to stimulate human dental pulp stem cell (hDPSC). As Sr has a similar charge and ionic radius to Calcium (Ca), it can substitute for Ca in BAGs, resulting in an expanded glass network, which enhances glass dissolution and ion release, and increase bioactivity. Similar phenomena are found when $CaCl_2$ and CaF_2 are incorporated into the BAG. Therefore, this study aims to investigate the effects of Sr substitution on bioactivity of BAGs containing $CaCl_2/CaF_2$.

Methods: The melt-derived bioactive glasses based on SiO_2-P_2O_5-CaO/SrO-$CaCl_2$-CaF_2 with 0, 5, 10, 25, 50 and 100 percent of SrO for CaO (Sr-BAG) were synthesised and characterised by DSC, FTIR and XRD. Ion release, pH change and apatite formation after immersion of the glass powder in Tris buffer at 37^{o}C for 1, 3, 6, 9, 24, 72 and 168 hours were investigated.

Results: The increasing pH and ion release of all BAGs were significant during the first 9 hours of immersion. The 100% Sr-BAG showed the greatest pH change and ion release. The fastest apatite formation was found in 100% Sr- BAG, detected by FTIR and XRD, after 1h, whilst the apatite formation was only found after 6h for 0-50% Sr-BAG. After 168h, the 0% Sr-BAG showed the lowest apatite crystal formation in SEM images.

Conclusions: The fully Sr-substituted BAG containing $CaCl_2/CaF_2$ has high bioactivity. Hence, this novel BAG has the potential for pulpal regenerative dentistry because of the stimulation property of Sr on hDPSCs.

051

A Novel Thiolated Chitosan-Silica Hybrid Hydrogel for Bone Tissue Engineering

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Objectives: Hydrogels combining inorganic-organic materials aim to mimic the composite nature of real bone by combining the toughness of a polymer phase with the compressive strength of an inorganic phase. Chitosan is a natural co-polysaccharide polymer which is widely used in drug delivery and bone tissue engineering. In the present study, a novel hydrogel was generated based on thiolated chitosan (TC) and silica for potential use in bone regeneration.

Methods: A novel hybrid hydrogel composed of TC and silica was prepared along with a low molecular weight chitosan (LMWC)/silica hydrogel for comparison. The functionalisation reaction of chitosan and silica was investigated using Fourier-transform infrared spectroscopy (FTIR) and nuclear magnetic resonance (NMR). Hydrogel rheology was assessed using frequency, amplitude and time-dependent sweeps. Hydrogel degradation was examined in phosphate buffer saline (PBS) or PBS containing 1.5 mg/mL lysozyme. Silicon released from hydrogels during the degradation process was measured using inductively coupled plasma atomic emission spectroscopy, and chitosan and glycerol release were measured using high-performance liquid chromatography. Viability of osteoblasts encapsulated in hydrogels was evaluated using the live/dead assay.

Results: FTIR spectra of TC/silica hydrogel showed characteristic absorption bands which included: Amide II, Si-O and Si-O-Si. NMR demonstrated a reaction between the epoxide ring of silica and thiolated chitosan. Rheological testing showed a solid-like response of TC/silica hydrogel and the gel had an adequate gelling time (1627 s ± 98) for use in surgical procedures. After 24 hours, silicon release remained at a relatively slow rate (0.3 µg/mL ± 0.2) over 21 days. All hydrogels exhibited limited cytotoxicity as viability of osteoblasts remained at >70% over 168 hours culture.

Conclusions: The newly developed TC/silica hydrogel exhibited specific degradation and mechanical properties with no significant cytotoxicity. Thus, the hybrid hydrogels may have potential to be used for bone tissue engineering.

052

Cytotoxicity and Biocompatibility of a Fluoride containing Bioactive Glass Composite.

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Objectives: Objectives: Dental caries and white spot lesions around orthodontic brackets are frequently observed with patients undergoing orthodontic treatment. Fluoride-containing bioactive glass (BAG) in orthodontic adhesive resins could prevent/remineralise such lesions by maintaining neutral pH level and releasing therapeutic ions such as fluoride, calcium and phosphate to promote apatite formation. The aim of this study is to provide evidence-based data, in terms of the safety of this material to be approved by the Medical and Healthcare product Regularity Agency by investigating the cytotoxicity and biocompatibility of this novel material.

Methods:

1. Fluoride-containing BAG (SiO_2: 35.7, $CaCO_3$: 42.42, Na_2CO_3: 5.95, P_2O_5: 5.63 and CaF_2: 10.3 mole%) was prepared by quench melt route, fabricated into composite disks, (80% by weight BAG or commercial inert glass (IG) plus 20% methacrylate resin or 100% methacrylate disk control) and seeded with 30,000 MG-63 osteoblast cells/disk in DMEM culture media.

2. 10,000 cells/well were seeded into 96-well-plates to assess cytotoxicity (Cell proliferation: fluorometric assay of DNA levels; Cell viability: neutral red uptake assay and MTT, and osteoblast differentiation: ALK Phosphatase activity) of BAG, and IG conditioned cell culture media on different cell-lines (MG-63, and SQCC/Y1 and N/TERT keratinocytes).

Results: Cell death was observed when seeded on to all fabricated disks - this was attributed to the toxic nature of the methacrylate resin. In the second experiment, neither BAG nor IG glass-conditioned media showed any cytotoxic effects in the cell-lines.

Conclusions: Fluoride-containing bioactive glass have no obvious detrimental effect on osteoblast-like MG-63, or SQCC/Y1 and N/TERT keratinocytes compared with the commercial used inert glass powder. However, commercial resins have cytotoxic effects, but are accepted to be used clinically.

053

Elution of Resin-based Composite Monomers into Groundwater

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Objectives: To assess the environmental pollutant risk of resin-based composite (RBC) after interment of cadavers containing restorations via an in vitro analysis of elution of monomers into groundwater.

Methods: Ceramic (lithium disilicate) teeth with uniform mesio-occluso-distal cavities were fabricated and restored, in accordance with recommended guidelines, with known volumes of two RBCs (CompA or CompB). CompA was a commercially available RBC and CompB a custom-made control standard; both containing all the monomers of interest in known amounts. The restored teeth were aged for 6 months in artificial saliva at 35°C to simulate the oral environment. Aged, restored models were placed in microcosms (in duplicates) containing groundwater at 10°C for 12 months. Sampling and analysis of groundwater was carried out at 5 intervals (t0, months 1, 5, 10, 12). Eluted monomers triethylene glycol dimethylacrylate (TEGDMA), urethane dimethacrylate (UDMA), bisphenol-A glycidyl methacrylate (Bis-GMA), hydroxyethyl methacrylate (HEMA), bisphenol-A (BPA) were quantified via solid phase micro-extraction coupled with high-performance liquid chromatography.

Results: Elution of all monomers was detected for CompA and CompB over the sampling period. TEGDMA eluted in the highest concentration for both composite materials. The ranking (greatest to least) of detected monomer concentrations was consistent between CompA and CompB (TEGDMA>HEMA>BPA>UDMA>BisGMA). The smaller molecular weight monomers (BPA, TEGDMA and HEMA) were detected in higher concentrations than the larger weight monomers (UDMA and BisGMA).

Average concentrations of monomers released over the sampling period for CompA were: TEGDMA 790mg/L, HEMA 48mg/L, BPA 45mg/L, UDMA 12mg/L and BisGMA 8mg/L. For Comp A, increased concentration over time for BisGMA correlated with a subsequent increase in BPA concentrations being detected.

Conclusions: Low concentrations of monomers from RBCs are released into groundwater over a prolonged time. The high number of restorations placed worldwide suggests a greater cumulative effect.

054

Assessment of microparticles and monomer elution following clinical operative grinding of resin-based composite restorations

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Objectives: To assess and compare the potential environmental pollutant risk of resin-based composite (RBC) after the removal of old restorations and the finishing and polishing of newly placed restorations.

Methods: Two RBCs, one representative of current commercially available materials (CompA) and one custom-made calibration composite (CompB) containing monomers of interest were tested (in duplicates). Standardised discs (0.5g) were uniformly polymerized and split into two groups, G1 and G2. G1 discs were aged for 12 months in artificial saliva at 35°C to simulate the oral environment and then ground following clinical protocols to simulate the removal of an old restoration. G2 discs were ground in the same manner, immediately after polymerisation to reproduce standard clinical finishing/polishing regimes. RBC microparticles were stored in tap water and sampled regularly over 12 months to simulate environmental release through waste water emissions. Eluted monomers triethylene glycol dimethylacrylate (TEGDMA), urethane dimethacrylate (UDMA), bisphenol-A glycidyl methacrylate (Bis-GMA), hydroxyethyl methacrylate (HEMA), bisphenol-A (BPA) were quantified via solid phase micro-extraction coupled with high-performance liquid chromatography.

Results: G1: A consistent trend of eluted monomers was observed over the 12 months period for both RBCs. In general, CompB leached monomers in higher (up to 8x) concentrations compared to CompA. For both composites TEGDMA was released in the highest concentration (550mg/L CompA, 4000mg/L CompB), peaking at 2-3 days. G2: CompA released up to 6x higher concentrations of monomers than CompB, except for TEGDMA. For CompA UDMA was released in the highest concentration (3300mg/L), while TEGDMA-release dominated for CompB (4500mg/L). CompB peak monomer release was reached within 1 month, while for Comp B for up to 200 days.

Conclusions: Elution of identifiable monomers was quantified from microparticles of both RBCs, which varied in accordance with the specific RBC formulation. Finishing and polishing regimes demonstrated longer-term consistent release of the monomers investigated than for the removal of old restorations.

055

Characterisation of interfacial area formed between calcium silicate based materials and root dentine

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Objectives: Calcium-silicate materials used in endodontic treatment are of great importance for the success of treatment due to a better sealing of the area. These materials have the ability for Ca^{2+} ions to diffuse through and form an interfacial surface composed of a calcium phosphate precipitate. However, this phenomenon may be compromised when the pH of the surrounding tissues decreases. The aim was to analyse the calcium phosphate precipitate in these materials following storage in an acidic environment.

Methods: Dentine slices (n=6) were obtained from human premolars. Intracanal lumens were prepared and divided into three groups; MTA Angelus, Endosequence RRM (ERRM), and Biodentine. Materials were placed inside the lumens and samples were sub-divided according to the storage media and time; (A) pH 7.2 phosphate-buffered saline (PBS) /34 days, (B) pH 4.5 acetic acid/4 days, followed by pH 7.2 PBS /30 days. Interfacial surface was analysed by SEM (x2000 magnification). EDX analysis was conducted to measure intensity values for calcium and phosphate species.

Results: For MTA, SEM showed a well-defined crystal structure in Group A whereas in Group B, a honeycomb, needle-shaped crystallisation was seen. The Ca/P ratio was 241/212 in Group A, whereas for Group B the Ca/P ratio was 83/84. For ERRM, SEM showed a well-defined crysallisation pattern in Group A whereas in Group B crystals irregular shaped crystallisation was seen. The Ca/P ratio was 194/106 in Group A, whereas for group A Ca/P ratio was 3/125. High amounts of gaps was observed in both materials. For Biodentine SEM showed moderate amounts of voids and irregular shaped crystal structure, but a compact interfacial area in both groups. Ca/P ratio was similar in both groups, 220/80.

Conclusions: All materials showed a calcium phosphate precipitate when stored at pH 7.2. However, when stored at an acidic pH, this significantly affected the crystal shape and structure for MTA and ERRM. Biodentine showed the highest resistance and ability to form precipitation after stored in acidic pH.

056

Evaluation of Light Curing Units in Primary and Secondary Dental Care

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Objectives: Long term clinical success of light activated materials is dependent on an adequate curing process. This project evaluated the efficacy of the light curing units (LCUs) at the Leeds Dental Hospital and General Dental Practices. The gold standard was to have LCUs with an irradiance > 500mW/cm^2 for optimal curing. The effect of light source distance, fibre optic tip contamination and damage to the tip on the irradiance was also assessed.

Methods: The irradiance of 157 light curing units (LCUs) were recorded with a BluePhase II radiometer (Ivoclar- Vivadent). The mean irradiance of three readings was recorded per unit. The effect of distance was recorded over 1- 10 mm source distances using a checkMARC device (BlueLight Analytics). The effect of chipping and contamination of the fibreoptic tip on the overall light output and the homogeneity of the light beam were also evaluated using the laser beam profiler Beamgage 6.3 (Ophir-Spiricon).

Results: The results showed that 25% of LCUs were not compliant with the gold standard. 44% of the fibre optic tips were contaminated and 25% were chipped. The decrease in irradiance over the 1 to10 mm testing distance ranged from 3%-40% (r^2 = 0.98, P = ≤ 0.05).

Analysis of the of the fibre optic beam profiles showed that contamination and damage reduces the total irradiance emitted by 17% and 18% respectively (r^2 = 0.95, P = ≤ 0.05).

Conclusions: There is a lack of awareness of the need for regular checking of LCU's irradiance. Due to the regular use of LCUs, they are more prone to damage and resin contamination which could significantly affect the irradiance. Another important factor to consider is the reduction of irradiance with distance. Clinicians should regularly check and maintain their LCUs to ensure optimum performance.

057

Assessment of Tooth Yellowness

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Objectives: To predict perceptual tooth yellowness with the development of an equation.

Methods: An experiment where 500 participants ranked a set of 58 shade guide samples produced a large set of psychophysical yellowness data. Using this psychophysical data a yellowness equation, YIO, was developed by optimizing the data to maximize the coefficient of determination, r^2. Three indexes, a new yellowness index, YIO and two existing equations (WIO and b*) were evaluated by comparing their values for the 58 shade guide tabs with the psychophysical data. Coefficient of determination (r^2) and '% wrong decision' were used to measure the performance of the equations. An experiment with 40 participants ranking 5 sets of 9 samples that were viewed on emissive display was used to validate the yellowness equation. The candidate equations were evaluated using the validation set of data, r^2, and %WD metrics

Results: The three indexes YIO, WIO, and b* strongly correlated with perceptual yellowness. However, YIO and WIO showed stronger correlations to the data than b*.

Conclusions: A new yellowness index YIO has been developed which correlates to perceptual tooth yellowness.

058 - WITHDRAWN

What are undergraduate dental students career plans, and why?

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059

Effects of Herbal Mouthwashes for Patients with Gingivitis

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Objectives: To evaluate the clinical effects of herbal mouthwashes for plaque and inflammation control when mouthwashes are used as supplements to the daily oral hygiene of patients with gingivitis, compared to placebos or chlorhexidine (CHX)-containing mouthwashes.

Methods: A detailed protocol was registered a priori on PROSPERO (CRD42019122841). PubMed, EMBASE, CDSR, CENTRAL, and grey literature databases were searched by descriptors combining population (gingivitis) and intervention (herbal mouthwashes). After the title/abstract and full-text screening, only randomised controlled trials with at least one plaque- or inflammation-related indices as an outcome measure on systemically healthy participants with gingivitis were included. Data were extracted from the included studies, and the risk of bias was evaluated. Due to the random allocation in individual studies, the mean and standard deviation of each index at the endpoint of study in each group (herbal, placebo, and CHX) were obtained to estimate the weighted mean differences (WMDs) and their 95% confidential intervals (95%CIs), comparing the effects between different mouthwashes.

Results: Of a total of 2699 articles, 13 studies satisfied the inclusion criteria of systematic review (Table 1), among which, 11 studies without high risk of bias were included in meta-analyses (Figure 1). After meta-analyses, significant differences were observed in favour of herbal mouthwashes compared to placebos in both plaque- and inflammation- related indices (Quigley-Hein Plaque Index, QHPI: WMD = -0.61, 95%CI (-0.80, -0.42), P < .001; Gingival Index, GI: - 0.28 (-0.51, -0.05), P = .02; Modified Gingival Index, MGI: -0.59 (-1.08, -0.11), P = .02; Gingival Bleeding Index, GBI: - 0.06 (-0.09, -0.04), P < .001) (Figure 2). No significant difference was found between herbal and CHX mouthwashes (Plaque Index, PI: P= .56; QHPI: P= 1.00; GI: P= .80; MGI: P= .33) (Figure 3).

Conclusions: Herbal mouthwashes have comparable clinical effects to CHX-containing mouthwashes on either the reduction of dental plaque or gingival inflammation control in patients with gingivitis, superior to those placebo solutions. Thus, herbal mouthwashes can be a reasonable substitute for CHX mouthwashes as supplements to daily oral hygiene in patients with gingivitis, and further high-quality studies are warranted.

060

A 3-dimensional accuracy assessment of digital impression in a single implant-supported prosthesis

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Objectives: To establish a metrology-based accuracy assessment method for digital impressions of a single implant- supported prosthesis

Methods: A simulation model using human extracted teeth containing an implant analog was prepared as a master model. Three reference spheres were attached to the model. Duplicated models (DMs) were made using conventional impression with polyvinyl siloxane. The master model was digitised by an intraoral scanner (Dental Wings, DWIO), a laboratory scanner (Dental Wings, 7-series, DW-7) and a coordinate measuring machine (Renishaw, Incise, CMM). The DMs were digitised by CMM only. The data were analysed by 3-D software.

Results: Based on reference spheres - The accuracy, determined by the mean deviation of measured diameter to the actual diameter of spheres (N=3), was 0.048mm for CMM, 0.142 mm for DW-7 and 0.072 mm for DWIO. The sphericity, determined by the standard deviations (SDs) of the best fit of the spheres, were 0.004, 0.012, and 0.032 mm for CMM, DW-7 and DWIO respectively. Based on the master model - The reproducibility, determined by the SDs (N=6), was 0.00 mm for CMM, 0.02 mm for DW-7, 0.06 mm for DWIO and 0.01 mm for DM.

Based on the reference device-The accuracy was determined by the mean 3-D linear deviations of the selected regions from CMM (N=6). For DWIO, the deviations were 0.19 mm over the teeth and 0.60 mm over the scan body; whereas for the DM, were 0.07 mm and 0.27 mm respectively.

Conclusions: 1.The sphericity and accuracy of the sphere digitised by CMM was the best among three digitising devices and the reproducibility of the model digitisation was the best when using CMM. Therefore, CMM can be used as a reference device for comparison with digital impressions.

2. The conventional impression had better accuracy than the intraoral scanner in a single implant-supported prosthesis when using an appropriate measurement protocol.

061

Fluorapatite and Hydroxyapatite Dental Implant Coatings: Interfacial Properties and Degradation

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Objectives: Hydroxyapatite (HA) coated dental implants may fail due to coating dissolution and delamination. Fluorapatite (FA) is more stable, with proven ability to enhance osseointegration and with promising antibacterial properties. This study aimed to perform detailed physical and mechanical surface analysis to explore the role of sintering on surface properties and degradation of each implant coating.

Methods: FA or HA coatings were deposited onto in-house prepared cpTi discs using a mild hydrothermal method. Half of the coated discs were sintered at 800°C for 180min, to give 4 groups (N=5). A morphological characterisation was performed using Scanning Electron Microscopy and Energy Dispersive Spectroscopy (SEM-EDS). Coating crystallinity was investigated by X-Ray Diffraction (XRD). Surface roughness (Sa) and thickness were analysed using Laser Profilometry. A diamond stylus scratch test (ST) was used to determine coatings' adhesion. Daily fluoride release at pH 4.0 was evaluated using a fluoride ion selective electrode for 8 weeks.

Results: Mild hydrothermal synthesis produced ordered FA coatings composed of well-aligned hexagonal crystals, and disordered HA coatings with randomly aligned spindle shape crystals. XRD confirmed FA and HA coatings' crystallinity. EDS analysis showed Ca/P for FA (1.78±0.02) and HA (1.72±0.06). FA presented with less roughness 3.88µm±0.9 and thickness 9.43µm±0.7 compared to HA 13.4µm±1.4 and 340µm±20 respectively, these were significantly reduced after sintering. ST showed a significantly higher FA delamination force compared to HA, this was significantly increased after sintering. Unsintered FA coatings showed daily F^- release ranging 4.7-12ppm which was entirely lost on the 14th day whilst sintered FA coatings maintained stable release for 8 weeks. HA coatings had completely degraded by the 3rd day.

Conclusions: The proposed hydrothermal method is effective in producing stable FA coatings. Sintering is effective in bringing about an enhancement in the surface morphology and stability of these coatings.

062

Novel inhibitors of proteolytic activity in oral bacterial biofilms

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Objectives: There are over 700 bacterial species present in the oral cavity, and it is well- documented that they produce proteases when grown as biofilms. Using an in vitro mixed aerobic-anaerobic oral biofilm model, we previously demonstrated the presence of proteases that degrade salivary proteins. The aim of this study was to use this biofilm model to assess the degradation of salivary proteins by bacteria with saliva growth-medium supplemented with; lactate (utilised metabolite), proline (highly produced metabolite), glucose (dietary carbohydrate) and citrate (dietary acid).

Methods: Biofilms were grown in a mixed aerobic-anaerobic environment on hydroxyapatite discs for 7 days by inoculation with stimulated whole mouth saliva. Pasteurised saliva was supplemented with either lactate, citrate, glucose, proline, or with no additives (positive control) and was refreshed every 3 days. Upon termination of the experiment, spent saliva from days 4 and 7 was assessed for degradation of salivary proteins by SDS-PAGE.

Results: The positive control demonstrated degradation of 9 salivary proteins, suggesting proteolytic activity regardless of exposure. Saliva from biofilms exposed to lactate, glucose, proline and citrate also demonstrated the same pattern of salivary protein degradation, although significantly lower than the positive control. Saliva from biofilms exposed to proline demonstrated significantly reduced levels of salivary protein degradation.

Conclusions: When oral biofilms are exposed to these compounds, the degradation of salivary proteins is reduced, suggesting inhibition of proteolytic activity in the biofilm. When proline is present in the saliva growth-medium, bacteria do not degrade proline-rich proteins.

063

Electronic cigarettes for smoking cessation in patients with periodontitis: the response of the subgingival microbiota

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Objectives: Tobacco smoking is a major risk factor for periodontitis which acts on the immune and inflammatory response and modifies the oral microbiota. Electronic cigarettes (e-cigarettes) are a new approach to smoking cessation with emerging evidence of effectiveness. This study aimed to explore changes in the subgingival microbiota following an e-cigarette intervention in smokers with periodontitis.

Methods: Subgingival plaque samples were collected longitudinally from 80 smokers with periodontitis taking part in a 6-month pilot randomised controlled trial. All participants received non-surgical periodontal therapy and standard smoking cessation advice. Those randomised to the intervention group additionally received an e-cigarette starter kit with brief training. The V4 region of the 16S rRNA gene was sequenced.

Results: Baseline bleeding on probing and oral dryness severity were significantly associated with microbial composition (P_{adj} = 0.044 and P_{adj} = 0.027, respectively) but not Shannon diversity. Post-therapy periodontitis status was significantly associated with differences in microbial composition (P_{adj} = 0.001). Those with unstable disease (n=34) had higher Filifactor (P_{adj} = 0.006) and Fretibacterium (P_{adj} = 0.039) and lower Veillonella (P_{adj} = 0.039) and Streptococcus (P_{adj} = 0.040), compared to those with stable disease (n=24). The subgingival microbiota was stable over time irrespective of the provision of smoking cessation interventions (including e-cigarettes) or quit success, with no evidence of significant differences at any time points. Participants who used an e-cigarette substantially during the study had significantly lower Shannon diversity (P_{adj} = 0.019), but there was no evidence of significant differences in bacterial profiles. Change in Shannon diversity within participants, over the 6 months, demonstrated those with substantial e-cigarette use generally had increased Shannon diversity at 6 months (change 0.2; IQR -0.1 to 0.4; P_{adj}= 0.023).

Conclusions: There was no evidence that switching from tobacco cigarettes to e-cigarettes had a significant impact on the subgingival microbiota, over the six months of this study. This finding should be validated in larger-scale studies exploring potential impacts on periodontal health status, including host and microbial biomarkers.

064

Antimicrobial and osteoconductive properties of copper-bearing implant materials.

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Objectives: Dental implants are susceptible to failure due to a variety of causes with bacterial infection being of particular concern. The aim of this study was to investigate the antimicrobial and osteoconductive properties of copper-bearing implant materials; titanium, cobalt/chromium and stainless steel alloys together with Cu-doped nanohydroxyapatite (nHA) coated onto titanium substrates.

Methods: Metal alloys (Institute of Metal Research, Shenyang) and nano-coated titanium substrates (Johnson Matthey and Promethean) were subjected to antimicrobial and bioactivity testing. Anti-biofilm assays were conducted against Escherichia coli and Staphylococcus aureus as indicator species. Alamar blue assays, alkaline phosphatase production and lactate dehydrogenase release were conducted with osteoblasts (MG-63 osteosarcoma cells) to investigate cell proliferation, differentiation and cytotoxicity, respectively.

Results: CoCrCu (2.8% Cu), 316L-Cu SS (Stainless Steel; 4.5% Cu), Ti-6Al-4V-5Cu (5.0% Cu) and Ti-5Cu (5.0% Cu) alloys reduced E. coli populations by 28%, 79%, 90% and 93%, and S. aureus populations by 25%, 48%, 76% and 79% respectively, as compared to control titanium substrate. Whereas, Cu-doped nHA (2 - 31% Cu) coated substrate demonstrated biofilm reductions of 31- 98% and 45 – 90% for E. coli and S. aureus respectively. Osteoblast proliferation and differentiation was not significantly different between test materials and control substrate. However, significant cytotoxic effects were observed with nano-coatings containing higher copper concentrations.

Conclusions: The addition of appropriate amounts of copper into metal alloys and coatings for dental implant materials offers excellent antimicrobial and biocompatibility properties. Further studies are required to examine copper ion release and mechanism of antimicrobial activity.

065

Investigating the role of periodontitis-associated organisms as novel mediators of chronic kidney disease.

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Objectives: Oral diseases such as chronic periodontitis (CP) are common within the general population and a known risk factor for myriad diseases, such as Alzheimer's, cardiovascular disease and chronic kidney disease (CKD). CP is mediated by a wide selection of microorganisms, which are a mixture of the microbiota and opportunist pathogens. The oral cavity in periodontitis has been identified as a source of systemic inflammation, with infection of the periodontium a method of systemic entry for microorganisms along with bacterial products, which may induce inflammatory responses in distal tissue. The objective of this study was to culture a selection of periodontitis-associated organisms, purify their bacterial supernatants and test them against human kidney cell lines.

Methods: A selection of periodontitis-associated microorganisms: Actinomyces israelii, Fusobacterium nucleatum, Parvimonas micra, Porphyromonas gingivalis, Streptococcus constellatus and Streptococcus sanguinis and non- periodontitis microorganisms were cultured. At chosen time-points over the growth cycle of the microorganisms, colony-forming units were recorded and supernatants were sampled. These supernatants were tested for their ability to affect kidney cell migration, cell viability and induction of the putative fibrosis-reporting gene, plasminogen activator inhibitor-1, in a transfected kidney cell line.

Results: These findings show that all bacterial supernatants had no significant effect on cell migration whereas only P. gingivalis had a significant effect on cell viability and induction of the fibrosis reporter. The loss of viability and fibrosis induction by P. gingivalis supernatants could be reversed by the addition of protease inhibitors indicating the effect may be caused by organism-specific secreted proteases.

Conclusions: This study shows that microbial products produced by a key periodontitis-associated organism, P. gingivalis, has the potential to elicit a detrimental effect on human kidney cells and is potentially reversible with the addition of protease inhibitors. This finding highlights scope for future work based on investigating this reported virulence factor.

066

Generating Tissue-engineered Oral Mucosal Equivalents Containing an Immune Component

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Objectives: Leukocytes play a key role in immune surveillance and orchestrating the response towards invading organisms or non-self molecules in the oral mucosa. 3D oral mucosal equivalents (OME) are used extensively to mimic the tissue but to date none have contained functional primary immune cells. This work seeks to address this knowledge gap by generating reproducible tissue-engineered OME containing functional immune cells that can be used as an improved model system to investigate immunity in the oral mucosa.

Methods: Human peripheral blood monocytes were differentiated into monocyte-derived macrophages (MDM) and cultured in 2D. Following differentiation, MDM were incorporated into a fibroblast-populated type 1 collagen hydrogel of an OME (MDM-OME). Bacterial lipopolysaccharides (LPS) from oral and non-oral bacteria were used to stimulate MDM-OME to examine immune functionality within the model. MDM viability was assessed using a LIVE/DEAD flexible blue viability stain, and by release of lactate dehydrogenase.

Results: MDM responded to LPS when cultured in 2D with increased cytokine gene expression and protein secretion. Different oral bacteria induced varying pro-inflammatory responses that were generally lower than the effect of Escherichia coli, a non-oral bacterium. When cultured within a 3D collagen hydrogel, MDM were viable and functional after 14 days. Within a complex MDM-OME, functionality was conserved in response to E.coli and Porphyromonas gingivalis LPS, with increased secretion of the pro-inflammatory cytokines IL-6 and CXCL8 compared to OME alone. MDM within LPS-stimulated OME displayed increased cell surface expression of immune activation markers when analysed by flow cytometry compared to unstimulated controls.

Conclusions: These data show functional activity of MDM-OME and suggest that these models will be useful for monitoring the immune response of the oral mucosa to identify potential inflammatory molecules in pathogenic or drug discovery studies.

067

Development of a Murine Oral Microbiome Database (MOMD)

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Objectives: The mouse oral microbiome is known to be simple and stable, with a major proportion of cultivable components. However, the lack of adequate information in the public domain of the mouse oral isolates from various sources and poorly curated 16S rRNA gene sequences in the public databases often leads to misidentification of the organisms, thereby affecting the outcome of such studies. Here, we have developed an extensively curated database of the Mouse Oral Microbiome, including a culture collection with representative genome sequences that can be used as a reference for oral microbial studies in mice models.

Methods: The murine oral cavity was sampled using swabs and cultured on Blood Agar plates, aerobically and anaerobically for 48 h. Isolates were identified using full length 16S rRNA gene sequencing and their taxonomic position determined using sequence alignment and phylogenetic analysis. Sequences were grouped at species level and identified by BLAST interrogation of the GenBank nucleotide database. All species-level taxa (named and un- named) were assigned a Mouse Oral Taxon (MOT) number

Results: Till date, 400 16 rRNA gene sequences from mouse oral bacterial isolates have been analysed and found to constitute 82 MOTs. The mouse oral taxa are distributed across four bacterial phyla – Firmicutes (78%), Proteobacteria (17%), Bacteroidetes (4%), Actinobacteria (2%). At the genus level, the predominant members observed belong to Staphylococcus and Streptococcus. 14% of the assigned MOTs represent previously unidentified species that need further characterization to be assigned a formal species name. Isolates from representative MOTs have been used to generate draft genomes that have been made publicly available at the NCBI genome database.

Conclusions: We report the development of a curated and well characterized mouse oral microbial database that should greatly benefit oral microbiome research in health and disease using laboratory mouse models. Work is currently underway to make the final version of the database available on a public domain, which should enable researchers to access and develop suitable reference datasets for both culture and culture independent studies

068

Modelling diabetes and periodontitis interplay via in vitro biofilm model.

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Objectives: Multiple mechanisms have been proposed to explain the bi-directional link between periodontitis and diabetes, including changes in the biochemistry of diabetic tissues and oral microbiome. The accumulation of advanced glycation end products (AGEs) increases as a consequence of hyperglycaemia and is reported in serum, gingival crevicular fluid (GCF) and gingival tissues in diabetes. Our objective was to utilise an in vitro biofilm system to model the influence of increased AGE on the development and composition of oral biofilms and the response of oral keratinocytes to such biofilms.

Methods: Human serum albumen (HSA) was treated to increase AGE modification and used to pre-condition hydroxyapatite coated pegs and supplement sterile saliva growth media. Inocula were prepared from pooled oral samples (saliva, supragingival plaque, tongue) from 8 healthy volunteers. Biofilms, grown anaerobically for ≤14 days, were harvested throughout and culture on selective media and shotgun metagenomic (Illumina HiSeq3000) analyses were carried out to examine the bacterial profiles. The human gingival keratinocyte cell line, TIGK was exposed to biofilms and cytokine secretion assessed by ELISA.

Results: Viable counts indicated AGE only significantly affected the abundance of facultative anaerobes. Principal component analyses showed clustering according to biofilm maturity. At the phylum level Proteobacteria and Fusobacteria decreased, while Synergistetes and Spirochaetes increased regardless of AGE in peg pre-conditioning or growth media. Detailed taxonomic analysis revealed subtle shifts in abundance of the top 50 most abundant genera. Mature biofilms induced a reduction in IL-6 and IL-8, but increased IL-1β secretion from TIGK cells in preliminary experiments.

Conclusions: This complex biofilm system can be adapted to model aspects of conditions representing states of oral health and disease. These results indicate the isolated influence of increased accumulation of AGE on oral biofilms is subtle.

069

Environmental influences on periodontitis-associated biofilm communities.

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Objectives: Nutrient sources affect microbial composition. We have demonstrated that an environment simulating inflammatory conditions found in periodontal pockets [using bovine serum as a surrogate for GCF] enriches for periodontal pathogens. This study investigated whether a medium mimicking health-associated conditions could restore members of the microbial community associated with oral health.

Methods: Complex biofilms were formed on the Calgary Biofilm Device (CBD, Innovotech, Canada) using pooled saliva, plaque and tongue samples from 8 dentally-healthy adult volunteers. Biofilms were cultured in growth media ±serum (human or bovine) for 3 weeks anaerobically at 37°C; the media were replaced with sterile human saliva for a further 2 weeks incubation. Shotgun metagenomics (Illumina HiSeq3000 PE sequencing) were used to characterise the taxonomy and functional potential of the biofilm communities (n=3 for each condition).

Results: Biofilms cultured in media containing human serum were enriched with Mogibacterium, Porphyromonas, Treponema and Fretibacterium species, while those cultured in sterile human saliva only had higher numbers of Prevotella, Streptococcus and Slackia species at week-3 incubation. Following 2 further weeks of biofilm culture in the presence of human saliva, biofilms were enriched in Catonella, Fretibacterium and Treponema species, while health- associated organisms such as Streptoccocus, Actinomyces and Neisseria species were found in low abundance. Fewer genes associated with iron and haem metabolism were found in the week-5 biofilms, however, higher proportions of genes involved in carbohydrate metabolism were detected in these samples.

Conclusions: Complex microbial communities were successfully established for 3 and 5 week experiments. Differences were found when cultures were enriched with human rather than bovine serum. The diversity and richness of the communities did not significantly differ between 3 and 5 week biofilms, indicating that an established dysbiotic biofilm community may become stable and not easily reversed by variation of the environment.

070

Micro-computed Tomography Study of Sound Enamel in Extracted Human Premolar Teeth

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Objectives: To determine enamel thickness and mineral density distributions of sound enamel in extracted human premolar teeth.

Methods: Tooth samples, each with three calibration standards (CSs) (fluorite, selenite, and PET), were placed in a vial and examined by a commercial Micro-CT system (Phoenix nanotom®m; GE, Germany). X-rays were generated at 110 kV and 160 µA, creating 2,000 two-dimensional projections over a 360-degree rotation of specimens (voxel Size=7µm). Frame averaging, flat-field correction, pre-filtration, and beam-hardening correction were applied. Created 2D images were 3D reconstructed and transferred to VGStudio-Max 3.0 (Volume Graphics, Heidelberg, Germany) for visualization, segmentation, and analysis. Region of interest (ROI) containing entire volume of enamel was created. Wall Thickness Analysis was performed to determine enamel thickness descriptive statistics. Scatter plot was created by plotting mean GSV of each CS (x) against its' calculated density (y), and a calibration function was established using least squares regression equation method. Under Porosity/Inclusion Analysis, defect analysis was performed on the ROI containing enamel to obtain descriptive statistics of GSVs of sound enamel.

Results: Ten unrestored, non-cavitated, extracted human premolars with closed apices were scanned. Teeth with developmental enamel defects were excluded. Wall thickness analysis revealed mean enamel thickness of 1.19 mm (min. 0, max. 2.04 mm, SD 0.34). Enamel thickness distribution revealed maximum enamel thickness at the coronal one third of enamel that gradually decreases toward the middle and cervical thirds reaching null at the CEJ. Enamel thickness around the fissures approximates that of middle third of enamel. Densities of sound enamel in the 10 extracted human teeth, based on mean GSVs, were 2.6-3.1 g/cm^3(min. 2.26, max. 3.94 mm, SD 0.21). Mineral density distribution revealed highest mineral content at enamel surface with gradual reduction toward the DEJ. Mineral density at the DEJ was 5-10% less than that of enamel surface.

Conclusions: Micro-computed tomography examination of extracted human teeth enabled the study of enamel thickness and mineral dentistry distributions.

071

Electric Toothbrush Heads Design Influences in vitro Stain Removal Efficacy

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Objectives: Recent studies on the reduction in plaque indicate the benefits of using electric toothbrushes when compared with manual toothbrushes. Subsequently the main aim of this study was to investigate the effects of different electric toothbrush heads on in vitro stain removal efficacy.
Methods: Eight bovine enamel specimens per treatment group were prepared to P320-ground finish. To stain the enamel specimens, a fresh mixture of diammonium iron (II) sulphate 6-hydrate and tannic acid was applied as successive layers (10) on enamel specimens with drying at 40°C for 10 mins. Stained specimens were double- brushed for 1,000 strokes in a reciprocal action brushing simulator with four Oral B electric toothbrush heads (Precision Clean, Floss Action, Dual Clean and TriZone) and manual Oral B-P35 medium toothbrushes and using two commercial whitening and non-whitening toothpaste slurries (25g toothpaste in 40ml water). Tooth specimen colour was measured using a calibrated spectrophotometer before staining, after the 10 layers of stain application as well as after brushing for 1,000 strokes and stain removal efficacy was subsequently determined.
Results: Statistically significant differences in terms of stain removal were detected between the tested electric toothbrush heads and Oral B-P35 manual toothbrushes, which were dependent on the brushing directions (parallel or perpendicular) and toothpastes (whitening and non-whitening). There was a trend for greater stain removal with the whitening toothpastes for the same number of brush strokes, and compared with the perpendicular brushing direction, more stain was removed from the tested enamel specimens when stained enamel specimens were brushed in a parallel brushing direction.
Conclusions: The data obtained demonstrated the importance of toothbrush design and toothpaste formulation combination in new product development.

072

Synthetic mouse ameloblastin and amelogenin genes for overexpression studies

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Objectives: Amelogenesis is initiated by the production of a proteinaceous matrix to allow the deposition of hydroxyapatite crystals in a correct orientation prior to degradation. Ameloblastin (AMBN) and amelogenin (AMELX) are the two most abundant proteins found in the matrix of developing enamel and play a crucial role in biomineralisation. Mutation in such genes in humans is often associated with development of amelopathic disease in humans. The precise functional mechanism however in such roles is not well understood. In this study, we report on the generation of synthetic genes for mammalian overexpression studies in cell lines in vitro.

Methods: Codon-optimised mouse amelogenin and ameloblastin open reading frames were generated using gene synthesis with a codon-adaptive index (CAI) of 1 for mus musculus. Using recombinase-based ligation-independent cloning (Infusion), synthetic reading frames for mouse amelogenin isoform X1 and ameloblastin isoform X1 were cloned into 3 constitutive or inducible mammalian expression vectors (pCAG, pVax, pTetOne) and verified by sequencing. Subsequently, the amelogenin coding sequence will be further modified using site-directed mutagenesis to mimic the murine amelogenesis imperfecta mutation Y64H for further studies.

Results: Current transfection studies in mammalian cells are ongoing to determine gene-dose and mutation dependent differences in subcellular localisation, ER-accumulation and ER stress related to human disease. All expression systems have been verified by sequencing and are currently undergoing in vitro studies in human dental pulp stem cells and murine cell lines.

Conclusions: This project succeeded in successful codon-optimisation and synthesis as well as subcloning of 2 highly relevant genes for human amelopathies which will help to elucidate molecular mechanisms associated with these diseases in the future.

073

Investigating the Timing of Toothbrushing in Relation to Acid Challenges

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Objectives: Investigate the timing of toothbrushing with stannous (SnF_2) and sodium fluoride (NaF) dentifrices in relation to an acid challenge.

Methods: Natural unpolished human buccal molar samples (n=72, REC ref: 12/LO/1836) were randomly assigned to three groups testing commercial SnF_2 and NaF dentifrices (1450ppm at RDA 112 and 113 respectively) against an artificial saliva control. Samples were stored in natural whole mouth saliva overnight before random allocation to 2 subgroups: 30 strokes of abrasion (300g) either immediately before or after citric acid immersion (0.3%, pH3.2, 10min), and the cycle repeated 3 times with a 2h remineralisation period in saliva between exposures. Samples were scanned before and after with laser profilometry and TSM qualitative analysis. Volume Change and Sa Roughness data were analysed. Data were normal and analysed using a two-way ANOVA and post hoc Tukey's in SPSS vers 25.

Results: The mean volume loss/mm^2 (SD) for SnF brushing was 2.5µm (1.1) before erosion and 4.8µm (2.4) after erosion. The mean volume loss/mm^2 for NaF brushing was 3.9µm (2.0) before erosion and 4.3µm (1.5) after erosion. The interaction between dentifrice and timing was statistically significant for SnF_2 (p=0.047). In the control group (no dentifrice), the mean surface roughness (SD) decreased by 0.023µm (0.007) from baseline brushing before erosion compared to -0.044µm (0.014) after erosion. Sa roughness increased significantly following brushing with dentifrices (p<0.001). SnF_2 increased by 0.012µm (0.006) before erosion and 0.035µm (0.012) after erosion; NaF increased by 0.028µm (0.013) and 0.022µm (0.007) before erosion and after erosion respectively. The timing was not significant for NaF (p=0.470) but was for SnF_2 (p=0.037).

Conclusions: Brushing with SnF_2 dentifrice before an acid challenge resulted in lower volume loss and a smoother surface compared to brushing after with SnF_2 or brushing with NaF, irrespective of timing, on natural unpolished enamel surfaces. This may have implications for oral hygiene instruction.

074

Anisotropic Agarose Scaffolds as Novel Gene Activated Matrices for Mineralised Tissues

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Objectives: Regeneration of gradated dental tissue interfaces requires gene delivery modalities that can provide multiple, distinct morphogenic cues in a spatially controlled manner, preferably as morphogenic gradients to moderate the transition of tissue types for interface generation. Recently, an electrophoretic platform technology has been developed to control precipitation of plasmid-DNA-loaded phosphate-salt nanoparticles within an agarose hydrogel to spatially control nucleic acid drug delivery, biomineralisation and therefore transfection of progenitor cells such as dental pulp stem cells. A release study was conducted in simulated body fluid (SBF) to investigate the release of plasmid DNA (pDNA), calcium ions and phosphate ions from the loaded hydrogels.

Methods: Agarose hydrogels prepared in a phosphate-loaded buffer were sequentially loaded with pDNAs and calcium chloride solution, across a range of concentrations, using a novel electrophoretic platform to spatially control the precipitation of calcium-loaded, transfection-grade pDNA nanoparticles. Hydrogel samples were placed in SBF, incubated and sacrificed at time points. Suitable assays were used to analyse the release of pDNA, calcium ions and phosphate ions into the supernatant.

Results: Fluorometric DNA assays demonstrated that hydrogel systems with larger amounts of calcium-phosphate nanoparticles resulting from higher calcium concentration released smaller amounts of pDNA into solution. This indicates a dose-dependent complexation of the pDNA payload to calcium-phosphate nanoparticles. Meanwhile, colorimetric calcium and phosphate assays showed that an increasing amount of calcium-phosphate nanoparticles in hydrogel systems resulted in greater absorption of calcium and phosphate from solution, indicating osteoconductive and hydroxyapatite nucleating properties.

Conclusions: This release study demonstrates desirable bioactivity of biomineralised hydrogels in vitro using a relevant SBF solution. Further development of the novel electrophoretic platform will allow tunable nucleation and growth of the pDNA-nanoparticles to optimize transfection efficiencies. Meanwhile, the progression to a 3D- electrophoretic system will allow the production of multiple-phasic hydrogel scaffolds to instruct interfacial tissue and pulp tissue regeneration.

075

Changes in Tooth Yellowness with Age in a UK Practice-Based Population.

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Objectives: To investigate the relationship between tooth yellowing in relation to age in a UK practice-based population.

Methods: As part of a larger study that considered changes in overall tooth color with age. The upper right central incisor of 658 subjects, in age cohorts of 7-10, 11-17, 18-25, 26-35, 36-45, 46-55, 56-65 and >65 years was measured with the Vita EasyShade tooth color measurement device. From this device CieLab values were reported and subsequently perceptual yellowness values were calculated using a new yellowness equation optimised for tooth color (YIO). The relationship between age and tooth yellowness was tested using a linear regression model. Data are reported for b* (blue-yellow vector of CieLab) and YIO.

Results: As previously reported the youngest subjects' teeth became lighter (0.5 BG shades) for all metrics including YIO up to the age of around 18 years and then became increasingly darker. For this reason, the slope of the relationship between age and yellowness was evaluated in those subjects 18 years and above (n=526). For b* and YIO, the slopes of the regression were 0.133 and 0.914 respectively representing 7.5 and 1.1 years per unit change for each metric.

Conclusions: Teeth become linearly perceptually yellower with age above the age of 18 years. A single unit change in YIO representing 1.1 years.

076

Instruments measuring oral health and orofacial pain in dependent adults

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Objectives: Dependent adults have been shown to have a greater experience of oral health deterioration and orofacial pain that could adversely affect them. This is partly because oral health problems and orofacial pain are not easily detectable in dependent adults. Thus, this systematic review aimed to identify measurement instruments that assess oral health and orofacial pain in dependent adults and evaluate their measurement properties, interpretability and feasibility.

Methods: Seven bibliographic databases were searched: MEDLINE, Embase, CINAHL, CENTRAL, HTA, OATD and OpenGrey. Citations and reference lists were manually searched. Two reviewers independently screened titles and abstracts, and then full texts. A quality assessment of included studies was conducted independently by two reviewers using the four-point scored COSMIN checklist. The best evidence synthesis method was used to synthesise results from different studies for each measurement instrument. Best evidence synthesis was carried out by integrating findings from the quality assessment of the studies' methods, findings, from the evaluation of measurement property results and findings regarding the level of evidence quality.

Results: Eight oral health and three orofacial pain measurement instruments were identified from 16 included eligible studies. These studies evaluated reliability, contract validity and responsiveness of the measurement instruments. Methodological quality varied from poor to very good. None of the instruments performed sufficiently on all measurement properties. In addition, all instruments lacked patients' inputs during the development.

Conclusions: Several measurement instruments with a potential for future use were identified in this systematic review. However, more studies are needed to evaluate measurement error, content validity, structural validity, internal consistency and interpretability of these instruments. In addition, the instruments might benefit from using inputs from patient-centred conceptual models of oral health and orofacial pain, which possibly would allow the instruments to more comprehensively measure oral health and orofacial pain in dependent adults.

077

Validity and reliability of the Mouth Handicap in Systemic Sclerosis (MHISS) questionnaire in a UK population

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Objectives: The objective of this study was to explore the psychometric properties of the Mouth Handicap in Systemic Sclerosis (MHISS) specifically exploring aspects of validity and reliability of MHISS in UK SSc patients.

Methods: 150 questionnaires were distributed in this study at Oral Medicine Department of UCLHT Eastman Dental Hospital, the Outpatient Rheumatology Clinic of the Royal Free Hospital and Scleroderma Family Day. Participants were asked to complete three questionnaires (SF-36, OHIP-14 and MHISS) along with a proforma of demographic and disease-specific questions. Both convergent validity and internal consistency reliability were examined. The convergent validity was assessed by the Spearman's correlation coefficient and internal consistency reliability was assessed by Cronbach's alpha.

Results: Of the 150 questionnaires distributed to participants, 68 respondents included. With regard to construct validity, a low to moderate degree of convergent validity was found between MHISS total score and all SF-36 subscales. However, the total MHISS score was highly correlated to all OHIP subscales.

Conclusions: MHISS questionnaire is a self-administered quality of life measure that assesses the mouth disability in SSc patients. However, improving the global and oral health of SSc patients is essential as there is no cure for the disease thus instruments that record the impact of the condition and indicate the effect of treatment on the lives of patients are of paramount importance. Current results demonstrate good psychometric properties (validity and reliability) among the UK population. MHISS is recommended to be used routinely in clinical practice to assess mouth disability in patients with SSc.

078

Interventions Addressing Non-traumatic Dental Condition Presentations at A&E: Systematic Review

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Objectives: Patients presenting to Accident and emergency (A&E) departments with Non traumatic dental conditions (NTDC) place a burden on the National Health Service. Treatment of NTDC involves an operative dental procedure and non-dental clinicians lack the skill neither do they have the equipment to diagnose and treat NTDC. Patients presenting to A&E with NTDC are typically given medications (analgesics and antibiotics). Appropriate treatment of NTDC does not only cure the symptoms but may also prevent the problem returning. These patients pose a potential public health problem not just in the UK but also in countries such as the United States, Canada and Australia. This study aimed to systematic review the literature for available strategies to divert or prevent inappropriate A&E NTDC presentations.

Methods: A full study peer reviewed protocol is available: International prospective register of systematic reviews (PROSPERO CRD42019133846). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used. The review was limited to interventions in developed countries. A search strategy was developed and conducted for primary and secondary literature using key dental and emergency care related terms. Databases searched: MEDLINE ovid, EMBASE ovid, PsycINFO ovid, CINAHL via EBSCO, Scopus, Web of Science and Cochrane Literature from inception till January 2019. HMIC ovid, NICE evidence and Grey literature (ZETOC, MedNar, Google Scholar, Google and some relevant dental websites) were searched in May 2019.

Results: Interventions identified includes improving access to primary care dentistry, colocation of emergency dental services with A&E, patient education, referral systems, financial incentives and voluntary/charity dental programs.

Conclusions: The evidence suggest interventions such as colocation of emergency dental services with A&E, patient education and improved access to primary care dentistry could have promising results if applied in the UK. The application of some interventions in the UK could be limited by the difference in health care systems and would require collective efforts from stakeholders. More research is however required to test these interventions as the heterogeneity in the available literature limits the conclusion on their effectiveness in the UK.

079 WITHDRAWN

Audit Assessing Smoking Cessation Advice Provided on Emergency Dental Clinic

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080

Implementation of a Supported Self-management Intervention for Chronic Orofacial Pain: a theory, evidence and person based approach.

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Objectives: Background: Evidence from systematic reviews supports the use of self-management interventions in the management of chronic orofacial pain. However they are not routinely implemented in the clinical care of these patients. We have previously developed a supported self-management intervention and shown it to be feasible and acceptable in a pilot trial. Aim: To evaluate the impact of our supported self-management intervention, in secondary care patients with chronic orofacial pain, by measuring post intervention consultation rates, pain severity, interference with life and impact on co- morbid pain conditions.

Methods: The intervention was delivered to 66 patients with chronic orofacial pain (predominantly chronic burning mouth syndrome, chronic temporomandibular pain, and persistent idiopathic orofacial pain) attending the oral medicine department at Leeds Dental Institute. Process mining was used to outline patient care pathways and consultation rates before and after the intervention was implemented. Brief Pain Inventory (BPI) scores were used to measure pain severity and interference with life before and after the intervention.

Results: Process mining showed high rates of service usage with 31 patients also attending 51 other specialist clinics between them reflecting the prevalence of co-morbid conditions in this group of patients. Average monthly specialist clinic visit reduced from 0.23/month before the intervention to 0.15/month after the intervention (p-value = 0.008). BPI scores also significantly improved after intervention. Of 22 patients with BPI recorded before and after clinical consultation, mean pain severity score (standard deviation: SD) reduced from 5.70 (1.89) to 3.78 (2.34); mean pain interference score (SD) reduced from 19.95 (9.41) to 12.05 (9.64).

Conclusions: Supported self-management for chronic orofacial pain has a positive impact on patient quality of life and service usage when implemented in secondary care. Early management to prevent chronicity by implementation in primary care should be a priority for future testing.

081

Longitudinal Effect of Rituximab on Salivary Gland Histopathology in Primary Sjögren's Syndrome.

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Objectives: To assess the effects of Rituximab on inflammatory aggregates and ectopic lymphoid structure (ELS) formation in salivary glands (SG) of primary Sjögren's syndrome (pSS) patients as part of the clinical Trial for Anti B- Cell Therapy In patients with primary Sjögren's Syndrome (TRACTISS) cohort.

Methods: 26 subjects randomised to Rituximab or placebo given at weeks 0, 2, 24 and 26, consented for SG biopsy and blood collection at baseline, weeks 16 and 48. SG biopsies were stained for haematoxylin and eosin, assessed at 2 cutting levels by 2 independent observers for focus score (number of mononuclear cell aggregates with at least 50 inflammatory cells in $4mm^2$ SG tissue area), aggregates average size and area fraction. Immunofluorescence staining was performed for ELS markers: B-cells (CD20+), T-cells (CD3+), follicular dendritic cells (CD21+) and plasma cells (CD138+). Circulating immunoglobulins (IgG, IgM, IgA), rheumatoid factor autoantibody and complement C3/C4 levels were measured in patient sera.

Results: Circulating IgG, IgM and IgA immunoglobulin levels directly correlate with SG focus score, area fraction and average size of aggregates at baseline. B-cell area fraction correlates positively with circulating IgM, while T-cell area fraction correlates with both IgA and IgG levels, supporting B-cell class switching and SG inflammation. This was also confirmed by the inverse correlation between T-cell area fraction and C3/C4 complement levels at baseline. Compared to placebo at week 48, aggregate average size and area fraction were reduced in the Rituximab arm due to a lack of B-cell accumulation over time.

Conclusions: Peripheral markers of B-cell hyperactivity reflect ongoing SG inflammation. Preliminary histological results show that Rituximab prevents worsening of SG inflammatory infiltrate size when compared with placebo, by preventing new B-cell infiltration, rather than affecting T-cell infiltration. This may explain significant clinical improvements observed in the unstimulated salivary flow in the Rituximab group.

082

Agreement in Clinical Decisions Regarding Root Angulation Based on Panoramic versus Cone-Beam CT Images

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Objectives: To compare clinical decisions made based on Panoramic (PAN) versus Cone-Beam Computed Tomography (CBCT) images regarding the correction of root angulation and root proximity.
Methods: A total of 864 teeth from 36 existing patient records with concurrent PAN and CBCT images were examined by two orthodontists first using PANs, then using CBCTs in a blinded manner. Each tooth was rated regarding the need for root repositioning, the direction of repositioning and existence of root proximity. Frequencies, percentage- agreement, and intra- and inter-examiner Cohen's kappa were calculated.
Results: There was 73.7 to 84.5% agreement in clinical decisions between PANs and CBCTs. Root proximity was more frequently reported on PANs than CBCTs ($p=0.048$ and $p<0.001$). Both PANs and CBCTs had substantial intra- examiner, within-radiograph-type reliability with Kappa values of 0.686 to 0.79 for PANs, and 0.661 for CBCTs ($p<0.001$). Inter-examiner and inter-radiograph-type Kappa values were moderate ranging from 0.414 to 0.51 ($p<0.001$). Assuming CBCT decisions were correct, 78.9% of PAN decisions were classified as "correct", 9.3% as "missed reposition", 11.3% as "unnecessary reposition", and 0.3% as "wrong direction".
Conclusions: PAN-based clinical decisions regarding root angulation were as reliable as CBCT-based clinical decisions.

083

Changes in the gingival margin after intrusion of supraerupted molars

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Objectives: To investigate the positional changes of the gingival margin after intrusion of the supraerupted molars.

Methods: Ten patients (4 men and 6 women; mean age, 33.7 years) with 10 supraerupted molars were treated using mini-implants. To quantify tooth movement, 3D virtual models were superimposed on a coordinate system and the positional changes of the tooth on the x-, y-, and z-axes were measured at the tip of each cusp. To quantify gingival movement, the clinical crown length in the 3D virtual models was measured with a program. To evaluate periodontal responses, periodontal indices and changes in alveolar crest levels were recorded at pre- and post-treatment.

Results: A supraerupted molar was intruded by a mean amount of 1.31 ± 0.39 mm on the buccal cusps and 1.21 ± 0.59 mm on the palatal cusps. The gingiva margin on the buccal cusps moved about 1.23 mm and that on the palatal cusps moved about 0.32 mm in the same direction per 1 mm intrusion of the supraerupted molar. In addition, there were insignificant changes in the periodontal indices in the supraerupted molar between pre- and post-treatment.

Conclusions: The amount of gingival covering on the buccal side of the supraerupted molar appears to be highly correlated to the amount of intrusion compared to that on the palatal side. Periodontal condition was well maintained after intrusion of the supraerupted molar.

084

Effectiveness of intervention to promote oral hygiene behavior of children during hospital stay and on discharge from hospital to home: a systematic review

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Objectives: This systematic review explored the evidence of any intervention to promote oral hygiene behaviors of children during hospital stay and/or on discharge.

Methods: DATA SOURCES: Eight databases (MEDLINE, COCHRANE, EMBASE, CINAHL, GLOBAL HEALTH, Web of Science, Scopus and PsycINFO) were searched for randomised control trials, experimental studies, longitudinal observational studies, before and after studies and case-control studies up to May 2018.

STUDY SELECTION: Studies included were based on PICOS elements (Population, Intervention, Comparison, Outcome, and Study design) for inclusion of studies.

DATA EXTRACTION: Based on the inclusion criteria, two reviewers independently reviewed the titles and abstracts and no disagreement was found. When a study met the initial inclusion criteria or information was insufficient to exclude, full-text articles were obtained. Subsequently, full-text of included studies from the initial title/abstract screening were obtained and reviewed independently by two reviewers. The references cited in the reviewed articles were checked to identify any further potential studies.

Results: One thousand, one hundred and eighty-eight papers were identified through electronic searching. Eleven abstracts were screened after removing the duplicates and non-relevant papers. Three papers from the 11 abstracts were considered for full-text screening. The full-text screening led to identifying and adding four hand-searched articles. Two studies were eligible to be included in the review after full text screening.

Conclusions: The currently available evidence of any intervention promoting oral hygiene behaviors of hospitalized children who are not in the ICU is weak. Hence, this review cannot provide oral hygiene recommendations for hospitalized children. However, this review identifies more research is warranted to develop evidence-base to which interventions are appropriate for hospital setting, how to deliver the intervention and how to ensure sustainability.

085

Effects of Electronic Cigarette Liquid on Oral Mucosa Wound Healing

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Objectives: This in vitro laboratory study aimed to highlight the effects of E-cigarette liquid on oral mucosa wound healing ability by using monolayer cell culture systems including both normal oral fibroblasts (NOF) and immortalized oral keratinocyte (OKF6) cell line.

Methods: Monolayer cell culture systems were developed and divided into negative control (exposed to culture medium), positive control (exposed to ethanol 70%) and test groups exposed to various E-cigarette concentrations (0.1%, 1%, 5% and 10%). Wounds were produced in the middle surface of the monolayer systems vertically using a disposable cell scraper. The test groups were cultured with E-cigarette liquid without added flavours, before and after creating a wound and then the wound was monitored until complete healing had occurred. Microscopic images were obtained pre- and post-wound creation on a daily basis to assess the healing time in both groups.

Results: Exposure to E-cigarette liquid with concentrations of 1%, 5% and 10% caused statistically significant difference in the time of oral wound healing of both NOF and OKF6 compared to control groups (p-value < 0.05). However, the 0.1% concentration of E-cigarette liquid group showed no statistically significant difference (p-value > 0.05).

Conclusions: E-cigarette liquid compromised the capability of oral mucosa wound healing in both NOF and OKF6 cell cultures.

086

Periodontal Pathogens Induce Epithelial-Mesenchymal Transition in a Periodontitis Model

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Objectives: Bacteria associated with subgingival plaque may initiate periodontitis through a persistent inflammatory response via epithelial-mesenchymal transition (EMT) signalling. This study aimed to determine the effects of periodontal pathogens on oral keratinocyte proliferation and viability and to investigate whether pathogen challenge increased EMT inducing pro-inflammatory cytokine release and associated changes in gene expression.

Methods: Porphyromonas gingivalis (P.gingivalis), Fusobacterium nucleatum (F.nucleatum), Campylobacter rectus (C.rectus) and Treponema denticola (T.denticola) were cultured anaerobically and characterised by culture, Gram staining and PCR. Bacteria were then heat-inactivated (HI) at 80^{O}C for 1 hour or oxygen-inactivated (OI) in atmospheric conditions and applied to oral keratinocyte cultures in a 100:1 bacteria to epithelial cell ratio. Enzyme- linked immunosorbent assay (ELISA) was performed for IL-1β and TGF-β1 on culture supernatants collected at days 1, 5 and 8. Semi-quantitative reverse transcriptase-polymerase chain reaction (Sq-RT-PCR) was performed for epithelial and mesenchymal markers at 8 day cultures.

Results: OI F. nucleatum challenge reduced keratinocyte growth significantly ($1.06x10^{6}$ to $6.6x10^{5}$ cells) and viability significantly (99.2% to 92.4%) when compared with control. Cultures challenged with HI P. gingivalis and HI F. nucleatum caused significant increase in TGF-β1 (282.6ng/ml to 414.6ng/ml) and IL-1β (116.1pg/ml to 155.8pg/ml) release. OI F. nucleatum caused significant release of IL-1β (62.5pg/ml to 102.7pg/ml) compared with control. HI F. nucleatum down-regulated epithelial marker E-cadherin expression (1 fold) and up-regulated mesenchymal marker N- cadherin expression (1 fold). HI P. gingivalis and F. nucleatum significantly upregulated expression of the key-EMT transcriptional factor, Snail-1 (1-2 fold).

Conclusions: Oral keratinocyte exposure to HI periodontal pathogens caused significant release of pro-inflammatory cytokines IL-1β and TGF-β1 and up-regulated expression of Snail-1, which is a strong repressor of E-cadherin. This loss of E-cadherin and increased N-cadherin after HI F. nucleatum exposure may lead to EMT induction characterised by breakdown of epithelium cell adhesion and loss of associated barrier function in periodontitis.

087

Role of PGE2 in the Pathogenesis of Asymptomatic Apical Periodontitis

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Objectives: Prostaglandin E2 (PGE2) is considered to be a mediator for the initiation and perpetuation of bone resorption. A possible role in the pathogenesis of asymptomatic apical periodontitis (AAP) is supposed. The study is focused on the induced secretion of PGE2 by peripheral blood mononuclear cells (PBMCs) isolated from patients with AAP and its relationship to the clinical characteristics of the disease.

Methods: Patients (n=20) diagnosed with AAP were enrolled in the study. The lesions' volumes were assessed by limited-volume cone beam-computed tomography (limited FOV CBCT). The volumetric measurements were calculated with automatic threshold volume generation. PBMCs were isolated from peripheral blood samples, cultivated in RPMI 1640 medium and stimulated with E.coli LPS. The supernatant was collected at two time points - 24th and 48th hour. PGE2 levels were determined by ELISA.

Results: PGE2 levels were higher at the 48-h time point compared with the 24-h time point. PGE2 levels detected in the supernatants of LPS-stimulated cultures of PBMC were significantly lower than in the unstimulated ($p=0,014$). No correlation between the lesion volume and PGE2 levels was determined.

Conclusions: We suggest that time-dependent secretion of PGE2 might reflect tissue destruction.

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088

Anti-inflammatory effects of cannabidiol to modulate induced inflammation on gingival-keratinocytes.

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Objectives: Periodontitis is a chronic inflammatory disease affecting oral tissues characterised by a destructive inflammatory process affecting tooth-supporting tissues. It can result in periodontal pocket formation, alveolar bone resorption and, eventually, tooth loss. The continuous challenge of host immune and resident cells and their virulence factors, such as lipopolysaccharide (LPS), results in enhanced and uncontrolled secretion of cytokines. Recently, cannabinoids have been discussed widely due to their therapeutic properties showing promising results in the treatment of various chronic inflammatory diseases. To evaluate the capacity of cannabinoids CBD to influence the secretion of inflammatory mediators in telomerase- immortalized human gingival epithelial (TIGK) cells induced by lipopolysaccharides (LPS) and flagellin.

Methods: The effect of different concentrations of CBD on the viability of TIGK cells was evaluated. TIGK cells were treated with various determined non cytotoxic concentrations of CBD prior to being stimulated or not stimulated with LPS or flagellin. The ability of CBD to modulate the release of interleukin (IL)-8 in TIGK cells was then evaluated at mRNA and protein level.

Results: The results obtained showed that CBD was cytotoxic at concentration 100 µM but not cytotoxic at concentrations below 10 µM on TIGK cells. CBD was able to modulate the expression and production of pro- inflammatory cytokine IL8 induced by LPS/flagellin; it decreased the expression of IL-8 by 325 times at mRNA and by 60-70 % at protein level.

Conclusions: The ability of CBD to determine immunomodulatory effects could provide possible therapeutic applications in the field of periodontal research.

089 WITHDRAWN

Defining xenobiotic metabolism in the oral mucosa to improve drug delivery.

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090

Development of a Clinically Relevant Index for Toothwear Treatment Needs

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Objectives: The aim of this study was to develop a toothwear classification system which combined the extent, severity, and aesthetic impact of toothwear and correlated them with the best clinical management strategy.

Methods: Three-hundred photographs of toothwear cases were used to develop a classification tool which contained four levels of severity and aesthetic impact (0, 1, 2, and 3) in three age groups of patients. Ten examiners assessed and classified the cases using validated forms. Additionally, they selected the recommended treatment modality for each level. The analysis was conducted using a coefficient correlation test.

Results: The coefficient correlation for the severity was 0.81, and 0.82 in the upper anterior and posterior segments, and 0.85 and 0.77 for the lower anterior and posterior segments respectively. The aesthetic impact correlation coefficient was 0.84. Examiners had agreed that most minor cases required monitoring or the simple restorative interventions. The moderate level cases had variety in the recommended management options depending on the aim of treatment. The severe level cases often required restoration of the function and aesthetic at an increased occlusal vertical dimension.

Conclusions: Within the limitations, a good agreement between the examiners was found using the provided tools. More strict criteria in the classification part of the tool can further improve the examiners agreement.

091

Effect of denture cleanser ingredients on in vitro stain removal

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Objectives: Denture cleansing is essential for the maintenance of good oral health. Removal of stain is an important and visible sign of good maintenance of a clean denture which is highly desirable for denture wearers. The effectiveness of denture cleansers at bleaching or removing stain can be modelled using acrylic substrates in vitro. The primary contributors to cleanser efficacy are reactive oxygen species (ROS) generated from ingredients such as sodium percarbonate (PC), potassium monopersulphate (MPS) and tetraacetylethylenediamine (TAED).

The objective of this study was to evaluate the effect of denture cleanser reactive oxygen species on the bleaching or removal of stain from acrylic substrates by in vitro testing.

Methods: Blends of denture cleanser ingredients were prepared in powder form using a two-level factorial design approach to assess the contribution of PC, MPS and TAED. Acrylic slides were stained using a standardised, reproducible chlorhexidine-tea cycling protocol to mimic denture staining. The different powder blends were added to 150 mL of water and acrylic slides added. The extent of stain removal/bleaching was assessed using reflectometry after 10mins treatment at 40°C and data was analysed using Design Expert® software to determine effects of ingredients alone or in combination and to identify synergistic or antagonistic effects.

Results: The data analysis assigned a significant factorial model based on ANOVA analysis of variance ($p=0.03$). MPS and PC individually provided significant contributions to stain removal/bleaching (65% and 12% at 10mins, respectively). Synergistic effects were observed between TAED and MPS and between MPS and PC (both resulting in 6% stain removal).

Conclusions: The study has demonstrated that the ROS-generating materials MPS and PC were able to reduce significantly tea stain on an acrylic substrate in an in vitro model after a relatively short exposure time. Further investigation of the effects on in vitro removal of a multi-food stain are planned.

092

Endocrown Restorations: A Systematic Review of Prospective Clinical studies

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Objectives: A systematic review was conducted to evaluate the long term clinical outcome of endocrown restorations compared to conventional treatments (post-core crowns, peripheral crowns, inlay/onlay, and direct composite resin).

Methods: This report followed the PRISMA Statement. A systematic literature search in electronic databases in addition to manual searches was conducted to identify prospective clinical trials and observational studies reporting on the clinical outcome of endocrown single tooth restorations compared to conventional restorations. Articles selection was performed according to set inclusion and exclusion criteria, followed by data extraction, and quality assessment for the included studies.

Results: The systematic literature search revealed that no RCT's are available to date on endocrown single restorations and only three studies fulfilling the inclusion criteria were identified. Due to the heterogeneity of these studies, only descriptive analysis was performed. According to the included studies, endocrown restorations seemed to perform similar to conventional restorations when applied to molars with a survival rate ranging from 87% - 99% for endocrowns and from 92% - 99% for conventional restorations. However, regarding premolars, conventional crowns showed a higher survival rate which ranged from 93% - 97% compared to a survival rate of 68% - 75% for endocrowns. The main cause of failure for endocrown restorations was reported to be adhesive failure and loss of retention.

Conclusions: Due to the lack of RCT's and inconsistency of the clinical data that have been published, no conclusive evidence favours endocrowns over conventional restorations or vice-versa. Further studies and especially clinical trials with long follow-up periods and RCT's are required.

093

Identifying internal change in teeth in response to external challenge using X-ray microtomography

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Objectives: The aims of this project are to study the defence mechanism in teeth using X-ray microtomography and to investigate the interaction of the external and internal damage or restoration with the biological response of the pulp (including the composition of peritubular and sclerotic dentine).

Methods: The aim is to collect multiple samples of extracted teeth subjected to a variety of dental insults prior to extraction from patients of different age groups and scan these teeth with a high contrast X-ray microtomography (XMT or micro-CT) to identify the paths of hypermineralization within the dentine. In addition to XMT, SEM and synchrotron X-ray diffraction will be used to determine the nature of the mineral that is formed. Although the mechanism(s) for both reactive and reparative dentine formation is understood, preliminary studies have suggested that mineral transport through the dentine tubules may also have a protective effect.

Results: This study is explorative in nature, but preliminary results indicate that the formation of peritubular dentine within the tubules link the pulp to the site of injury. Large areas of exposed dentine tubules as a result of caries, abrasion, wear, cracking, etc., form peritubular dentine in response, and possibly contributing to remineralisation or mineral formation. This observation has previously been based on anonymised teeth and therefore we cannot rule out the effect of age changes. This study will collect data including patient age, gender and ethnicity at the time of extraction in attempt to resolve this problem.

Conclusions: Collecting a detailed dental history prior to extraction using anonymized data, can be beneficial in determining the responses from any previous dental insult. Increasing our understanding of the natural defences will in turn enable therapeutic developments to take advantage of these processes.

094

Correlation Of ICP-OES Parotid Saliva Trace Element Concentration With ICDAS-score

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Objectives: Human parotid saliva contains many trace metals ions, whose function is not always identified. The aim was to measure the concentration of specific inorganic elements (K^+, Na^+, Ca^{2+}, Al^{3+}, Sr^{2+}, Li^+, Zn^{2+}, Mg^{2+}) in human parotid saliva using of Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES). The parotid saliva concentration of each element was then correlated with the International Caries and Assessment System (ICDAS) in a group of subjects from Northen Italy.

Methods: Stimulated parotid saliva samples from 21 (11 male and 10 female) subjects were collected using the Lashley cup method. Each sample was analysed using ICP-OES to determine the elemental parotid saliva composition of each sample. Also, flow-rate and pH were recorded. Clinical caries scores for each subject were classified using the International Caries Detection and Assessment System (ICDAS). The correlation of each element concentration with the ICDAS score for each subject was statistically analysed using Pearson's Correlation test.

Results: Parotid salivary flow rates ranged from 0.07 to 0.42 ml/min. The pH ranged between 5.85 and 7.6. ICP-OES analysis of each element revealed that the mean concentration (± standard error) of elements was: Al^{3+} 0.35±0.09ppm; Ca^{2+} 4.88±0.46ppm; K^+ 44.45±3.36ppm; Li^+ 0.30±0.08 ppm; Na^+ 7.79±1.43ppm; Sr^{2+} 0.16±0.04ppm; Zn^{2+} 0.08±0.01ppm, Mg^{2+} 0.13±0.02ppm. The concentrations of Al^{3+}, Sr^{2+} and Li^+ were correlated (negatively) with the ICDAS score, whereas the other elements were not. Only the concentration of Mg^{2+} was (negatively) correlated with the pH, and the flow rate.

Conclusions: The use of ICP-OES in conjunction with ICDAS provides comprehensive analysis of saliva composition in relation to dental caries. A higher concentration of Al^{3+}, $Sr^{2+}$and Li^+were found in subjects with a lower caries score (ICDAS), suggesting a cariostatic role for these elements. The concentration of Mg^{2+} correlated with a more acidic pH and a reduction in the flow rate.

095

Conditioned Medium from Dental Pulp Stem Cell Cultures stimulate proliferation and differentiation of PC-12 Neuronal cells

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Objectives: Evidence indicates that dental pulp stem cells (DPSCs) secrete neurotrophic factors which may play an important role in neural development, maintenance and repair. The PC-12 cell line is considered a suitable model for neuronal cell differentiation and survival. This study aimed to investigate the neurotrophic effects of DPSCs on PC-12 cells.

Methods: DPSCs were harvested and cultured from 2-3 weeks' old rat incisors. Subconfluent cultures at passage 3-4 were serum-starved and the conditioned medium (CM) was collected after 3-days' incubation. Neurotrophic factors BDNF and NGF in DPSC-CM were analysed by specific rat enzyme-linked immunosorbent assays (ELISA). The effect of DPSC-CM on the survival and growth of PC-12 cells was evaluated by Live/Dead and MTT assays. The number of differentiated cells with neurite outgrowths and the length of neurites from each differentiated cell were measured using Image J analysis. Immunocytochemical staining was used to evaluate the expression of neuronal markers NeuN and MAP-2.

Results: PC-12 cells treated with 50ng/ml NGF for 8 days differentiated into neuronal-like cells characterised by typical neurite outgrowths. PC-12 cells exposed to 50% DPSC-CM displayed a similar pattern of extensive neurite outgrowth and high degree of neuronal differentiation as compared with controls. Moreover, the number and percentage of viable PC-12 cells was significantly higher in DPSC-CM in comparison with controls. Immunocytochemistry of NeuN and MAP-2 demonstrated positive immunostaining in the NGF and DPSC-CM differentiated PC-12 cells. Negative control cultures didn't show any neural phenotypic features. ELISA indicated the presence of NGF and BDNF in DPSC-CM, two important factors in neuronal cell survival and differentiation.

Conclusions: The results demonstrate that DPSC-derived trophic factors promote survival and differentiation of PC-12 cells. Further studies are ongoing to utilise this model to investigate the mechanisms and application of DPSCs for neuronal neuroprotection and regeneration.

096

Evaluation of Strategies for Human Skin 3D Bio-Printing

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Objectives: Three-dimensional in vitro organ equivalent systems are highly desired for the research in regenerative medicine and cancer biology, as well as in pharmacology and cosmetic industries. Organs such as skin and mucosa undergo dynamic cell proliferation and differentiation programs in the epidermal compartment that require constant molecular support from the underlining stroma. In this study, we aimed to optimise a favorable strategy in 3D bio- printing human skin.

Methods: 3D bio-printed collagen and hydrogel-based biomaterials with different printing and crosslinking techniques were used to first reconstruct the stroma environment by seeding or mixing fibroblasts with different hydrogel based bio-materials. The cell migration rate and viability were evaluated using 3D imaging and measurement. The constructed models were then used to support keratinocyte stratification and differentiation for up to 3 weeks. The basement membrane formation and stem cell status, as well as cell proliferation and differentiation were assessed with immunohistochemistry using specific antibodies, as well as cell cycle indicator systems. The stroma collagen deposition and remodelling were quantified using 3D imaging.

Results: Using micro-extrusion 3D bio-printing techniques we identified a nano-fibrillar cellulose alginate bio-material that is superior for both the bio-printing process and supporting dermal fibroblast culture. We found that the collagen cross-linking methods highly affect fibroblast viability and mobility within the bio-materials. Keratinocyte initial seeding and subsequent stratification required accompanying dynamic changes of calcium concentration to allow for terminal differentiation and subsequent stratification of epidermal cells for a full thickness skin model invitro.

Conclusions: We conclude that an efficient 3D skin bio-printing strategy requires mimicking stroma anatomical details as the first step to facilitate desired epidermal layer formation.

097

Prescribed medication in dental hospital outpatients: Changes over three decades

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Objectives: To compare the number and types of medications taken by dental outpatients in 2017 with data from 1995 and 1983.

Methods: The prescribed medication for 200 consecutive outpatients at Leeds Dental Institute was collected. The number of medications was grouped into 'No medication', 'One medication', 'Two medications' or 'Three of more medications'. Each medication taken by a patient was classified into a drug category according to the British National Formulary. The data was compared to previously collected data from 1983 (500 patients at University College London Dental School) and 2005 (200 patients at Newcastle Dental Hospital). The data was analysed for significant change using an extended chi test.

Results: 32.0% of patients in 2017 took 3 medications or more. This is a significant increase from 13.0% in 1995 and 5.6% in 1983. Only 46.0% of patients took no medication, which is a significant reduction from 57.0% in 1995 and 57.6% in 1983. 102 different medications were taken in 2017, compared to 79 in 1995. Both of these samples were of 200 patients. In 1983 only 32 different medications were taken in a larger sample of 500 patients. The most common drug categories varied over the decades. Significantly more antimicrobials were being taken in 1983.

Conclusions: There has been a dramatic increase in the proportion of hospital outpatients taking medications in 2017 compared to 1995 and 1983. A significant proportion of the patients in this sample are polypharmacy patients. Medications can have oral side effects and can interact with medications commonly prescribed by dentists, and the more that a patient takes, the more likely they are to experience these problems. An increasingly wide variety of medications are taken by dental patients. Focused pharmacological training is essential for the safe delivery of dental care, as well as regular CPD.

098 WITHDRAWN

A clinical audit to improve orthodontic assessment in primary practice

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The Surgical Management of External Cervical Resorption: A Retrospective Observational Study

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Objectives: 1. To assess the survival and clinical success of individual teeth with external cervical resorption (ECR) who underwent surgical repair; 2. To assess inter and intra-observer agreement in using two different classification system for ECR. (Hiethersay classification, CBCT 3D classification).

Methods: A retrospective study was carried out in a Teaching Dental Hospital in England. The inclusion criteria was limited to patients who underwent surgical management of ECR between 2015 and 2018. Periapical radiographs and CBCT scans of 13 patients were assessed by 2 independent dental practitioners using (Heithersay's and CBCT 3D classification). The same radiographic assessment of those records was then repeated three weeks later by one operator. Inter and intra observer agreement was tested using Cohen Kappa test.

Results: A total of 14 teeth affected with ECR were identified in 13 patients (6= female, 7= males) with a mean age of 41y. On presentation 46% (n=6) reported symptoms associated with the affected tooth. The mean follow-up was 18 months. At follow up survival was noted in all cases (n=13) however, clinical success describing endodontic success, comprehensive restorative integrity and arrest of resorptive process was only met in 11 cases. A measure of Cohen's kappa regarding inter-observer reliability of 2D vs 3D classifications (Table 1).

Conclusions: ECR is a complex, aggressive and uncommon form of external resorption. Long-term success of the treatment is predictable but strictly related to careful case selection and high operative skill. In reference to ECR classifications, ambiguity still exists between their distinctive categories and further improvement is required to enhance inter-observer agreement.

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Variations in fluoride varnish application across England and Wales over the last 6 years

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Objectives: Preventing caries is both cheaper than treating established caries and has better outcomes for the patient. Delivering Better Oral Health advises regular fluoride varnish (FV) application to children's teeth at regular intervals based on their caries risk. This project aimed to assess whether dentists are following this guidance.

Methods: FoI requests were made the NHS Business Services Authority to obtain data on the number of courses of treatment for children aged 3-16 years and the number containing a claim for FV during the last 6 years for all NHS GDPs in England and Wales. Postcode data for each of the practices was also obtained.

Results: In England and Wales in the year 2012/13 19.68% of courses of treatment for children contained claims for FV application, this rose to 51.24% in 2017/18. This increase was seen across all 34 NHS Area Teams. There was clear geographical variation - more claims for FV in the North (59.86%, 2017-18) than the South (46.08%, 2017-18) and Wales (29.17%, 2017-18). Practices in the South Yorkshire and Bassetlaw consistently applied the highest amounts of FV over the 6 years examined.

Conclusions: Claims for FV application have increased 2012-2018 but are still short of the 100% target advised by DBOH. There are several explanations for this increase in claims including altered clinical practice and altered claiming habits. South Yorkshire and Bassetlaw was the area team with the highest FV application rate, one reason for this could be related to the new requirement to document the date of last FV application when making paediatric secondary care referrals. The geographic variation is difficult to explain.

FV application appears to be increasing, targeted work could be done to encourage dentists in the worst performing areas to change their practice.

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Erosive changes on dentine by evaluating surface loss

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Objectives: Tooth wear is a multifactorial condition; chemical, biological and behavioral factors are involved in the aetiology and pathogenesis of tooth wear. Most studies on erosive tooth wear have focused on the reaction to acids of enamel. But dentine, once exposed, is the primary tissue involved with severity. If left untreated, it may affect the longevity of teeth and eventually, the patient's quality of life. The aim of this study was to investigate the effects of citric acid on polished dentine by evaluating surface loss.

Methods: Dentine specimens (n=110) were cut from the coronal aspect of previously extracted human molars. Specimens were polished to achieve a flatness tolerance of ±0.9µm confirmed by surface profilometry. Adhesive tape, applied to the surface, was used to create a window of exposed dentine and two protected zones of reference in 1:3 ratios. The samples were randomly divided into 11 groups (n=10) each treated with 0.3% citric acid at pH 3.2 or pH 2.7 and fully immersed and stirred at 60rpm for 5, 10, 15, 20 or 25 mins, respectively, with the last group serving as the control (distilled water). The mean step height was measured using confocal non-contact white light laser profilometry.

Results: The mean step height at pH 3.2 ranged from 0.72um and standard deviation(SD) 0.5um for the control in distilled water and at 5, 10, 15, 20 and 25 mins were 1.07 (0.32), 2.85 (0.46), 3.98 (0.4), 5.64 (0.88) and to 5.85um (0.89um) respectively. At pH 2.6 the results were 1.82 (0.46), 4.97 (0.96), 6.71 (0.56), 8.35 (0.79), 9.37 (0.85) for each time period and 0.72 (0.5) in distilled water.

Conclusions: Dentine erosion increased with increasing the time of exposure to citric acid as well as decreasing the pH value of the acid.

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Provisional before definitive restoration of dental implants: A systematic review.

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Objectives: A systematic review comparing differences in treatment outcomes between de novo placement of definitive fixed implant supported restorations compared to the prior use of provisional fixed implant supported restorations.

Methods: The study protocol was registered (PROSPERO- CRD42018093236).

Selection Criteria: Search included randomised controlled trials (RCT), systematic reviews and Cohort/Case Control studies in English language.

Search Strategy: Electronic Data base (Medline via OvidSp, Embase), Hand search (journals and reference lists from articles eligible for inclusion additionally searched and grey literature).

Data collection and analysis: Data were independently extracted by two review authors (AD and GM) and analysed. Disagreements were mitigated with a third reviewer (BA). A quality assessment of included studies was undertaken using GRADE approach, and risk of bias was assessed using the Cochrane Collaboration risk of bias for RCTs.

Results: 440 articles were identified after removal of duplicates. After title and abstract screening, 14 articles remained. 7 were further excluded with 7 remaining for qualitative analysis. All 7 included studies were RCTs (high quality – GRADE), 5 of which were multicentre studies. The outcomes investigated included aesthetics, patient satisfaction, peri-implant soft tissue, crown prosthesis failure, implant survival and marginal bone loss. Statistically significant results were found by individual studies for the effect of provisional restorations on marginal bone levels, patient satisfaction and aesthetics. However, there was insufficient evidence to support/refute the practice of fitting a definitive fixed implant supported prosthesis as compared to the prior use of a provisional restoration. Meta-analysis was not performed due to heterogeneity of designs, interventions, comparators and outcome measures of these studies.

Conclusions: Current clinical practice appears to be based mainly on the experience of the clinician rather than evidence. To our knowledge, no similar systematic reviews have been published that depict the lack of evidence available to guide clinicians in this clinical situation.

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Mechanical assessment of 3D-printed PMMA filament for denture base applications

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Objectives: Polymethylmethacrylate (PMMA) has been broadly used as denture base material and its formulation and manufacturing routes have undertaken significant developments within the past 10 years; one example of the development of new PMMA-based materials has been the introduction of PMMA 3D printing filaments. The use of 3D printing PMMA filament is a potentially cost-effective approach for the production of denture bases from a digital scan; although using a filament-based manufacture approach (Fused Deposition Modelling, FDM) is attractive, little is known regarding the mechanical properties and surface finish of 3D printed PMMA denture bases. This study aimed to explore the potential to use commercially available PMMA 3D-printing filament for creating denture bases via developing a comparative study exploring the mechanical properties offered by a range of acrylate-based constructs manufactured via conventional and new fabrication methods.

Methods: Samples were distributed within five main groups: Cold cure acrylic resin and heat cure acrylic resin, Milling, and 3D printing (FDM & Stereolithography (SLA)). 3D printed samples divided into three subgroups depending on printing orientation: X,Y&Z. Mechanical testing (flexural strength, impact strength) followed ISO 20795-1:2013 specifications. In addition, the hardness of the samples was analysed using Vickers Hardness test. The data was analysed using one–way ANOVA.

Results: all orientations of the experimental 3D printed PMMA filament performed close to the ISO requirements for flexural strength while only two orientations (X&Y) passed the ISO requirements for impact strength. For hardness, conventional samples showed highest hardness values among tested groups and all groups showed glossy appearance after polishing.

Conclusions: Orientation of printing layers of FDM was crucial for evaluating the mechanical properties, with high properties being achieved when the layer orientation was perpendicular to the direction of load. Further research needs to be done to ensure PMMA 3D-printing filament can achieve other clinical requirements of denture base materials.

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Covalent attachment of osteogenic peptides to synthetic calcium phosphate biomaterial surfaces for bone tissue regeneration

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Objectives: Synthetic calcium phosphates are successfully used as bone graft substitutes. There is, however, an unmet clinical need for a biomaterial that stimulates more consistent bone tissue regeneration in elderly or compromised patients. One potential solution is the addition of covalently attached biologically active peptides that imitate the function of proteins involved in natural bone healing. Published methodologies report the need to plasma polymerise acrylic acid on the surface of a material prior to peptide binding, but it is unknown whether this pre- treatment is required for calcium phosphates.

Methods: Calcium phosphate discs were prepared using a gel casting with a medical grade calcium phosphate powder. Sintered discs were characterised using x-ray diffraction. Acrylic acid was deposited onto the surfaces of the discs via plasma polymerisation, grafting carboxylic acid functional groups to the discs. The grafting density of carboxylic acid groups was determined using a Toluidine Blue titration assay. A biotinylated GFOGER hexapeptide was bound to both the plasma treated and untreated discs using carbodiimide chemistry. The quantity of peptide attached to the discs was determined by the immobilisation of streptavidin-horseradish peroxidase (HRP) conjugate, with the amount of horseradish peroxidase present acting as a function of peptide grafting density. This was determined by the HRP catalysed oxidation of tetramethylbenzidine, which was measured spectrophotometrically.

Results: X-ray diffraction confirmed that the discs were composed of a biphasic blend of hydroxyapatite and beta tricalcium phosphate. Carboxylic acid groups were detected on the acrylic acid plasma treated discs, but not on untreated discs. Spectrophotometry showed that discs treated with both acrylic acid plasma polymerisation and carbodiimide had significantly more biotinylated peptide attached the disc surface than untreated discs.

Conclusions: The data suggested that the GFOGER peptide is covalently anchored to a calcium phosphate biomaterial, with further evidence that plasma polymerisation may not be required to covalently attach the peptide.

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Parents' and children's decision–making for management of multiple decayed primary teeth.

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Objectives: Parents of children with multiple decayed primary teeth face complex decisions: active monitoring, restoration only, extraction only or a combination of restoration and extraction, along with choices about local anaesthetic (LA), inhalation sedation (IS) or general anaesthetic (GA). This study aimed to explore factors involved, from both the child and parents' perspective, in this decision-making process.

Methods: Qualitative interviews were conducted with a purposive sample of 17 dental patients (aged 3-8 years) and their parents/guardians. All children had recently experienced a variety of treatment modalities (including dental GA) in either a community dental service or hospital setting. A topic guide was used based on the literature and previous service evaluations. Data were analysed using Framework Analysis.

Results: Previous dental treatment of either the child or other family members influenced what treatment modality parents opted for. Parents' perceptions of their child's ability to cope, their own dental anxiety, concerns about treatment itself (particularly in relation to dental GA) and the value they placed on treating primary teeth were identified as important factors in the decision-making process. Parents also considered the number of visits required as well as where the treatment would be carried out. Consideration was given to the amount of treatment required, their child's age and whether they had any symptoms. Parents were aware of the long term impact of treatment on the child (particularly in relation to dental anxiety and ability to cope with treatment as an adult) as an important decisional factor. The child's perspective influenced the process, in terms of their own preferences and how the dentist communicated the options to them.

Conclusions: This study provides a meaningful insight into factors parents and children consider when deciding how to manage their decayed primary teeth. Findings will be used to develop a future patient decision aid.

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A multi-variate retrospective analysis of factors influencing completion time of multi-disciplinary clinic care in a cohort of hypodontia patients

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Objectives: Dental treatment times can be lengthy for patients with developmental absence of their secondary dentition (hypodontia). This retrospective analysis of a cohort of multi-disciplinary-treated hypodontia patients aimed to assess factors influencing length of treatment in a single UK NHS Specialist referral centre.

Methods: Clinical Records (Paper and electronic) from hypodontia patients completing multidisciplinary hypodontia treatment were retrospectively analysed from patients attending for dental care at The Royal London Dental hospital (Barts Health NHS Trust). Both the amount of time and number of appointments in active treatment from orthodontic bond-up until fit of final prosthetic restoration were selected as the primary dependent outcome variables. Patients (n=50) (Female=32, Male=18) were randomly selected from a local database of those completing MDT care and had a median age of 12.7yrs (range 6.8-44.5yrs) at initial referral. The severity distribution of hypodontia was; Mild (1-2 teeth) (n=18; 36%), Moderate (3-5 teeth) (n=18; 36%) and severe (≥6 teeth) (n=14; 28%). Patients were treated in line with normal standards of care and received Resin Bonded Bridges (RBBs) (62%), Implants (20%) or combinations of RBBs and Implants (12%) with 6% not receiving any restorations. Stepwise multivariate linear regression was carried out to assess the influence of a range of independent predictor variables on time in active treatment.

Results: On average patients spent 5.2 years in overall treatment with 3.1 years in orthodontics and 10.8 months in Restorative care. Multivariate linear regression revealed that number of missing teeth pre-operatively, poor attendance and missing lower canines were significantly associated with increased treatment times.

Conclusions: Knowledge of both pre-operative and decision-influenced factors can help better predict treatment time in multidisciplinary hypodontia treatment and improve our understanding of the treatment journey.

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Preliminary Physico-Chemical Characterisation of Rationally Designed Peptide P11- 4DL

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Objectives: The treatment of dental caries using peptide based biomimetic scaffolds (P_{11}-4) is of increasing interest. We aimed to design a new peptide motif (P_{11}-4LD) based on existing design principals that would be capable of hierarchical self-assembly and subsequently be able to promote enamel remineralisation

Methods: To design P_{11}-4LD, P_{11}-4 has been modified with the incorporation of alternating L and D amino acids, in-order to remove the intrinsic twist of the resultant hierarchical structures thereby modifying its surface properties. The solution phase assembly as a function of concentration and pH were characterised by circular dichroism (CD) and FTIR in order to determine the secondary structure of the peptide assemblies. Transmission Electron microscopy was used to determine the morphology of the resultant assemblies and cytotoxicity testing was carried out using L929 Murine fibroblast and Alamar-Blue cell viability assay. The behaviour of the two rationally designed peptides P_{11}-4 and P_{11}-4LD were compared in terms of physical and structural properties in solution.

Results: Conformation studies in the dilute regime by CD showed that both peptides P_{11}-4 and P_{11}-4LD followed a concentration and pH dependent assembly profile, indicating a large random coil component at low concentration and at basic pH. Notably the proportion of beta-sheet grew upon increasing concentration and in acidic environments. TEM studies showed characteristic fibrils observed for P_{11}-4, fibrillar structures were absent for P_{11}-4DL. Initial results in the semi dilute regime show that P_{11}-4 demonstrated a strong beta-sheet component by FTIR and self-supporting nematic gels. By contrast the P_{11}-4LD reviled better solubility with a failure to produce any self-supporting gel in all concentrations and pH conditions.

Conclusions: Our data suggest that that the modification of P_{11}-4 with the inclusion of D amino acids as the only variable greatly affect the self-assembling properties of this motif of rationally designed peptide.

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Dimensional stability of gutta-percha with different root canal sealer cements

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Objectives: Introduction: Gutta percha (GP) is used with a wide range of sealer cements to form a dimensionally stable mass of filling within the root canal. The influence of root canal sealer cements on the dimensional stability of GP is poorly understood. This study investigated the dimensional stability of GP in contact with cements of differing chemistry in vitro, with air and water exposure as controls.

Methods: Ninety GP cylinders (3x2mm) (Obtura Spartan; Fenton, USA) were prepared under 5x magnification. Baseline dimensions were recorded with a travelling microscope and volumes calculated. Specimens were divided into 5 groups (n=18) for immersion in: Tubli-Seal™ Kerr (USA) (TS-group 1), AH Plus® Dentsply (Konstanz, Germany) (AH- group 2), BioRoot™ RCS Septodont (Louisville, USA) (BR-group 3). Air (group 4) and water (group 5) served as controls. Sub-groups (n=6) were immersed for 1, 3 and 21 days before measuring as previously. Changes in volume were averaged for each sub-group and significant differences from baseline were assessed using non-parametric statistics (at significant level of $p<0.05$).

Results: There were no significant changes in control groups or in group 3. Specimens in groups 1 and 2 showed significant increase in volume compared with baseline ($P > 0.01$). Specimens in group1 had the highest average percentage increase in volume during 21days of immersion (23.5%; $p = 0.002$). Group 2 showed an average percentage increase in volume of 7.75% ($p = 0.002$).

Conclusions: Significant dimensional changes occur in GP specimens after immersion for up to 21 days in TS and AH. Immersion in BR was not associated with volumetric change. The clinical significance of these observations has yet to be investigated.

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Molecular Dissection of Human Antibody Responses against Porphyromonas gingivalis OMVs.

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Objectives: About 10-15% of the adult population suffers from periodontal disease. This disease has been linked to life-threatening systemic conditions including Alzheimer's neurodegeneration, atherosclerosis and diabetes mellitus. Porphyromonas gingivalis, a proposed keystone pathogen plays an important role in chronic periodontitis. Virulence factors such as gingipains, cysteine proteases and outer membrane vesicles (OMVs) play a central role in the colonization of the bacterium in the periodontal pocket and manipulate the innate immune system facilitating periodontal disease. Previous studies have shown that a murine monoclonal antibody against a specific epitope of gingipain (HRgpA) could delay the re-colonization of P. gingivalis in the gingiva. Here we seek to find human monoclonal antibodies against P. gingivalis OMV-associated virulence factors.

Methods: An individual with enhanced occupational exposure (almost 2 decades) to P. gingivalis was identified. Antibodies against an extract of laboratory cultivated P. gingivalis W50 and its corresponding OMVs were detected in the serum of this donor individual. Peripheral blood monocytes were isolated and mRNA recovered and converted to cDNA. DNA encoding the variable regions of the antibodies were PCR amplified and assembled into an antibody library. Using in-vitro eukaryotic ribosome display the library was selected against the outer membrane vesicles of P. gingivalis.

Results: All the variable heavy (VH) and light chain (VL) fragments were amplified and assembled into an antibody library. The library encodes in-frame scFv fragment with a random combination of the variable heavy and variable light regions. In-vitro transcription/translation of the assembled DNA generated an antibody-ribosome display library.

Following selection against P. gingivalis OMVs captured on Protein G using the donor serum, 11 VH and 11 VL regions were recovered with 7 unique VH/VL combinations.

Conclusions: The antibody library has been assembled and used in ribosome display selection against OMVs derived from P. gingivalis W50. The outputs are currently being characterised to identify the antigens and to select candidates for further evaluation in biological assays.

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Metatranscriptomic Study of Dental Caries Lesions

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Objectives: Enamel and dentine degradation, commonly known as dental caries, is the most common chronic disease in children worldwide. The efforts to understand the genes in the oral microbiota responsible for the ecological changes during the caries process are scarce. Here, we present a metatranscriptomic approach in order to unravel the differences at the functional level between health and caries-associated microbiotas.

Methods: RNA from oral biofilms associated to healthy teeth surfaces, enamel and dentine caries lesions from different patients was sequenced using NextSeq Illumina technology. mRNA reads were used to describe the taxonomical composition and functional profile of microbial communities associated to each of the three scenarios.

Results: Statistical analyses showed differences among caries and healthy-associated microbiotas. Interestingly, caries-associated active microbiota in enamel samples was more similar to healthy samples than dentine. When we focused on taxonomical differences at the genus level, 13 genera were significantly more represented in healthy patients while 30 were more abundant in enamel and/or dentine caries.

Similarly, several genes were found associated to healthy, enamel or dentine caries samples. Caries lesions showed a wide array of mRNAs corresponding to enzymes involved in their proteolytic metabolism, and included glucanases, endoglucanases, glucosidases, ATP-dependent proteases and glycoproteases. Expression was also confirmed of collagen-binding proteins, collagen adhesins and collagenases, which confirms that bacteria contribute to the degradation of dentine tissue, where collagen is the most important protein.

Interestingly, genes involved in nitric oxide production were upregulated in healthy individuals compared against caries lesions. Meanwhile, the reduction of nitric oxide to nitrous oxide (NO2) was more represented in caries samples. Human mRNA was also identified in the sequences of dentine caries lesions and included the expression of genes related to the immune system.

Conclusions: In conclusion, this is the first time that the functional profiles of oral microbiotas associated to caries lesions are studied and the first time that nitric oxide production is proven to be downregulated in caries patients.

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Dying odontoblasts activate an innate reparative inflammatory response

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Objectives: Reparative dentinogenesis is a regulated process that occurs following the death of native odontoblasts. It involves recruitment and differentiation of dental pulp stem cells (DPCs) into odontoblast-like cells to produce dentine. However, the role of dying odontoblasts in this process is unknown. The aim of this study was to investigate the role of danger associated molecular patterns (DAMPS) released from dying odontoblasts in the reparative dentinogenesis process.

Methods: DPCs were differentiated into odontoblast-like cells and subjected to freezing-thawing cycles to produce odontoblast-like necrotic cell lysate (ONCL). THP-1 monocytes were differentiated into macrophages prior to treatment with ONCL. ELISA and multiplex arrays were used to measure the level of cytokines released from THP-1 cells. Western blotting was employed to determine the signalling pathway. The effect of ONCL on migration of DPCs was assessed using a Trans-well migration assay. Odontogenic differentiation of DPCs was determined by RT-qPCR, alkaline phosphatase (ALP) activity assays and Alizarin Red staining.

Results: Treatment of THP-1 cells with ONCL induced the release of inflammatory cytokines IL-1β, IL-6, IL-8 and the growth factors angiogenin and angiopoietin. IL-1β release from THP-1 treated with ONCL was reduced upon treatment with a caspase-1 inhibitor. P38 MAPK was shown to be activated in THP-1s upon treatment with ONCL. Trans-well migration assays showed that ONCL contains chemoattractant properties leading to the migration of undifferentiated dental pulp cells. IL-1β treatment of DPCs demonstrated an increase in ALP activity and mineralisation.

Conclusions: ONCL activates a sterile, innate reparative inflammatory response. Further work is underway to further characterise the signalling pathway.

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Multilevel Principal Components Analysis (mPCA) of Age-Related Changes in Facial Shape in Adolescents

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Objectives: Populations of subjects or images used in medical imaging often contain naturally occurring groups or clusters. One approach to dealing with such effects is effectively to ignore them; one analyses all subjects or images irrespective of any naturally occurring groupings in the data. However, important (possibly competing or confounding) effects might be omitted by this approach.
Methods: Another approach is to analyse results from each group separately. However, this approach might lead to results that do not generalise and / or are not statistically efficient because one is not using all of the data in a single model. Multilevel statistical methods present a third way of dealing with such effects by modelling both the differences between groups and differences within groups separately at different levels of the model. Multilevel principal components analysis (mPCA) has previously been shown to provide a simple and straightforward method of forming point distribution models that can be used in (e.g., active) shape models. Here we use mPCA to investigate the effects of age on facial shape in adolescents.
Results: Monte Carlo (MC) simulated data is used in one dataset and mPCA is seen to provide reasonable results. The effects of outliers added to the MC training data are shown to be reduced by the use of robust covariance matrix estimation and robust averaging of matrices. These methods are applied to another dataset containing thousands of GPA-scaled (3D) landmark points for subjects aged 11 to 16 years old. Modes of variation correctly reflect effects due to ethnicity and sex at one level of the mPCA model and effects due to age at another. A clear progression in standardised component scores is seen with age, again at an appropriate level of the model.
Conclusions: These analyses are an excellent first test of the ability of multilevel statistical methods to model age-related changes in facial shape in adolescents.

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The adjunctive effect of Low-Level Laser therapy and Magnification on healing in chronic periodontitis patients

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Objectives: To determine the combined effects of Low-Level Laser therapy (LLLT) and Magnification as an adjunct to the root surface debridement (RSD) procedure on clinical parameters in chronic periodontitis patients

Methods: A total of 80 patients were recruited and assigned into 4 groups- 20 in each: Group1 – RSD; Group 2 - LLLT following RSD; Group 3 - RSD with magnifying loupes; Group 4 – LLLT following RSD with magnifying loupes. RSD was performed using area specific, universal curettes and after five series along with an ultrasonic scaler. 2.5 X magnification was used (STAC 2.5 X) with a light source. Low-Level Laser Therapy was performed using diode laser 810 nm (Picasso AMD LASERS, LLC, USA) with 0.7 watts, with energy density of 4J/cm^2. This study was done at Department of Periodontics, SRM Dental College, Ramapuram, Chennai, India. The clinical parameters assessed were; Probing Pocket Depth (PPD), Clinical attachment Level (CAL), Gingival index, sulcular bleeding index. Wound healing index was assessed at 7th week.

Results: All clinical parameters improved from base line to 7th week across all groups and were statistically significant. There was a statistically significant difference between group 1 and group 2 in PPD ($P=0.02$), CAL ($P=0.01$) and highly significant in wound healing index. ($P<0.001$). Group 4 showed statistically significant wound healing index compared to group 3 alone ($P=0.007$). Group 4 showed better clinical parameters at 7th week compared to group 1 ($P<0.001$) suggesting the efficacy of low level laser therapy and magnification in positive clinical outcome.

Conclusions: Within the limits of this study, the clinical outcome were superior with low level laser therapy and magnification in the non-surgical periodontal treatment of chronic periodontitis patients.

114 WITHDRAWN

A Comparative Study of the Mechanical Properties of Some Experimental Resin Composites Containing Silver nanoparticles and Bioactive Glass S45S

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Novel Fluoride Rechargeable Dental Composites Containing Ca^{2+} or Mg^{2+} LDH

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Objectives: To investigate the repeated absorption and release of fluoride (F^-) from experimental dental composites incorporating calcium-Ca^{2+} or magnesium-Mg^{2+} layered double hydroxide (LDH), (10wt% and 30wt%), in de-ionised water (DW) and artificial saliva (AS).

Methods: Ca-LDH and Mg-LDH powders were produced using a 2:1 M^{2+}:Al^{3+} ratio and characterised using powder X-ray diffraction (pXRD) and Scanning Electron Microscopy (SEM). Dimethacrylate-based composite discs were prepared as follows; 1) control - no LDH and 2) incorporating Ca-LDH or Mg-LDH (10wt% or 30wt%; n=12). Each disc was charged in sodium fluoride (NaF) solution (15ml, 0.1M, 37±0.1°C) for 48h and transferred to DW or AS (5ml, 37±0.1°C; n=6). F^- release was measured after 24h (F^- ion-selective electrodes-NICO2000, precision ±2%), 5ml DW/AS was replaced, and F^- release re-measured after 24h. The samples were then re-charged in 0.05M NaF (37±0.1°C) for 5min. Five absorption-release cycles were conducted over 10 days.

Results: pXRD confirmed LDH structures were successfully produced and SEM revealed hexagonal shaped LDH crystallites (<1 - 2μm). Ca-LDH and Mg-LDH significantly increased the amount of F^- released from the composites compared to the control, in both media ($P<0.05$). In AS, the mean release after every recharge, was greater for Mg-LDH-composite (10wt% and 30%; 0.49±0.08ppm and 0.97±0.15ppm) compared to Ca-LDH-composites (10wt% and 30%; 0.24±0.10ppm and 0.31±0.07ppm). After every recharge, the F^- release was greater than the previous release cycle ($P<0.05$) from all LDH-composites. More F^- was released in DW than in AS ($P<0.05$), with the 30wt% Ca-LDH- composite releasing the greatest amount (1.89±0.37ppm). The initial enhanced release of F^- may be due to the initial charging time (48h), in comparison to subsequent 5min recharges.

Conclusions: Experimental dental composites containing Ca-LDH and Mg-LDH are capable of a rechargeable sustained release of F^- over time, thereby demonstrating their potential for early-stage and secondary caries prevention.

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Investigation of RMGICs capability to re-mineralise and form apatite

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Objectives: The objective was to study the ability of experimental RMGICs to re-mineralise and form apatite in artificial saliva (AS).

Methods: Three experimental RMGICs with varying phosphorus content in glass ($0.5P_2O_5$, $0.75P_2O_5$, $1P_2O_5$) and commercial cement (Fuji II LC) were studied. Set cement disks were immersed in AS for 2-weeks, 1-month, 3-months, 6-months and 12 months. To evaluate apatite formation ability of these cements, ^{31}P Magic-Angle-Spinning-Nuclear-Magnetic-Resonance (^{31}P MAS-NMR), ^{19}F Magic-Angle-Spinning-Nuclear-Magnetic-Resonance (^{19}F MAS-NMR), Fourier-transform-infrared (FTIR), X-ray diffraction (XRD) and Scanning-Electron-Microscopy with energy dispersive X-ray-spectroscopy (SEM/EDX) were used.

Results: Low phosphorus synthetic compositions exhibited evidence of increasing apatite formation over time, as shown by ^{31}P, ^{19}F MAS-NMR, FTIR, XRD. A drastic change on the surface of the cement disks after immersion and deposition of a calcium phosphate layer was observed on SEM images. EDX confirmed a relative increase in phosphate (P) and calcium (Ca) concentration over the nominal concentration of aluminium (Al) and silicon (Si) on the surface of ageing cements. The commercial composition, on the other hand, displayed no sign of apatite formation even up to 12-month immersion period.

Conclusions: RMGICs are capable of forming apatite on immersion in AS with time similar to GICs, using the same ionomer glass composition.

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Release of bioactive ions by novel Bioglass particles.

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Objectives: Secondary caries due to marginal leakage is a key concern of existing dental composites. Bioactive glass (BAG) containing dental composites can overcome this problem releasing therapeutic ions that can produce remineralization at the tooth restoration interface. Therefore, the aim of this study is to develop a novel bioactive glass composite that release bioactive ions to enhance the tooth remineralisation.

Methods: The bioactive glass SiO_2-CaO-CaF_2-Na_2O was prepared via the melt quench technique. All metal oxides were put in a platinum crucible in a furnace at 1400 ºC for one hour. The prepared glass was rapidly quenched in water, dried and then milled to produce glass. This glass powder was immersed in artificial saliva (AS) at pH=4.0, pH=7.0 and pH=6.5. At predetermined time intervals the solutions and the immersed glass were characterized by Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), ICP-OES, pH and ISE techniques.

Results: All samples showed increase in pH with time and was linearly correlated to BAG immersion time. Both FTIR and XRD patterns showed characteristics peaks of formation of apatite. FTIR spectra indicated the presence of apatite with time. BAG powder start making apatite earlier in AS 6.5 compared to AS 7.0 and AS4.0. ICP and ISE results confirms the release of bioactive ions i.e Ca, P, and F necessary for the formation of hydroxyapatite and flourapatite especially in AS 6.5.

Conclusions: Novel BAG filler particles has the ability to form apatite layer by releasing bioactive ions in body simulated fluid e.g. artificial saliva. Thus, this BAG can be used for different dental and biomedical applications.

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Photodynamically Active Electrospun Fibres for Antibiotic-Free Infection Control

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Objectives: Antibiotic-free antimicrobial dental membranes are critical to manage infections and control the spread of antibiotic resistance, whilst supporting regeneration, e.g. in the case of boney defects. New and simple antimicrobial chemistries are needed that can be integrated with current dental membranes to enable long-term antimicrobial functionality and tissue safety. To explore this challenge, this study explores the feasibility of equipping an electrospun polymer system with on-demand antimicrobial effect via photodynamic therapy (PDT) principles. To enable antimicrobial PDT, our strategy was to encapsulate a photosensitiser (PS) in polyester fibres in the PS inert state, so that the antibacterial effect could be activated on-demand following irradiation with visible light.

Methods: Electrospun fibres were successfully obtained from clinically-approved polyesters, either poly(ε- caprolactone (PCL) or poly[(rac-lactide)-co-(glycolide)] (PLGA), with encapsulated PS, i.e. methylene blue (MB) or erythrosin B (ER). Resulting mesh samples were characterised for their PS loading efficiency (UV-Vis spectroscopy), microarchitecture (SEM, porometry and BET analysis), tensile properties, hydrolytic behaviour (contact angle, PS release capability, degradability) and antimicrobial PDT effect.

Results: The electrospun fibres achieved ~100 wt.% loading efficiency of PS, whereby PS-encapsulated fibres displayed significantly increased tensile modulus, as well as reduced average diameter and pore size, with respect to PS-free controls. In vitro, quantitative PS release was observed within 100 hours by PCL fibres, whilst PLGA fibres displayed significant macroscopic shrinkage and fibre merging following incubation in phosphate buffered saline (PBS) solution. Exposure of PS-encapsulated PCL fibres to visible light successfully led to at least 1 log reduction in E. coli viability after 60 minutes of light exposure, whereas PS-free electrospun controls did not inactive microbes.

Conclusions: This study successfully demonstrates the significant potential of PS-encapsulated electrospun fibres as photodynamically-active system for antibiotic-free infection control. This system could be further exploited to develop long-lasting membrane for guided bone regeneration.

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Spatial distribution of lidocaine in oral mucosa ex vivo determined using mass spectrometry imaging following delivery from an electrospun polymer patch.

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Objectives: Many oral conditions are painful, but sustained local delivery of analgesic or anesthetic drugs is especially challenging in the moist conditions in the mouth. The aim of this research was to develop a lidocaine-containing electrospun patch with mucoadhesive properties, and determine if the drug was released in a biologically active form and taken up by tissues.

Methods: Electrospun mucoadhesive patches were produced using a dope containing of 10% (w/w) poly(vinylpyrrolidone (PVP), 12.5% (w/w) Eudragit RS100, and 10% (w/w) polyethylene oxide (PEO, 400 kDa), and amounts of lidocaine base or lidocaine HCl resulting in a 3% (w/w) drug loading were added. Electrospun patches were characterized, and in vitro release into phosphate buffered saline was determined using high performance liquid chromatography. Finally, experimental patches were placed on ex vivo porcine buccal mucosa in a modified Ussing chamber model, and matrix-assisted laser desorption ionisation – mass spectrometry imaging (MALDI-MSI) was used to investigate localisation of released lidocaine within oral tissues.

Results: Drug was released more rapidly from the lidocaine HCl electrospun patches compared to lidocaine base electrospun patches, with double the amount of lidocaine released in the first 15 minutes (0.16 ± 0.03 mg) compared to lidocaine base patch (0.08 ± 0.03 mg). Lidocaine released from lidocaine HCL electrospun patches retained biological activity, demonstrated via inhibition of veratridine-mediated opening of voltage-gated sodium channels in SH-SY5Y neuroblastoma cells The permeation of lidocaine from the lidocaine HCl electrospun patches through ex vivo porcine buccal mucosa was also detected using MALDI-MSI in only 15 minutes, whereas permeation of lidocaine from the lidocaine base patch was not detected.

Conclusions: It was concluded that a mucoadhesive electrospun patch may be a valuable innovative technology for the sustained delivery of an anesthetic drug that is taken up rapidly by oral mucosa.

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Novel Bioactive-Glass Containing GIC for the Use in Atraumatic Restorative Technique

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Objectives: The objective of this study was to characterise the mechanical properties and apatite formation of a novel GIC with added bioactive glass for use in ART technique.e

Methods: A novel ionomer glass based on the system $4.5SiO_2$- $3Al_2O_3$- $0.5P_2O_5$-2CaO-$3CaF_2$ was synthesised via melt-quench route, followed by milling and sieving to optimise the particle size. Sodium free bioactive glass of the experimental formulation based on SiO_2-P_2O_5-CaO-CaF_2system was synthesized via melt-quench route and milled into coarse particle size powder. Prior to cement mixing, the bioactive glass was added to glass powder in 5%,10% and 20% weight fractions. Cylindrical cement samples (n=360), with dimensions 4x6mm, were prepared and immersed in Tris buffer, and artificial saliva pH4.0, and pH7.0 for 1, 6, and 12months. The compressive strength and modulus of elasticity were measured before and after immersion using universal testing machine. Apatite formation was analysed using solid-state ^{31}P and ^{19}F MAS-NMR. Fluoride-ion release was measured using fluoride-ion selective electrode. Calcium and Phosphate ions release was measured using ICP-OES.

Results: Cement compositions containing up to 10% weight fraction of BAG showed compressive strength values higher than the ISO standards for GIC restorative materials (>100MPa). Further increase in BAG led to reduction of the compressive strength. NMR data revealed evidence of apatite formation that increased substantially by adding more BAG. Slight increase in F ion release was detected as more BAG was incorporated into GICs. The addition of BAG into the GIC composition resulted in greater concentrations of Ca^{2+} ion release.

Conclusions: The novel GIC with added bioactive glass showed acceptable mechanical properties and great potential for remineralisation through apatite formation.

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Effects of P.gingivalis OMVs and Secreted Proteins on PECAM-1 expression

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Objectives: The oral bacterium Porphyromonas gingivalis is a keystone pathogen in periodontal disease. A growing number of reports have shown the presence of P.gingivalis in the circulation and its association with systemic conditions, including cardiovascular disease although, to date, little is known about how periodontal pathogens interact with the vasculature. Our previous work showed that gingipains produced by P. gingivalis can cleave cell surface adhesion molecules following infection. This study aimed to elucidate the source of P. gingivalis gingipains in the cleavage of the endothelial cell adhesion molecule, PECAM-1.

Methods: Anaerobically grown wild-type W83 and mutant K/R-AB (gingipain-deficient) P.gingivalis cultures were used. Bacteria were isolated and supernatant sterile filtered prior to separation of outer-membrane vesicle (OMVs) and soluble proteins (>10 kDA) from overnight-grown cultures. Sterile concentrated BHI was used as a control.

Samples were diluted in PBS and protein quantified by BSA assay, characterised through Coomassie staining, immunoblotting and Cryo-EM immunogold labelling. HMEC-1 endothelial cells were infected with whole bacteria, OMV or soluble protein fraction from W83 or K/R-AB mutant and abundance of PECAM-1 analysed by flow cytometry.

Results: BSA assay revealed no differences in protein levels from each sample group. Clear differences in expression of proteins, in particular gingipains, was observed in protein characterisation tests for W83 versus K/R-AB. Flow cytometric analysis showed significantly decreased cell surface abundance of PECAM- 1 following treatment with W83 whole bacteria, W83-derived OMV and soluble protein, which was not evident following infection with the K/R-AB- derived equivalents or controls.

Conclusions: Isolated OMVs and proteins from P.gingivalis reduce PECAM-1 cell surface expression in vitro and this appears to be mediated by gingipains. These data suggest P.gingivalis cardiovascular pathogenesis mediated via cleavage of endothelial cell adhesion molecules is by gingipains present in OMVs and proteins, as well as the cell walls of whole bacteria.

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Bacteria Associated With Feline Odontoclastic Resorptive Lesion And Oral Health

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Objectives: Feline odontoclastic resorptive lesion (FORL) is a prevalent feline oral disease, causing severe pain. It is characterised by tooth resorption due to the destructive activity of odontoclasts, gingival inflammation, destruction of the periodontal ligament and tooth loss. Its aetiology remains unclear but is likely to be multifactorial and include bacteria as a cause of the chronic inflammation observed. The objective of this study was to characterise the bacteria associated with FORL and feline oral health.

Methods: Supragingival plaque was collected from 40 cats with FORL and 25 orally healthy cats. Samples were subjected to bacterial culture and isolates identified by 16S rRNA gene sequencing. Bacteria were also identified by high-throughput sequencing of the V3-V4 region of the 16S rRNA gene by paired end sequencing using Illumina MiSeq. Sequences were clustered into OTUs using USEARCH, QIIME was used to select the most abundant sequence of each OTU, and the representative sequence of each cluster was assigned a taxonomy using the RDP classifier. Data was analysed using linear discriminant analysis effect size (LEfSe), principal component analysis (PCA) and diversity indexes.

Results: 1040 isolates from FORL and health were identified by culture. Actinomyces was predominant in both health (7%) and FORL (10.3%). Porphyromonas species were found at higher frequency in FORL than in health. High- throughput sequencing identified 441 OTUs (health 317, FORL 404) of which nine were unique to health and 24 unique to FORL. Porphyromonas and Moraxella were most predominant in both health and FORL. PCA found no significant difference in the data between health and FORL and there were also no differences in species richness and diversity between the two groups. However, two-step cluster analysis of the data identified two distinct sub-groups in FORL (FORL1, FORL2), with FORL2 most closely resembling the healthy group in terms of microbiome diversity and composition; FORL1 exhibited a lower microbial diversity than the FORL2 and healthy groups.

Conclusions: This is the first study to explore differences in the oral microbiome between healthy cats and those with FORL. While it was not possible to associate specific bacteria with FORL, a sub-group of cats with FORL with an altered microbiota was identified.

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Bacteriophage: biological antimicrobials for oral infections in the age of AMR?

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Objectives: This talk will summarise recent advances in bacteriophage therapies in the scientific literature and explore using our work on bacteriophage isolated against endodontic strains of Enterococcus their potential to treat oral and potentially other types of Enterococcus infections.
Methods: Phage targetting a range of Enterococcus strains were isolated by standard methods from the environment and characterised by TEM, genome sequencing and phage infection profiling. Molecular determinants of phage adhesion to infected cells were explored using a range of capsular Enterococcus mutants. The effectiveness of the phage was established in standard and tooth-slice biofilm models, while their effectiveness in systemic infections was established using systemic zebrafish infection models.
Results: A range of phage of the siphoviridae family were isolated and characterised at the molecular level as well as their effectiveness in biofilm removal from tooth surfaces and in systemic models of infection. In addition the import of the bacterial capsule in docking prior to productive infection was also investigated, highlighting a two-stage process.
Conclusions: Although forgotten or overlooked for decades in the 20th and 21st centuries, it is now time to re- evaluate the potential of bacteriophage therapy as adjunct or alternative therapies to combat and reduce AMR, especially in light of the overuse of antibiotics worldwide in dentistry.

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Validating an ex vivo bone marrow model to study cell responses to bacterial infection

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Objectives: Bacterial infection can occur around dental and hip implants to hinder bone healing during osseointegration and can lead to bone loss post-loading. Whilst Staphylococcus aureus bacterial species are commonly associated with implant infection, the pathologic mechanisms leading to bone loss are poorly understood.

Aims: To develop an ex vivo osseous model that provides a culture system promoting the viability of cell populations. To validate the responsiveness of these cells to bacterial virulence factors following infection with Staphylococcus aureus bacterial species.

Methods: Male wistar rat femoral slices were embedded in semi-solid agar and cultured at a liquid-air interphase in αMEM, 10% FBS, 1% ascorbic acid, supplemented with 30ng/mL RANKL and 20ng/mL M-CSF, along with a microinjection of mixed bone marrow cells. Maintenance of cell populations for up to 48hr was confirmed by immunocytochemistry identifying CD105, CD14, CD68, neutrophil elastase as markers for mesenchymal stromal cells (MSCs), monocytes, macrophages and neutrophils respectively. Femoral slices were also cultured for 24h in the presence of agar that had been infected with two different Staphylococcus aureus species; oxford reference strain and 7791, representing an osteomyelitis clinical isolate. Following infection, the secretion of pro-inflammatory cytokines, IL-1β, IL-6, TNFα was assessed by ELISA. Heat inactivated bacteria provided a negative control.

Results: Immunocytochemistry showed good maintenance of MSCs, monocytes and macrophages during 48h of culture. Following infection with either Staphylococcus aureus species, cells responded to secrete pro-inflammatory cytokines TNFα and IL-1β. Secretion of these cytokines was significantly higher for tissue infected with the osteomyelitis strain ($p<0.005$). IL-6 secretion by uninfected and infected cells was low.

Conclusions: The data suggests the successful development of an ex vivo bone marrow culture model, capable of supporting the various heterogenous cell populations. Infection of the culture model has demonstrated immune response of pro-inflammatory cytokines that is representative of the clinical environment.

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Effects of Chlorhexidine mouth rinse on the oral microbiome in healthy patients

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Objectives: Bacteria within the oral microbiome can regulate systemic health, and thus alterations in their equilibrium or oral dysbiosis may lead to systemic disease. Chlorhexidine is routinely used as an antibacterial mouthwash, but surprisingly little is known about its specific effects on the oral microbiome. The aim of this study was to determine the effects of daily chlorhexidine mouthrinse on specific bacteria comprising the oral microbiome in the saliva of healthy volunteers.

Methods: 36 subjects (24 females/11males; 26 ± 6 y/o) participated in a randomised, cross-over and single-blinded study, receiving either a placebo or 0.2% chlorhexidine as a mouth rinse for 7 days. Saliva samples were then collected and stored at t -80 °C, before extracting salivary DNA using a QIAamp® DNeasy kit, and sequenced using the Ion Torrent Personal Genome Machine as previously described. Taxonomy was assigned using the Greengenes database.

Results: Results demonstrated that at the phyla level bacteriodetes (Gram negative aerobic or anaerobic) levels decreased; firmicutes (mostly gram positive, for example clostridium Spp.) and proteobacteria (Gram negative, for example legionella, E Coli, Salmonella and Helicobacter Spp.) levels increased; whereas Fusobacterium (Gram negative anaerobic) and Actinobacteria (Gram positive) remained unchanged.

Conclusions: Our data suggest that chlorhexidine used as a daily mouthwash modulates the oral microbiome of saliva in favour the bacterial phyla firmicutes and proteobacteria. These encompass species of bacteria causative for disease, for example Clostridium, Legionella, Salmonella, Helicobacter and E. coli. However, further studies are required to correlate these findings to systemic health.

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Antibiotic Prescribing: Towards a reducTion in Urgent Dentistry in England (APTiTUDE)

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Objectives: To develop an evidence-based, theory-informed bundle of interventions to reduce antibiotic prescribing by NHS dentists for patients with toothache and/or infection in England.

Methods: In the first part of the study, factors that influenced treatment (including antibiotic prescribing) during actual urgent dental appointments in high-street practices and out-of-hours clinics were explored. This was based on direct observations and patient, dentist and dental nurse telephone interview, resulting in a list of factors associated with treatment decisions. A prioritization of these factors was carried out involving people with experience of receiving urgent dental care, dental team members and NHS managers working together collaboratively. Finally, using behavioural science (the Theoretical Domains Framework and the Theory & Techniques of Behaviour ChangeTool), tools were designed aimed at reducing antibiotic prescribing by tackling these priority factors.

Results: The bundle of interventions developed included two new communication and engagement tools. One was for use before and during urgent dental appointments, the other was a drama-based tool for engaging a wider audience. Because ‘antibiotic beliefs’ was the only factor found to influence dentists and patients and dental nurses, providing ‘information about consequences’ (a known way to address behaviours driven by 'beliefs and consequences') was at the heart of the communication and engagement tools developed. A selection of other priority factors identified during the research were also included in the intervention design.

Conclusions: To slow the spread of antibiotic resistant infections, clinicians are encouraged to use antibiotics only when necessary. Two evidence-based, theory-informed behaviour change interventions have been developed to complement tools already within the UK dental antimicrobial stewardship toolkit.

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Neurogenic Differentiation of Dental Pulp Stem Cells

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Objectives: Neurogenesis is a vital process in dental pulp development and regeneration. Dental pulp stem cells (DPSC) are a promising source of neural progenitor cells, however, establishing a DPSC-based neurogenic model remains a challenge. The aim of this study was to create a neuronal-like cell model using DPSC.

Methods: Primary human DPSC were cultured in α-MEM. The SH-SY5Y neuroblastoma cell line used as a neurogenic control and was cultured in DMEM/F12. Both cell types were differentiated using 10μM all-trans retinoic acid (ATRA) in 10% FBS-media for 5 days, followed by culture in serum-free media supplemented with 50ng/ml brain- derived neurotrophic factor (BDNF) for 7 days. Neuronal differentiation was evaluated by immunocytochemical staining of the neuronal markers neurofilament medium (NF-M), Glial fibrillary acidic protein (GFAP), and β3-tubulin (TUBB3). Quantitative RT-PCR was used to analyse the gene expression of a panel of neuronal markers.

Results: Immunocytochemistry revealed that differentiated DPSC (dDPSC) and SHSY5Y (dSH-SY5Y) showed increased expression of NF-M and TUBB3 compared with control cultures. GFAP staining was increased in dDPSC, but was decreased in dSHSY5Y cultures. Significant upregulation in gene expression of neuronal markers CHAT, ACHE, ENO2, SCN9A, POUF1, PRPH, MNX1, SYN1 was observed in both cell types after differentiation. The cholinergic markers CHAT and ACHE were significantly increased in both cell types and noradrenergic marker (DBH) was reduced in dSH-SY5Y and not detected in dDPSC. These data indicated selective differentiation into cholinergic- like neurons. In addition, expression of nociceptive sodium channel gene SCN9A, sensory genes markers POUF1 and PRPH, and the motor marker MNX1 were increased in both cell types indicating nociceptive afferent interneuron differentiation. dDPSC displayed typical sensory bipolar neuronal cell morphology (cell body with two axon-like extensions). Further electrophysiological record is still ongoing.

Conclusions: We have created a viable neuronal-like dDPSC model that represents cholinergic nociceptive interneuron with bipolar neuronal like-cell morphology. This offers a new approach to research in neurogenesis.

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Comparing the Direct Effect of Residual Double and Triple Antibiotic Paste on the Regenerative Potential of Dental Pulp Stromal Cells.

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Objectives: To compare the direct effect of two different concentrations of double Antibiotic paste (DAP) (including Ciprofloxacin and Metronidazole), and Triple Antibiotic paste (TAP), (including Amoxicillin, Ciprofloxacin, and Metronidazole) on viability, mineralisation and changes in gene expression of dental pulp stromal cells, cultured in vitro in presence and/or absence of TGFβ-1.

Methods: We have compared the effect of two concentrations of DAP and TAP (1.5 µg/ml and 25µg/ml), in presence and absence of 5ng/ml of TGFβ-1, on dental pulp stromal cells (DPSCs) (n=3) cultured for 3 and 7 days, *in vitro*. Cell viability (using LDH assay), mineralisation (using Alizarin Red stain) and changes in odontogenic genes (COL-1, OPN, DSPP, and DMP-1) and angiogenic gene (VEGFR-2) expression (using qRT-PCR) were all compared at both time points, in both groups.

Results: DPSCs showed a significant increase in cell death after 7 days of culture compared to 3 days, in both DAP and TAP groups, in the presence and absence of TGFβ-1. However, the highest rate of cell death was noticed in the 25µg DAP and TAP groups, in the presence of TGFβ-1 followed by the 1.5 µg DAP group in absence of TGFβ-1.

Mineralisation nodules were observed in TGFβ-1 (positive control) and 25µg TAP + TGFβ-1 cultures. There was a variation in gene expression with a decrease or loss of major dentin matrix proteins expression under the lower concentrations of antibiotics in DAP compared to TAP treated groups. The VEGFR-2 showed the highest expression in the 25µg TAP group in absence of TGFβ-1 compared to all other TAP/ and DAP groups.

Conclusions: In this *in vitro* study, we attempted to simulate the clinical scenario of regenerative endodontics. From this study, we have concluded that using TAP with amoxicillin might be safer and more cell-friendly compared to DAP in regenerative endodontics.

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Identification of novel biomarkers and therapeutic agents for pulpitis using ssCMAP

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Objectives: The aim of this study was to use microarray data and differential gene expression analysis in healthy and inflamed dental pulp to create a pulpitis gene signature to identify potential biomarkers, followed by sscMap to search for therapeutic agents that could potentially treat pulpitis.

Methods: The Gene Expression Omnibus (GEO) database was searched for microarray datasets on inflamed and healthy pulp. Differential expression analysis was used to identify up- or down-regulated genes to generate a pulpitis gene signature. The statistical significant connectivity map (ssCMap) method was used to identify compounds with a highly correlating gene expression pattern. An ex-vivo pulpitis model was developed to validate the findings.

Results: Differential gene expression analysis identified 17 up-regulated and two down-regulated genes. Among the top upregulated genes, CXCL8, IL-6 and MMP9 were previously identified as potential biomarkers, while CCL21, MT1H, FOSB, PI3, MT1G, CLEC4, SDS were novel findings. The down-regulated genes SH3GL2 and TRHDE had not previously been identified in pulpitis. Analysis using the ssCMap revealed several drugs with a strong correlation to the pulpitis gene signature. MTT assay confirmed that at the predicated concentrations these drugs were not toxic to dental pulp or immune cells. Ongoing ex-vivo studies have validated drug-induced effects on the pulpitis gene signature.

Conclusions: A bioinformatics approach combining differential gene expression analysis and ssCMap is a novel, systematic method to identify biomarkers and drugs to treat pulpitis.

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Mitochondria coordinate mouse incisor tooth epithelial stem cell fate determination

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Objectives: Stem cell maintenance and lineage differentiation require synergistic actions of cellular events and molecular cascades. Mitochondria act as the “powerhouse” in the stem cells and its integrity is highly associated with stem cell cycle re-entry. Mouse incisor teeth contain epithelial and mesenchymal stem cells where the roles of mitochondria have not been fully described. In this study, we aim to research into the function of mitochondria in the tooth epithelial stem cell fate determination.
Methods: Postnatal day 7 CD1 strain mouse lower incisor teeth were used for quantifying the integrities and densities of the mitochondria using Tomm20 as a marker. To study the effects of mitochondria integrity on stem cell activation, mdivi1 was applied. The cell cycle checking points gene expression and cell differentiation markers were evaluated using real time RT-PCR, immunofluorescent staining, as well as western blotting. The linkage of mitochondria status with epithelial stem cells were evaluated using a modified Ki67 fluorescent cell cycle system (Ki67-FUCCI).

Results: We show that both in vivo and in vitro, mitochondria have distinct expression patterns between stem cells and transit amplifying cells. The integrity of mitochondria is associated with cell cycle re-entry. The disturbance of mitochondria impact stem cell maintenance and activation, which can be associated with pathological situations that affect lineage differentiation, i.e. ameloblast development and enamel formation.
Conclusions: We conclude that mitochondria are important for incisor tooth epithelial stem cell self-renewal, activation and lineage differentiation.

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Investigating the Required Forces to Cut Extracted and Artificial Teeth

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Objectives: There is a consensus of dissatisfaction from dental students when practising on artificial teeth. Students' perceptions highlight the difference between the physical characteristics of artificial teeth compared to their real-life counterparts. The aim of this study was to investigate the forces required to cut artificial teeth compared to extracted and, through this investigation, to understand students' perceptions of artificial training aids through haptic response.
Methods: Artificial (PMMA-based) mandibular first molars were randomly selected from six companies, along with extracted caries-free mandibular first molars for comparison. Two experiments were designed to evaluate a haptic response to cutting both extracted and artificial teeth by recording the forces applied to the two sets of specimens. Firstly, ten clinicians and ten non-clinicians were asked to perform a Class I cavity on the extracted and artificial teeth. Secondly, a comparison to a user was established using an automated stage set-up to measure the cutting forces in one direction (mesiodistally) at a set rate of 0.1mm/s, incrementally removing a depth of 1 mm with each cut. For both experiments, a high-speed turbine handpiece with diamond burs and irrigation was used. Teeth were mounted to a three-axis load cell during cutting, with all force measurements from the bur recorded in real-time.
Results: Data collected from the clinician and non-clinician experiment showed that more than double the force was used to cut artificial compared to extracted (a 2.4N mean force compared to 1.1N respectively). Both clinicians and non-clinicians exhibited the same trend of applying more force when cutting artificial teeth compared to extracted teeth. The automated stage set-up showed similar results to the user haptic responses with, on average, artificial teeth requiring 1.2N compared to extracted teeth requiring 0.4N.
Conclusions: Results showed that more force was required to cut artificial teeth compared to extracted teeth both from haptic response data and using an automated stage set-up. The increased force for the PMMA-based artificial teeth highlights the difficulty that students have when performing procedures on them but is perhaps surprising as PMMA is a softer material than found in extracted teeth such as enamel and dentine.

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Millable CAD/CAM laboratory composites

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Objectives: Millable CAD/CAM laboratory composites are a relatively new addition to the market which offer the clinician a new and useful indirect material. It is crucial to understand how this material withstands challenges faced by the oral environment. This is especially pertinent with composite being the material of choice in Tooth Surface Loss restoration cases. As such, it is important to understand the effect of a high carbonated drink diet on these composite restorations. This study aimed **t**o investigate the effect of a low pH diet on the surface integrity of two commercially available millable CAD/CAM laboratory composites; Grandio Blocs by Voco and Brilliant Crios by Coltene, using Vickers Hardness Testing.

Methods: Two millable CAD/CAM composites; Grandio Blocs (Voco), a nano-hybrid composite, and Brilliant Crios (Coltene), a reinforced composite, were prepared. Fifteen specimens were prepared for each composite. The dimensions of the Grandio specimens were 14 x 17 x 14mm and the Brilliant specimens were 17 x 13 x 11mm. Each specimen was polished using white stone polishing burs and the Shofu Super-Snap Rainbow Composite Polishing Sets to replicate clinical application. Each specimen was tested using a Struers Duramin hardness testing machine with a Vickers indenter to establish a baseline. An acidic solution of pH 2.5 and a saliva substitute were created under laboratory conditions to allow cycling at 37°C between the acidic environment and neutralising saliva. This cycling was carried out to replicate eight acid attacks per day for five weeks. The specimens were then Vickers hardness tested again to establish the test results.

Results: Statistical analysis revealed a significant difference in the Vickers Hardness of the test samples when compared to the baseline samples.

Conclusions: A high carbonated diet has a significant effect on the surface integrity of millable composite restorative material. Clinical effects may be aesthetic - gloss, stain resistance or structural over a longer period of time.

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The Effect of the particle size on synthesis and crystallization of potassium fluormica glass-ceramics

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Objectives: This study investigated the role of the glass powder particle size in synthesis and crystallization of potassium fluormica glass-ceramics.

Methods: Potassium fluormica glasses were produced with compositions 51.2SiO_2, 10.6Al_2O_3, 6.5K_2O, 12.8MgO, 7.9B_2O_3, 10.7MgF_2 (mol%) using the melt-quench method. Glass frits were milled and sieved producing three glass powder batches with different particle size fine (MF), medium (MM) and course (MC). Glass powders where characterized using differential scanning calorimetry (DSC), simultaneous thermal analysis (STA), X-ray diffraction (XRD) and ^{19}F MAS-NMR. then heat treated at 1000°C for 5 hours. The produced glass-ceramics were characterized using XRD, SEM and ^{19}F magic angle spinning-nuclear magnetic resonance (MAS-NMR).

Results: DSC results showed a similar glass transition temperature (Tg) for the different particle sizes. STA results revealed that the percentage weight loss decreased with increasing particle size. XRD results showed that only MF glass-ceramic did not have all diffraction lines of potassium fluorphlogopite. SEM images of MF glass-ceramics showed fewer and less developed mica crystals than the others. ^{19}F MAS-NMR spectra of the glass and all heat treated glass powder showed that the fluorine was presented as F-Mg(3) in the parent glass and glass-ceramics.

Conclusions: Particle size of the parent glass powder plays an important role in synthesis and crystallization of fluormica glass-ceramics

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The Development and Evaluation of an Electrospun Mucoadhesive Device for Transmucosal Delivery of Therapeutic Peptides and Proteins

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Objectives: Peptides and proteins represent a rapidly growing field in pharmaceuticals with great potential in impactful therapeutic areas including oncology and heart disease. In general, these molecules must be delivered subcutaneously to avoid degradation in the gastrointestinal tract. This is inconvenient and unpleasant where repeated doses are required and leads to poor patient compliance. An alternative strategy is transmucosal delivery across the oral mucosa. To overcome the poor specificity and dose control of existing formulations targeting this site, the aim of this research was to investigate an electrospun mucoadhesive device for the controlled delivery of large peptides or proteins.

Methods: Lysozyme was used as a model protein with antimicrobial properties, and incorporated into poly(vinylpyrrolidone)/Eudragit RS100 polymer patches using electrospinning from an ethanol/water mixture. A protective hydrophobic backing layer was produced by electrospinning poly(caprolactone) and melting at 65°C to produce a continuous film. Loading, release kinetics, and biological activity were investigated. Fluorescent labelling and confocal microscopy were used to investigate distribution. Disc diffusion assays were utilised to assess the antimicrobial effect against oral bacteria strains.

Results: Lysozyme was uniformly distributed within the fibres with a loading efficiency of 93% with a small reduction in fibre diameter. Release was relatively rapid (83% of the enzyme released at 1 h), with only minimal loss of activity. It was further demonstrated that the protein had not been denatured by the heat treatment used to produce the backing layer. The biological activity of released lysozyme was further confirmed by demonstration of inhibition of growth of Streptococcus mutans.

Conclusions: The resulting protein-loaded patches displayed high bioactivity and clinically relevant release rates making them a promising proof of concept for the delivery of bioactive peptides to the oral mucosa. Additionally, lysozymes' antimicrobial properties may give the patches a potential application as antiseptic dressings for oral wounds.

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The Efficacy of Bis[2-(methacryloyloxy)ethyl] Phosphate in Self-Etching Dentine Bonding Systems

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Objectives: Resin-dentine bonding involves etching to expose dentinal collagen followed by infiltration of an adhesive resin. This interface created between the dentine and resin composite restoration is termed the 'hybrid layer'. Enzymatic degradation of collagen fibrils within the hybrid layer and hydrolytic degradation are major factors thought to destabilise the resin-dentine interface. Current strategies in bonding systems explore the function of acidic functional monomers with phosphate groups, towards stabilizing the dentine-bonded interface. This study reports the effect of concentration of Bis[2-(methacryloyloxy)ethyl] phosphate (BMEP) into a potential primer to constitute a two- step self-etching adhesive and evaluate the efficacy of dentine bonding and further understand the process of overall bonding.

Methods: Two experimental primers were formulated containing either 15 or 40 wt% BMEP, designated as BMEP15 and BMEP40, respectively, and were used with an experimental adhesive containing BisGMA, UDMA, TEGDMA and HEMA. Clearfil^{TM}SE Bond (Kuraray) was used as a commercial reference (CFSE). The etch pattern on dentine was viewed under scanning electron microscopy (SEM) and the resin-dentine interface using confocal laser scanning microscopy. Measurement of microtensile bond strengths (mTBS) after 24 h, 5000 thermal cycles and 3 months dynamic ageing will be reported.

Results: The BMEP-containing primers exhibited distinct etch patterns on dentine as shown in Figure 1, indicating the etching ability. mTBS results after 24 h storage in distilled water did not show any significant difference between the groups, however a significant difference was observed in the mode of failure for the higher concentration of BMEP.

Conclusions: The initial results demonstrate that BMEP demineralizes the mineral phase of dentine and although the interaction between dentine and resin monomers is complex, the results of the mode of failure indicate interaction of the primer monomer with hydroxyapatite is an important factor.

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3D Printing Alginate Hydrogels for Cleft Palate Repair

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Objectives: Cleft lip & palate is the second most common birth defect found amongst new-borns, affecting approximately 1 in 1,000 live births and has implications for oral health. 3D printing has previously enabled the production of bespoke implants from patient imaging data which could be applied as an ideal solution for cleft palate. Alginate is a natural polysaccharide which is well known for its biocompatibility which has interesting viscoelastic properties that suit 3D printing. The aim of this project is therefore to assess the suitability of 3D printing sodium alginate hydrogels as a novel method to treat cleft palate.

Methods: Sodium alginate and calcium chloride were mixed separately into distilled water with a stirrer until completely dissolved. The sodium alginate and calcium solutions were then loaded into syringes and mixed rapidly to produce homogenous, partially crosslinked alginate samples. An Allevi 2 bioprinter was used to print partially crosslinked samples and the results were assessed visually. The optimal concentration was then characterised using a rheometer to assess its viscoelastic properties using a variety of rotational and oscillatory tests. Samples were then secondarily crosslinked, their compressive behaviour analysed using the rheometer and their Young's moduli calculated.

Results: Crosslinked samples were found to be inhomogeneous with large amounts of calcium however were too weak to retain their shape with low amounts of calcium. A niche existed in the centre that satisfied printability and print fidelity. As alginate concentration and crosslinking amount increased, viscosity increased exponentially.

Partially crosslinked samples are capable of behaving viscously and elastically depending on the shear rates applied. Greater molarities of secondary crosslinker and crosslinking times produced samples with increased young's moduli.

Conclusions: Alginate-calcium hydrogels have been shown to be viable 3D printing materials which have the mechanical properties to support layer-by-layer production. Rheology results show that partially crosslinked gels are viscoelastic and thixotropic which allows ease of printing and high shape fidelity retention. Compression tests show that after secondary crosslinking, the mechanical properties of alginate are similar to that of the soft palate.

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Effect of CPP-ACP and BIOMINF® on Remineralisation of Enamel, Analysed by ^{19}F MAS-NMR

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Objectives: Casein Phosphopeptide-Amorphous Calcium Phosphate complex (CPP-ACP) is the main remineralising additive in GC Tooth Mousse®. The objective of this study was to analyse the fluoride containing phases formed on enamel after application of GC Tooth Mousse (GC), BIOMINF® (BF) and fluoride in an acidic environment.

Methods: Enamel blocks (n=5), measuring ~5×5mm with a maximum thickness of ~ 1mm, were cut from caries-free permanent human molars. Each enamel block was immersed in 50ml of acidic solution (0.1M acetic acid pH 4.0) at 37°C for 24hrs. Subsequently, the samples were subjected to remineralisation by immersing them in a fresh acidic solution (0.1M acetic acid pH 4.0) containing either 1g of BF,1g GC, 1g GC+18ppm F- or 18ppm F-. These samples were then stored for a further 96hrs at 37°C. All enamel blocks were accurately weighed (± 0.0001g) before and after the demineralisation and remineralisation cycle to calculate the percent weight loss/gain. At the end of the remineralisation cycle the enamel blocks were ground to a powder and analysed for fluoride containing phases using ^{19}F MAS-NMR. The remineralisation solutions were tested for changes in pH using a calibrated pH electrode. Changes in F- concentration was monitored using ISE, whereas Ca and P concentrations were analysed using ICP- OES

Results: BF showed the highest weight increase during remineralisation followed by GC+18ppm F- and GC Tooth Mousse. The 18ppm F- only samples showed a further weight loss. BF showed enhanced buffering capacity as compared to any of the materials tested and showed the highest consumption of fluoride during remineralisation. ^{19}F MAS-NMR spectra showed formation of fluorapatite and CaF_2 in varying proportions for all the samples. However, for 18ppm F- samples, the peak for CaF_2 was more prominent as compared to other samples.

Conclusions: BIOMINF® has enhanced remineralisation properties as compared to ACP-CPP containing GC Tooth Mousse.

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Assessment of Dentine Tubule Occlusion and Remineralisation Using Serial-Block-Face SEM

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Objectives: To determine the level of tubule occlusions and degree of remineralisation by Sensodyne repair and protect and rapid-relief toothpastes containing Novamin® and Stannous fluoride (SF) respectively using serial-block-face scanning electron microscopy (SBF-SEM).

Methods: Bovine dentine discs (n=6) were etched with 1% citric acid for 30 seconds, washed with deionised water and were randomly divided in to two treatment groups (n=3). Discs were halved with one half treated with one of the toothpastes and one as control. The toothpaste treatment consisted of two brushing cycles a day for two minutes over 7 days with storage in artificial saliva between brushing. Blocks were cut from the discs, embedded in resin and glued to a pin, 600 60nm slices were cut by a diamond knife in a microtome with back scattered electron images taken of the block after each section producing imaging depth of approximately 36µm. Mineral density by measuring grey scale values, tubule occlusion and diameter were measured every 3µm to the depth of 30 µm away from the surface.

Results: SBF-SEM data showed that 100% of the tubules were blocked at the surface when treated with Novamin® compared to 83% for SF. Occlusion percentage decreased with increasing depth away from the surface. 20% and 14% of tubules were occluded at 30 µm respectively. The tubule diameter significantly ($p<0.05$) reduced from 0.8±0.05µm to 0.66±0.21 µm after treatment with NovaMin®, no significant ($p>0.05$) change was seen after SF treatment. Grey scale values around the tubules showed significant differences ($p<0.05$) between the control and treated samples with NovaMin® significantly higher ($p>0.05$) than SF.

Conclusions: Tubule occlusion and depth of penetration was quantifiable by SBF-SEM. Both treatments occluded over 80% of tubules at the surface. Novamin® produced better levels of occlusion both at the surface and at 30µm below the surface and resulted in increased dentine remineralisation.

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Observing the effect of an in vitro post-eruptive maturation pH-cycling model on acid erosion

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Objectives: Observe changes in enamel morphology following a post-eruptive maturation (PEM) model. Observe what protective effect this model has against a subsequent erosive challenge.

Methods: Polished bovine enamel blocks (n=32) were divided into groups (8 blocks/group) and exposed to a 16 day PEM-relevant pH-cycling regime consisting of three 20 min/day demineralisation events (4.1mmol/l $CaCl_2 \bullet 2H_2O$, 8mmol/l KH_2PO_4, 130mmol/l KCl, 50mmol/l acetic acid, 4.25µmol/l F (as NaF), plaque fluid proxy (1mmol/l $CaCl_2 \bullet 2H_2O$, 12.7mmol/l KH_2PO_4, 130mmol/l KCl, 20mmol/l HEPES, 5.7µmol/l F (as NaF); pH: 6.58) between demineralisation events and overnight, and two 2 min NaF treatments/day (228ppm F^-) pre/post overnight step, simulating F^- concentration in the mouth following brushing. Controls consisting of NaF treatment only, pH-cycling only and baseline enamel were also analysed. These blocks were exposed to a citric acid erosive challenge (50 mmol/l; pH: 3.6) and analysed at numerous time-points (0/1/2/4/8/16/30/60/90/120 mins) using multispectral imaging (MSI) and quantitative light-induced fluorescence (QLF-D) to observe progressive changes in enamel during the challenge. Post-challenge enamel morphology and mineral loss were analysed using non-contact surface profilometry (NCSP) and transverse microradiography (TMR).

Results: Fluorescence change (ΔF) during the erosive challenge was significantly decreased in the pH-cycled enamel compared with baseline enamel and NaF treatment only enamel ($p = <0.05$). Overall mineral loss and lesion depth were significantly lower in pH-cycled enamel (2523.33 ± 23.86 vol%.µm; 30.06 ± 0.16 µm) compared with baseline enamel (3313.33 ± 70.22 vol%.µm; 36.71 ± 0.74 µm) and NaF treatment only enamel (2831.11 ± 35.72 vol%.µm; 33.56 ± 0.25 µm) ($p = <0.05$). There were no significant differences in ΔF, mineral loss or lesion depth when NaF treatments were excluded from the model.

Conclusions: The PEM model provides a protective effect against acid erosion. Removal of NaF treatments from the model decreases this effect, but not to a statistically significant degree. Analysis of chemical changes in pH-cycled enamel will provide further insight.

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Reversal of root caries using varnish either containing CPP-ACP and fluoride or fluoride alone in dry-mouth

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Objectives: To investigate the efficacy of a dental varnish containing Casein Phosphopeptide–Amorphous Calcium Phosphate (CPP-ACP) and fluoride compared with fluoride alone in reversing/arresting root caries in dry-mouth patients over one year.

Methods: Initially, laboratory-based studies assessed fluoride, calcium and phosphate ion release characteristics in three different varnishes; CPP-ACP&5%NaF(MI Varnish GC Japan), bioactive glass&5%NaF(Experimental, Dentsply USA), and 5%NaF(F, NUPRO, Dentsply USA). Results showed that ion releases were significantly higher in CPP- ACP&5%NaF>bioactive glass&5%NaF>5%NaF ($p<0.001$), and no evidence of apatite formation was observed in both groups following tris buffer immersion using NMR. Following this, varnishes with CPP-ACP&5%NaF and 5%NaF alone were chosen for the clinical study. A total of 80 dry-mouth patients (64.74±10.63 years) with primary root caries (n=184) and unstimulated salivary flow rate of <0.02ml/min, were randomly allocated to receive either CPP- ACP&5%NaF (n=41, 83 lesions) or 5%NaF (n=39, 101 lesions). Clinical assessments and severity index for root caries (SI), DIAGNOdent measurements and varnish application were carried out at baseline, 3, 6 and 12 months. Oral hygiene instructions and 1,450 ppm fluoride dentifrice were provided during the study.

Results: Results from the clinical study showed 63.9% of root caries in CPP-ACP&5%NaF became hard with SI of 0 (n=46 lesions) following three months compared to 5%NaF (n=35, 39.3%) ($p<0.017$). After six and 12 months, the difference was insignificant (CPP-ACP&5%NaF, n=60, 83.3%) (5%NaF, n=66, 74.2%) ($p=0.36$), and (CPP- ACP&5%NaF, n=60, 89.6%) (5%NaF, n=67, 81.7%, n=1 soft, 1.2%)($p=0.29$)[OR(95% CI)=0.33(0.77–1.44),$p=0.14$] respectively. In both groups, non-cavitated lesions were more likely to change from leathery to hard texture. A significant decrease in plaque index, surface roughness, lesion dimension, DIAGNOdent readings, and significant increase in lesion distance from the gingival margin were reported in both groups ($p<0.05$).

Conclusions: Fluoride dental varnish either with or without calcium and phosphate has the potential to arrest/reverse root caries, especially in non-cavitated lesions for patients with dry-mouth.

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Transmission of 405nm light through dentine towards phototherapeutic applications

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Objectives: Cariogenic bacteria infiltration into dentine causes dietary substrates fermentation, acid release, tissue demineralisation and eventual pulp pathosis. The aim of this study is to investigate the transmission of 405nm light through dental tissues for phototherapeutic applications.

Methods: Dentine discs (n=45) were sectioned using a water cooled low-speed saw (IsoMet, BUEHLER, USA) and polished using a carborundum stone (CARBORUNDUM, France) in occlusal, oblique, and buccal orientations (n=15). Spectral Irradiance through surface-air-dried (30 seconds) specimens were measured through 1, 2 and 3mm thick specimens (n =5) using a fibre coupled (CC3-UV; 3.9mm sensor diameter, Ocean Optics) UV-Vis spectrometer (USB4000, Ocean Optics). The transmitted irradiance was normalised against corresponding irradiance measurements without samples at 1, 2, and 3mm distance between the light source and the sensor. Representative images of dentinal tubules were obtained by Scanning Electron Microscope (EVO MA10, Carl Zeiss; Germany) and analyzed using ImageJ (National Institutes of Health; USA). Significant differences for transmission were identified using one-way ANOVA and post-hoc Tukey comparisons ($p<0.05$).

Results: Increasing dentine thickness decreased light transmission significantly ($p<0.001$) between 1, 2 and 3mm (1mm: 11-23%; 2mm: 1.5-3%; and 3mm: 0.3-0.8%) irrespective of orientation. Occlusal and oblique specimens exhibited higher transmission compared with buccal specimens. The oblique dentine gave statistically comparable results to occlusal dentine independent of section thickness when the light was delivered parallel to tubule orientation. SEM image analysis identified differences in dentinal tubules density with respect to orientation and depth (Occlusal: 22,936-25,648/mm^2; Oblique: 17,217-28,891/mm^2; and Buccal: 10,554-17,806/mm^2) which correlated with transmission where a higher number of tubules resulted in higher transmission.

Conclusions: Dentinal tubule microstructure and density affects light transmission at 405nm which can be optimised when irradiated vertically through the occlusal surface. Phototherapeutic applications require optimal delivery of irradiance and exposure time. Data presented here may inform clinical applications of 405nm light for photodisinfection and photobiomodulation.

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Crystallographic and microstructural studies of developing human deciduous enamel

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Objectives: Background: Knowledge of the process of mineral deposition during enamel maturation would extend our understanding of developmental enamel defects and in caries progression. It may provide the basis to develop biomimetic dental materials to repair or replace damaged enamel structure Aims and objectives: To compare and correlate the mineral concentration and gradient, the crystallite orientation, and microstructures in the enamel of unerupted developing (UE) and mature exfoliated (ME) deciduous teeth.

Methods: Material and methods: Twelve unerupted archived deciduous teeth, alongside eight, naturally exfoliated healthy non-carious deciduous teeth were used. X-ray microtomography (XMT) was used to measure the enamel mineral concentration and Synchrotron X-ray Diffraction (S-XRD) was used to investigate and compare the orientation of crystallites in the developing and mature enamel.

Results: A steeply increasing gradient in mineral concentration from the outer enamel surface enamel ($1.2gcm^{-3}$) towards the EDJ ($2.1gcm^{-3}$) in the middle and cervical portion of the UE teeth. For the ME teeth, a shallow reverse gradient was observed in the same regions. The S-XRD results revealed two distinct populations of crystallites with an angular separation of ~40 degrees to each other at the EDJ and became more aligned to each other towards the natural enamel surface. This pattern was observed in the buccal surfaces of both UE and ME teeth. However, on the palatal surface of UE teeth, only one population of crystallites was found.

Conclusions: Conclusion: There is a correlation between the mineral concentration, crystallite orientation and their spatial location within the tooth. Primary mineralisation begins at the cusp tip moving towards the cervical area and from the inner surface at the EDJ, whilst maturation starts from the outer surface. The higher mineral concentration and crystallite orientations on the outer enamel surface provide the strength and resistance to wear.

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Decellularised Bovine Dental Pulp as a Scaffold for Regenerative Endodontics: in vitro and in vivo studies

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Objectives: Regenerative endodontics (REs) is a tissue engineering-based therapy for managing pulp necrosis in immature permanent teeth. Outcomes are currently unpredictable and are affected by the lack of an appropriate scaffold that mimics the pulp extracellular matrix (ECM). The aim of this work was to develop a scaffold from bovine pulp ECM through the process of decellularisation and to assess its suitability for human dental pulp regeneration both in vitro and in vivo.

Methods: Bovine pulp tissues were decellularised using a detergent-based protocol. The success of decellularisation was assessed using histological analysis and DNA quantification assay. The resulting scaffolds were then characterised for the retention of essential pulp ECM proteins and growth factors using immunohistochemistry. Scaffolds were repopulated with human dental pulp stem cells (hDPSCs), then cells' viability, proliferation and differentiation were assessed using live/dead cell assay, DNA quantification assay and quantitative RT-PCR, respectively. An in vivo study was then conducted in which scaffolds were repopulated with hDPSCs, implanted in pulpless teeth slices, and then transplanted into immunodeficient mice. The resulting tissues were then analysed using histology and immunohistochemistry.

Results: The decellularisation protocol generated acellular scaffolds with more than 98% reduction in total DNA content, and retention of essential pulp ECM proteins and growth factors. Scaffolds were capable of supporting the growth, maintaining the viability and inducing the odontoblastic and angiogenic differentiation of hDPSCs. The in vivo study revealed the formation of a well-organised vascularised connective tissue in the root canal spaces of pulpless teeth slices with a layer of cells lining the dentine walls and resembling odontoblast morphology.

Conclusions: Bovine dental pulp was shown to be a rich source for decellularised scaffolds. The scaffolds were capable of supporting hDPSCs' growth and differentiation in vitro and guided the formation of a well-organised pulp- like tissue in vivo. The future application of those scaffolds in REs may fulfil a yet unmet need for an appropriate scaffold and help to improve the clinical outcomes and the survival of teeth with otherwise poor prognosis.

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"Sweet Tooth" is associated with Altered Intra-oral Sucrose Metabolism

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Objectives: Reduced perception of sweet taste is associated with excess consumption of sugar and adverse systemic metabolic consequences of sugar intake. Whether similar sensory associated differences in metabolism occur intra- orally has not been reported. This study looked at differences in the intra-oral catabolism of sucrose between sensitive and insensitive tasters.

Methods: Targeted proton nuclear magnetic resonance spectroscopy (^{1}H-NMR) was performed on saliva collected from 52 healthy volunteers. Salivary flow rate was measured following a water control rinse and a 0.25 Molar sucrose rinse and participants rated sweetness perception and hedonic response. Perceived intensity responses were ranked and the lowest and highest quadrants (13 per group) were compared. Hedonic responses were classified into sucrose dislikers (n=9) or likers (n=17). Differences in net biofilm output of metabolites were compared.

Results: The lactate:pyruvate ratio was significantly increased in low vs. high perceivers (27:1 vs. 16:1, $p<0.05$), whereas the citrate:pyruvate ratio was significantly reduced in low vs. high perceivers (-0.22:1 vs. 0.7:1, $p<0.05$). Thus, the net microbial metabolism favoured pyruvate conversion to lactate in low perceivers whereas high perceivers featured ongoing citric acid cycle activity. This may reflect compositional differences in oral biofilms with low perceivers being characterised by anaerobes whereas high perceivers may feature more aerobic and facultative species. When analysing hedonic responses sucrose likers generated significantly higher concentrations of glucose than sucrose dislikers (11.8 mM vs. 2.7 mM, $p<0.05$). Lactate output was also raised in sucrose likers although this was not significant (9.3 mM vs. 6.3 mM, $p=0.1$).

Conclusions: These collective findings reveal differences in intra-oral sucrose metabolism based on sensory response. Importantly, these results indicate that those predisposed to sugar consumption may experience greater risk of adverse oral metabolic consequences including more rapid glucose production and enhanced conversion of pyruvate to lactate instead of entering the citric acid cycle.

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Novel Bioactive-Glass Containing GIC for use in Atraumatic Restorative Technique

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Objectives: The objective of this study was to characterise the mechanical properties and apatite formation of a novel GIC with added bioactive glass for use in ART technique

Methods: A novel ionomer glass based on the system $4.5SiO_2$- $3Al_2O_3$- $0.5P_2O_5$-2CaO-$3CaF_2$ was synthesised via melt-quench route, followed by milling and sieving to optimise the particle size. Sodium free bioactive glass of the experimental formulation based on SiO_2-P_2O_5-CaO-CaF_2system was synthesized via melt-quench route and milled into coarse particle size powder. Prior to cement mixing, the bioactive glass was added to glass powder in 5%,10% and 20% weight fractions. Cylindrical cement samples (n=360), with dimensions 4x6mm, were prepared and immersed in Tris buffer, and artificial saliva pH4.0, and pH7.0 for 1, 6, and 12months. The compressive strength and modulus of elasticity were measured before and after immersion using universal testing machine. Apatite formation was analysed using solid-state ^{31}P and ^{19}F MAS-NMR. Fluoride-ion release was measured using fluoride-ion selective electrode. Calcium and Phosphate ions release was measured using ICP-OES.

Results: Cement compositions containing up to 10% weight fraction of BAG showed compressive strength values higher than the ISO standards for GIC restorative materials (>100MPa). Further increase in BAG led to reduction of the compressive strength. NMR data revealed evidence of apatite formation that increased substantially by adding more BAG. Slight increase in F ion release was detected as more BAG was incorporated into GICs. The addition of BAG into the GIC composition resulted in greater concentrations of Ca^{2+} ion release.

Conclusions: The novel GIC with added bioactive glass showed acceptable mechanical properties and great potential for remineralisation through apatite formation.

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The Atomic Force Microscope in Basic Dental Research

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Objectives: To highlight the capability of the atomic force microscope (AFM) applied to a range of interdisciplinary research related to oral biology. The working principles of the AFM will be introduced and exemplars of its application in current collaborative basic dental research will be summarised.
Methods: The AFM is a high-resolution surface profiling microscopy that utilises a microfabricated force sensing cantilever to detect forces between the sample and a sharp nanoscale tip. It feels the surface as the cantilever is scanned over it to produce a 3D topographical image of the sample. It can also make force measurements by controlling the tip-sample distance perpendicular to the sample. In this force mode, it can either indent a soft surface (e.g. hydrogel) to determine the local modulus or measure surface adhesion by pulling the tip away from the surface. It is a versatile nanomaterial characterisation tool due to its ability to measure forces at the nanoscale and operate in both ambient air and aqueous liquid environments, allowing in vitro studies, either in an ex-situ or in-situ manner.
Results: Recent results from a range of collaborative projects will be presented including;
1) Nanomechanical behaviour of collagen fibrils and hydrogels for regenerative medicine.
2) Bacterial cell wall structure and in situ cell division.
3) Single molecule outcomes of convergent and tandem transcription for simple in vitro gene models related to tooth development.
4) Formation and structure of DNA origami nanomaterials as potential drug and gene delivery vehicles.
Conclusions: The AFM is a versatile instrument for hard and soft material characterisation in real space at the nanoscale. High magnification imaging can resolve molecular details of complex bioassemblies but theresolution achieved is still somewhat dependent on the stiffness of the material coupled with the environmental conditions. Force measurements in aqueous environments allow accurate characterisation of the moduli of hydrogel constructs, important for the development of stem cell based therapies. It is expected that AFM will play an increasingly important role in basic research related to the complex environment of the oral cavity.

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Characterisation of the Bioactivity of Two Commercial Composites

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Objectives: The aim of this study was to characterise the ion release, pH changes and apatite formation ability of two potentially bioactive composites; Cention N (CN) and Activa (ACT).

Methods: Ion release and apatite formation were investigated in three different immersion media; Tris buffer pH 7.3 (TB), Artificial Saliva pH 4 (AS4) and Artificial Saliva pH 7 (AS7), in order to mimic the conditions present in the mouth. Characterisation of the solutions were carried out using Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES) and Ion Selective Electrode (ISE) to quantify the ion release. The discs were characterised using Attenuated Total Reflectance-Fourier Transform Infrared Spectroscopy (ATR-FTIR), X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) to detect apatite formation on the surface of the discs.

Results: Apatite formation was observed in CN in AS7, but similar results were not found for ACT in any immersion media. CN also showed a reacted layer of glass particles in the SEM images for AS4, indicating the acid hydrolysis of Al-O-Si bonds, as glass ionomers (GIs) degrade under acidic conditions. A reacted layer of glass particles were not observed for the ACT. ACT released very few fluoride ions upon immersion in TB and AS7, but released other ions such as significant quantities of aluminium ions in AS4. This would suggest the glasses in ACT are acid degradable fluoro-alumino-silicate glasses similar to the glasses used in glass ionomer cements. There was no evidence of any apatite formation with ACT. CN released more ions in TB and AS7 than ACT, and formed an apatite-like phase in AS7. The calcium fluoro-silicate glass in CN was observed to degrade significantly in AS4.

Conclusions: CN has bioactive properties in many different characterisation techniques, which may explain the low incidence of secondary caries found clinically with this composite material. These bioactive properties were not found for ACT.

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Dose-Response Cariostatic Effect of Stannous Ions on Demineralisation

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Objectives: Stannous ions (as SnF_2) are incorporated into several dentifrice products. However, the impact stannous ions directly on cariostatic function remains obscure. The aim was to compare the cariostatic efficacy of stannous ions at 25 and 2.3ppm. NaF at each equivalent fluoride concentration was used as a control in order to remove the efficacy of fluoride from the comparison using Scanning Microradiography (SMR) with hydroxyapatite discs.

Methods: 4 hydroxyapatite discs (20% porosity, Plasma Biotal, UK) were located in individual SMR cells. Demineralising solution (pH4.0) was pumped through each cell (approx. 11ml/h) for 48h at 25°C. Then SnF_2 at either 25 or 2.3ppm was added to the demineralisation solutions, and demineralisation continued for 144h. Then, deionized water was washed through for 96h. Finally, demineralisation solution (without SnF_2) was pumped for 168h. Control experiments with equivalent fluoride concentrations (NaF) were similarly carried out. SMR was used to measure demineralisation rates in each disc throughout. The percentage inhibition of demineralisation for each case was calculated and compared.

Results: The percentage inhibition under each condition described are shown in Table 1. This shows that under all conditions demonstrated inhibition of demineralisation. However, the inhibition was greater at higher fluoride conditions. However, at 25ppm stannous ions significantly increases the cariostatic inhibition over the equivalent fluoride concentration. Whereas, at 2.3ppm, there is no additional cariostatic effect of stannous ions, although again the cariostatic effect of both fluoride systems remains after washing.

Conclusions: The increased cariostatic function remains, even when the source of ions is removed, suggests that ions are retained within the HAP even after washing. The results show there is a dose-response of the additional cariostatic effect of stannous ions.

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Effects of Stannous Fluoride (SnF_2) and Sodium Fluoride (NaF) on in vitro Enamel Demineralization analysed by ^{19}F MAS-NMR

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Objectives: To elucidate the mechanism of action of SnF_2 on the demineralisation of hydroxyapatite using ^{19}F-MAS-NMR. Stannous ions are incorporated into several dentifrice products. However, the impact stannous ions directlyon cariostatic function remains obscure. The aim was to compare the cariostatic efficacy of stannous ions (as SnF_2) using NaF at each equivalent fluoride concentration as a control in order to remove the efficacy of fluoride.

Methods: Hydroxyapatite disks (PlasmaBiotal Buxton UK) were immersed in 0.1M Acetic acid (pH4.0) containing different concentrations of fluoride where the fluoride source was either SnF_2 or NaF for 96h. The immersion solution was analyzed before and after immersion by ICP-OES and the fluoride ion concentration determined using an ISE.

The hydroxyapatite discs were powdered and ^{19}F-MAS-NMR carried out. The experimental protocol and methods were almost identical to those used by Mohammed et al. Caries Research 47, (2013): 421 except hydroxyapatite was used rather than enamel.

Results: The results for NaF study mirrored the previous data obtained for enamel blocks obtained by Mohammed et al.; high concentrations of fluoride above 45ppm formed fluorite (CaF_2) whilst lower concentrations formed Fluorapatite $Ca_{10}(PO_4)_6F_2$. Formation of CaF_2 resulted in higher concentrations of phosphate in solution and increased weight loss.

The behaviour of SnF_2 was more complicated than NaF. The fluoride concentrations in solution did not match the SnF added. At intermediate concentrations the fluoride concentration was approximately 50% of the expected values suggesting that SnF_2 may form SnF^+ species in solution. At lower concentrations SnF_2 appeared to dissociate more and at higher concentrations less but the situation is further complicated by its possible change in oxidation state from Sn(II) to Sn(IV) and consequent precipitation from solution. SnF_2 formed CaF_2 and an amorphous Sn compound was detected within the porous hydroxyapatite disc. Low concentrations of phosphate and fluoride were detected in solution that may indicate that the Sn precipitate contained phosphate and fluoride.

Conclusions: The mode of action of SnF_2 is complex, but probably involves the formation of CaF_2 and the formation of amorphous tin compounds on the surface that may inhibit demineralization.

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"I am worried something bad will happen": Giving anxious children a voice.

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Objectives: To explore children's specific anxieties about a dental visit, using a structured communication proforma 'Message to dentist' (MTD).

Methods: 105 children, aged 9-16 years, with varying degrees of dental anxiety, were invited to complete the MTD at their assessment. Participants were recruited from both a general dental practice and a hospital paediatric dentistry clinic. This tool, used as part of a cognitive behavioural therapy approach to reduce dental anxiety, prompts children to express their worries, coping plans and requests to the dental team. The free text was subject to thematic analysis by four independent investigators.

Results: Children's specific worries were found to fall within four themes: experiencing pain; something bad happening (catastrophising); not knowing what was happening (uncertainty), and specific procedures (such as needles and injections). Children were found to catastrophise about the dentist making mistakes e.g. taking out the wrong tooth or dropping something down their throat. In regards to what children wanted to happen, four further themes emerged: an absence of pain; good communication; speed, and a positive clinical outcome. Children wanted to be listened to and be able to say 'stop'. When reflecting on what went well, three themes were identified: clinician competence; good communication and effective use of their own coping strategies. Adhering to a plan appeared to help children feel in control and contributed to a positive experience.

Conclusions: Purposefully exploring and formally recording children's worries are key to anxiety reduction. Children want an absence of pain, efficient and successful treatment and good communication with their dental team.

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PLATOON: Logistical Challenges, Limitations And Solutions

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Objectives: The process of operationalising a research protocol into a large birth cohort study running multiple studies simultaneously has been unexplored. The objective is to describe the challenges, limitations, and solutions of operationalising a school-based data collection protocol, part of PLATOON (Premature Loss of bAby Teeth and its impact On Orthodontic Need) study, into the vibrant Born in Bradford (BiB) birth cohort.

Methods: Two examples from the research protocol will be used to showcase complexities and inter-disciplinary communication needed to enable the effective and efficient delivery of PLATOON study in primary schools.

Results: A pilot study involving seven primary schools and up to n=207 Year Six pupils will be conducted in July-2019. *Identification and Recruitment*: Previous research identified n=1080 BiB children who have had extraction of primary teeth. A matched control group of BiB children with no primary tooth extractions will be recruited based on their school and class. Recruitment, supported by the National Institute for Health Research Clinical Research Network (NIHR CRN), will involve identification of both primary schools and pupils. It is uncertain how many control children may have had extractions at their own dentist, therefore making them eligible for the exposure group. *Data collection and entry*: Data, including intra-oral examination, orthodontic photographs and dental impressions will be collected from each child. The complexity of collecting data in school settings requires management of data confidentiality and logistics for safe transport of clinical waste. Data will be entered through a secure bespoke web-application to enable efficient entry. The suitability of a 4G mobile data dongle will be tested to enable access to the web-application in different schools.

Conclusions: Operationalising a complex project requires consideration of many aspects of participant recruitment, data collection, and data transfer. Pilot study will inform data collection over the remaining ten months of the study and quantify the uncertainties.

152 WITHDRAWN

Child-reported impacts of treatment for caries under general anaesthesia

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HABIT: An Oral Health Intervention for Infants- Qualitative Findings

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Objectives: Supporting parents to adopt good oral health habits for their young child is crucial for long-term oral health. Universal home visits undertaken by health visitors at 9-12 months provide an opportunity for oral health guidance. Underpinned by an intervention mapping and co-production approach, we developed the HABIT (Health Visitors delivering Advice in Britain on Infant Toothbrushing) intervention to support these oral health conversations. To explore the acceptability and feasibility of delivering the HABIT intervention with parents and health visitors.
Methods: Following the delivery of the HABIT intervention, qualitative semi-structured interviews with parents, and focus groups with health visitors, were undertaken. Interviews were audio recorded, transcribed and analysed using a framework analysis underpinned by a theoretical framework of acceptability and the Theoretical Domains Framework.
Results: Seventeen parents were interviewed. Three themes captured the acceptability of the intervention to parents: “integration with family life”, “timing” and “health visitor as a ‘trusted’ person”. Parents described the benefits of HABIT including additional skills and knowledge regarding oral health. Parents identified difficulties as their child became more independent and resistant to parent led toothbrushing. Five health visitors and three nursery nurses participated in two focus groups. Three themes were developed from the health visitor focus groups: “training and resources”, “organisational challenges” and “changing family norms”. Health visitors found the HABIT resources and training helpful, however struggled to implement the ‘action plan’ and requested further structure to their conversations. They described difficulties accessing dental care for children and the challenge of supporting parents from disadvantaged backgrounds or complex family dynamics, particularly when toothbrushing was not seen as a priority.
Conclusions: Overall, HABIT was feasible and acceptable to deliver. The results identify the need for minor modification to the HABIT resources and training of health visitors before progressing to a definitive study.

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The role of patient feedback in undergraduate dental education: A patient participation project

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Objectives: To explore the influence of timely chairside patient feedback, using a questionnaire application on a tablet on undergraduate dental students.

Methods: This project was conducted with year five undergraduate dental students in a United Kingdom (UK) dental school over a four-week period. Patients treated by fifth year dental students on adult dental health clinics were approached by supervising clinical teachers at the end of clinical sessions to request feedback using a short questionnaire. The questionnaire was developed using "Online Surveys (formerly BOS)". This was made available as an application on tablets and adapted to ensure timely feedback by an E learning consultant. The questionnaire consisted of two Likert scale questions and two open ended questions. Simple statistical analysis was conducted, and content analysis was carried out on the responses to open-ended questions.

Results: Thirty-four year five dental students received fifty-one items of patient feedback over a four-week period. The majority (76%) of students found this feedback to be useful. 94% of students felt receiving the feedback within one week of the clinical encounter was timely. Only 14% of the students discussed their feedback with their clinical tutors and found it useful.

Students found patient feedback to be useful because it gave "insight into how our patients feel and how we can improve patient satisfaction" and to "help us reflect. However, students also felt that "anything negative, I don't think patients would be comfortable to say it" and patients may make "generic positive comments".

Conclusions: Feedback from patients in the clinical environment immediately after a student-patient interaction is valuable and powerful. These findings suggest the tablet-based application facilitated a method to capture timely feedback and can be used to develop insight and reflective practice.

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Dental EHR system illustrates association between oral and general health.

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Objectives: Use dental electronic health record (EHR) data to investigate relationships between medical questionnaire responses and oral health status as measured by D_3MFT

Methods: The responses to medical questionnaires and the clinical EHR D_3MFT score as recorded on same day (after Jan 1st 2004) were identified for 130,226 schoolchildren between the ages of 6 and 15 inclusive. The 10 most commonly positively answered questions were extracted and matched to the D_3MFT score of the patient.

Results: 'Healthy' patients with no recorded medical conditions represented 42.95% of the group, the most commonly reported condition was Asthma (13.5%) followed by Hay Fever (11.5%), and Cold Sores (8.1%). Whilst 56% of the 'Healthy' group were caries free, only 46% of those with a history of 'Cold Sores' were. This was the lowest $D_3MFT = 0$ value, with all of the others in the low/mid 50's. The data has not been adjusted for any confounding factors such as age etc.

Conclusions: Age is, without doubt, a confounding factor here. The probability of diagnosis of a medical condition and the chances of having caries both increase with time meaning that the older children get, the more likely they are to report at least one diagnosed medical condition and also to have caries. These profiles could easily be developed to address age and other confounding factors. Exploratory analysis such as this helps give an intuitive feel for the data and can sometimes reveal unexpected hypothesis-generating results appropriate for more detailed future analysis.

156 WITHDRAWN

Studying Enamel Matrix Derivative (EMD) at Molecular and Cellular Level

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Trueness and precision of a novel surgical guide to place implants in an edentulous patient.

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Objectives: For edentulous patients, the mobility of the oral mucosa causes problems for the accuracy of implant surgical guides. A novel approach uses orthodontic screws to align scans and provide retention for a surgical guide. The aim of this study was to assess the accuracy of the resultant surgical guide.

Methods: Three orthodontic screws were placed in a model of the mandible. The model was optically scanned and a CBCT taken. The screws were used to align the scan of the model with the CBCT to obtain a 3D virtual model. The implant position was planned on the virtual model and the surgical guide printed. The implants were placed into the model using the guide. A CBCT image was taken of the model with the implants placed. The trueness and precision of the placed implants was assessed. A power calculation yielded that 16 repeated runs of the assessments were required. The outcome measures for the assessment of accuracy were, angular deviations in axis, linear deviations in height, and position at the apex and at the shoulder. Measurement tools used for the outcomes were assessed for precision by repeating measurements on the first block 10 times.

Predetermined clinically acceptable tolerances for the accuracy of placement of implants are reported in the literature. The Null Hypothesis is that the new method does not align the implants to the planned position within clinically acceptable tolerances.

Results: Measurement showed that there was no clinically significant difference in the planned and actual placement position using the novel approach outlined above.

Conclusions: The results reveal the Null Hypothesis should be rejected. The results from the study suggest the new placement method is more accurate than previously reported figures used in edentulous surgery.

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Complications and patient's experiences during Class II malocclusion treatment. A systematic review

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Objectives: In the view of the high prevalence of Class II malocclusion and the range of correctors used in adolescent children, it is important to explore the impact of these appliances on patient-reported outcomes and subsequently treatment success in a systematic manner.

Methods: A systematic review was undertaken, with a defined electronic search strategy, using PICO selection principles and following PRISMA guidelines. Adolescents with Class II malocclusion, treated with any Class II corrector including functional appliances, headgear and maxillary molar distalizer. The presence of comparison and/or control was not essential. Outcomes: prevalence and severity of complications, patient experiences during treatment and impact on OHRQoL. Only prospective studies including randomised (RCT) and non-randomised (CCT) clinical trials, cohort studies, and case series incorporating subjective data on patient experiences and complications were included. The Cochrane Collaboration's Risk of Bias and Newcastle-Ottawa Scale were used to assess the quality of included studies. Screening, data extraction, and quality assessments were performed by 2 investigators independently.

Results: A total of 461 studies were identified, of which 26 unique datasets were eventually included: 9 RCTs, 5 CCTs, 1 case series, 8 cross-sectional, and 2 qualitative studies. Only one was deemed a high-quality study, with no meta-analysis justified due to considerable clinical heterogeneity in the type of appliances and outcomes measures. Overall, 1602 adolescents were treated, the majority received functional appliances (n=688 fixed, n=672 removable and n=60 hybrid type) and the remainder treated with headgear and Carrier appliances. The fixed-functional was associated with a significant rate of complications (34%), with lack of reporting for removable variety. However, the failure rate with the removable was significantly greater compared to the fixed type (43% versus 4%).

Conclusions: Further prospective studies are needed to clarify patients' experiences and potential harms associated with Class II correctors.

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Volatile Organic and Volatile Sulfur Compounds in Denture Malodour

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Objectives: To study the volatile organic compounds (VOCs) and volatile sulfur compounds (VSCs) present in the oral odour of partial and full denture wearers.

Methods: Mouth air samples and denture headspace samples were collected from denture wearers using a grab sampler (Easy VOC, Markes), into inert-coated sorbent tubes (Sulficarb and Tenax TA; Markes), according to an ethics approved protocol. The samples were analysed using a Thermal desorption-gas chromatography-mass spectrometry method. Further, VSCs were detected from mouth air samples using the Oral Chroma. The oral health of the study participants were also assessed using routine clinical assessments.

Results: The number of VOCs detected in the breath of participants ranged from 24 to 88, with a higher number of compounds detected from the denture headspace (ranging from 25 to 102) in both full and partial denture wearers. A higher number of compounds were detected in the mouth air and denture headspace of partial denture wearers than the edentulous, in particular ketones and aldehydes, suggesting a greater potential for malodour in partial denture wearers. In addition, VSCs were detected in more partial denture wearers than the fully edentulous.

Conclusions: The detection of more malodorous VOCs emanating from the dentures in both full and partial denture wearers suggests denture wearing may have a role in causing oral malodour.

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Development of "My Retainers" mobile application: Triangulation of two qualitative methods

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Objectives: To describe the development of a patient-informed mobile application aimed to enhance retainer wear.

Methods: Four aspects were considered during mobile application development: participant preferences; analysis of publicly-available retainer-related posts on Twitter; available interventions; and behaviour-change theories. Audio- recorded one-to-one interviews were conducted with a subset of participants to account for patient preferences in terms of features, design and content. A criterion-based purposive sample of participants wearing vacuum-formed retainers for at least 4 years was used. Thematic analysis of transcribed data was undertaken.

Results: The need to facilitate communication with the treating clinician, responsive reminder and tracking systems, and access to useful and engaging written and visual information, in addition to other personalised and interactive features were considered important. Concerns related to retainer wear shared on Twitter informed an exhaustive list of frequently-asked questions. Application features were mapped to relevant theoretical constructs. Determinants of existing behavioural change theories were used to link application features to expected outcomes.

Conclusions: A holistic process involving both patient and professional input can be useful in informing the development of mobile applications. The orthodontic application ("My Retainers") will undergo further scrutiny in relation to its effectiveness in inducing behavioural change and concerning patient experiences prior to finalisation.

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The CRTC1-MAML2 Fusion Protein- an Innocent Bystander or Tumour Promoter?

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Objectives: 1. Develop a novel and specific assay to detect the CRTC1-MAML2 fusion gene in formalin-fixed, paraffin-embedded (FFPE) MEC samples; 2. Understand the role of CRTC1-MAML2 fusion protein in MEC development.

Methods: A chromogenic BaseScope assay was performed on (FFPE) human MEC cell lines and patient tissues using a probe targeting the novel exon-exon junction in the CRTC1-MAML2 fusion transcript. An epitope-tagged CRTC1-MAML2 expression clone was generated by amplifying the translocated genes from fusion- expressing MEC cell lines.The CRTC1-MAML2 expression clone was transfected into primary salivary gland cells, isolated from human explanted tissues, to study the down-stream effects of novel fusion protein expression. A three-dimensional (3D) organoid model of salivary glands using the normal human cells was developed to validate the monolayer cell culture results.

Results: Using the BaseScope assay, we detected the RNA transcript signal for the CRTC1- MAML2 junction in known fusion-positive cells but no signal was detected in known fusion-negative cells. Staining with the CRTC1- MAML2 fusion probe revealed distinct fusion events, in the form of punctate red dots, in MEC tissues. We have fully quantified the expression of the fusion gene in MEC cases of low, intermediate and high grade. A Flag-tagged mammalian expression construct has been generated and verified by overlapping sequencing. Primary salivary gland cells have been successfully transfected, and protein expression subsequently detected. A 3-D organoid model, including a folded duct-like cell structure has been developed.

Conclusions: In this study, we have demonstrated for the first time that, the BaseScope assay accurately detects the CRTC1-MAML2 fusion transcripts and thus provides an alternative chromogenic technique, for use in routine clinical labs, to aid accurate diagnosis of MEC. The CRTC1-MAML2 fusion construct provides a valuable tool, which we are now using to generate a stable cell-line. This will allow us to further elucidate the role of the fusion protein in tumourigenesis.

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Targeting Head and Neck Tumours with HSV1716 Oncolytic Virotherapy

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Objectives: Head and neck cancers (HNC) constitute the sixth most common malignancies worldwide and their incidence is increasing. Despite advances in surgical intervention and treatments, prognosis for HNC remains poor. Evidence suggests that oncolytic viruses (OV) can target tumour cells reducing and in some instances abolishing their growth. However, data for effectiveness of OV on HNC is lacking. The aim of this research was to examine the oncolytic activity of the modified human herpes simplex virus (HSV) 1716 on HPV-negative and HPV-positive HNC cells.

Methods: FaDu (HPV-negative) and SCC90 (HPV-positive) cell lines cultured in 2D monolayers or 3D spheroids were infected with increasing doses of HSV1716 and viability measured by MTT and LDH assay. Quantitative PCR and ELISA was used examine the expression of pro-inflammatory and apoptotic genes upon infection. Histology and Immunohistochemistry were used to determine viral-induced tumour cell damage, apoptosis and viral load on 3D cultured spheroids.

Results: HSV1716 caused FaDu and SCC90 cell death in a dose- and time-dependent manner in both 2D and 3D culture models. Increased release of LDH over time was observed in both 2D and 3D models indicating increased cell lysis. Significant reductions in tumour volume were observed in HSV1716-treated spheroids and marked cell damage was identified on their periphery that was associated with high viral loads by immunohistochemistry. Expression of both pro-inflammatory (CXCL8, CXCL1, CCL5) and apoptotic genes (PUMA, DAPK1) were significantly increased in HSV1716-treated cells compared to control cells, indicating an increased innate immune response to viral infection.

Conclusions: These in vitro data suggest that not only is HSV1716 highly effective at killing HNC cells but also induces expression of immune factors that will attract anti-tumour immune cells (T cells) into the tumour microenvironment, further aiding tumour eradication.

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Chronic periodontitis and air flow limitation in older Swedish adults.

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Objectives: To investigate whether there was an association between chronic periodontitis (CP) and air flow limitation in older adults.

Methods: Study individuals were randomly selected from the Swedish civil registration database representing the aging population (60-96 years) in Karlskrona, Sweden. Clinical and radiographic dental examinations were performed. Alongside this participants completed questionnaires gathering information on their medical history, social circumstances, demographic background and tobacco use. A physical examination assessed anthropometric measures. Spirometry measures were performed using the Vitalograph 2120 electronic flow volume spirometer (Vitalograph, Buckingham, UK). Multiple logistic regression models were used to investigation the association between CP and airflow limitation with adjustment for age, sex, smoking, anthropometric measures, physical activity, other medical conditions, and socio-economic status.

Results: 826 Caucasian dentate subjects were included in the analysis. The mean age was 73.2 years (SD 9.0), and 443 (54.6%) subjects were female. CP, defined by ≥30% sites with ≥5mm distance between the cemento-enamel junction and alveolar bone level, was found in 196 (23.6%) subjects. 86 (10.4%) individuals presented with air flow limitation, defined as a forced expiratory volume in 1s / forced vital capacity ratio of <0.7. Multiple logistic regression analysis showed that CP was independently associated with air flow limitation, OR=2.1 (95% CI 1.2-3.8) p=0.01.

Conclusions: In this group of older dentate adults from Southern Sweden, CP was significantly associated with airflow limitation independent of other known risk factors.

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Visualisation and Quantification of Inflammation in 3D Oral Mucosal Models

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Objectives: The aim of this study was to develop and optimise irritated and inflamed 3D tissue-engineered human oral mucosal models to visualise and measure inflammation using different qualitative and quantitative approaches.

Methods: Normal human oral fibroblasts, TR146 keratinocytes and THP-1 monocytes were cultured and expanded in vitro until sufficient numbers of the cells were obtained. 3D oral mucosal models were engineered inside tissue culture inserts using cell-populated collagen hydrogels to construct the connective tissue component which was subsequently layered with the epithelial cells to form full-thickness oral mucosa equivalents. Inflamed models containing monocytes were simulated with Lipopolysaccharide (LPS) of Escherichia coli (E. coli) and treated with Tumour Necrosis Factor (TNF-α) to induce inflammation. Tissue models were assessed using histology, PrestoBule assay and ELISA for measurement of inflammatory cytokines.

Results: Normal and inflamed full-thickness 3D human oral mucosal models were successfully tissue engineered and characterised. PrestoBlue assay showed statistically significant increase in proliferation and fluorescence intensity in the inflamed 3D oral mucosal models compared to normal non-inflamed models ($p<0.05$).

Conclusions: The inflamed 3D oral mucosal model developed in this study has the potential to be used as a suitable in vitro test system for biological evaluation of dental materials and oral care products as well as for the investigation of inflammatory diseases of human oral mucosa.

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Development of a Radiographic Index for Periodontitis

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Objectives: To introduce a radiographic index to aid clinicians in determining the extent and severity of interproximal alveolar bone loss, in relation to individual root lengths, among patients with periodontitis.

Methods: A retrospective analysis of 50 anonymised and randomly selected dental panoramic tomograms (DPTs) from a list of patients with a baseline diagnosis of periodontitis from March 2018 to March 2019 was conducted. Visual interpretation of interproximal alveolar bone levels was recorded by 30 volunteering clinicians for the "worst site" in each quintant on the DPTs following the proposed scoring codes including 0 (no bone loss), 1 (mild 1-15% bone loss), 2 (moderate 16-33% bone loss), 3 (severe 34-66% bone loss), and 4 (very severe 67-100% bone loss). Results were then compared to the "Schei Technique" - a gold standard alveolar bone level quantification method.

Results: Cohen's kappa ($_K$) analysis on IBM® SPSS Statistics 25.0 software revealed a complete intra-examiner agreement ($_K$ = 1.00) and a high level of inter-examiner agreement ($_K$ = 0.85) when both the severity codes (0-4) and defect types (* = furcation involvement, H = horizontal bone loss, V = vertical bone loss) were considered.

Conclusions: The proposed radiographic index may serve as a simple, yet valid and reliable, adjunctive screening tool to further assist clinicians in determining the extent and severity of interproximal alveolar bone loss in patients with periodontitis.

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High Speed Imaging of Biofilm Removal via Ultrasonic Cavitation at Different Distances

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Objectives: Cavitation bubbles form in the cooling water around dental ultrasonic scalers and are being researched as a novel method of biofilm removal for periodontal therapy. The aim of the present study was to use high speed imaging to understand the effect of tip distance from the surface in biofilm removal from a titanium (Ti) disc.

Methods: Streptococcus sanguinis (ATCC 10556) biofilm was grown on grade IV Ti discs for 7 days to mimic biofilm on a dental implant surface. Tip 10P was used in conjunction with a P5 Newtron Ultrasonic Scaler operating at power 10 for 2s. The ultrasonic scaler tip was immersed in an imaging tank filled with water and held either 0.5 mm or 2 mm away from a Ti surface containing biofilm (n=3). Biofilm removal in real time was imaged using a high speed camera. Image analysis was used to compare the amount of biofilm removal.

Results: Biofilm was removed faster when the ultrasonic scaler tip was held closer to the biofilm. This is likely to be because the acoustic pressure is greater in the region closer to the ultrasonic scaler tip. It may also be a result of cavitation clouds from the tip touching the surface and aiding in biofilm disruption. Image analysis of the high speed images showed that after operating the scaler for 2s , 49 ± 8% biofilm was removed when the tip was held 0.5 mm away and 26 ± 11% biofilm was removed when the tip was held 2 mm away from the biofilm ($p<0.05$).

Conclusions: The results of this study show that cavitation from dental ultrasonic scalers is more effective when the scaler tip is held closer to the biofilm. The clinical implications of this are that the instrument can be used close to the surface without the tip making contact, whilst still cleaning via cavitation.

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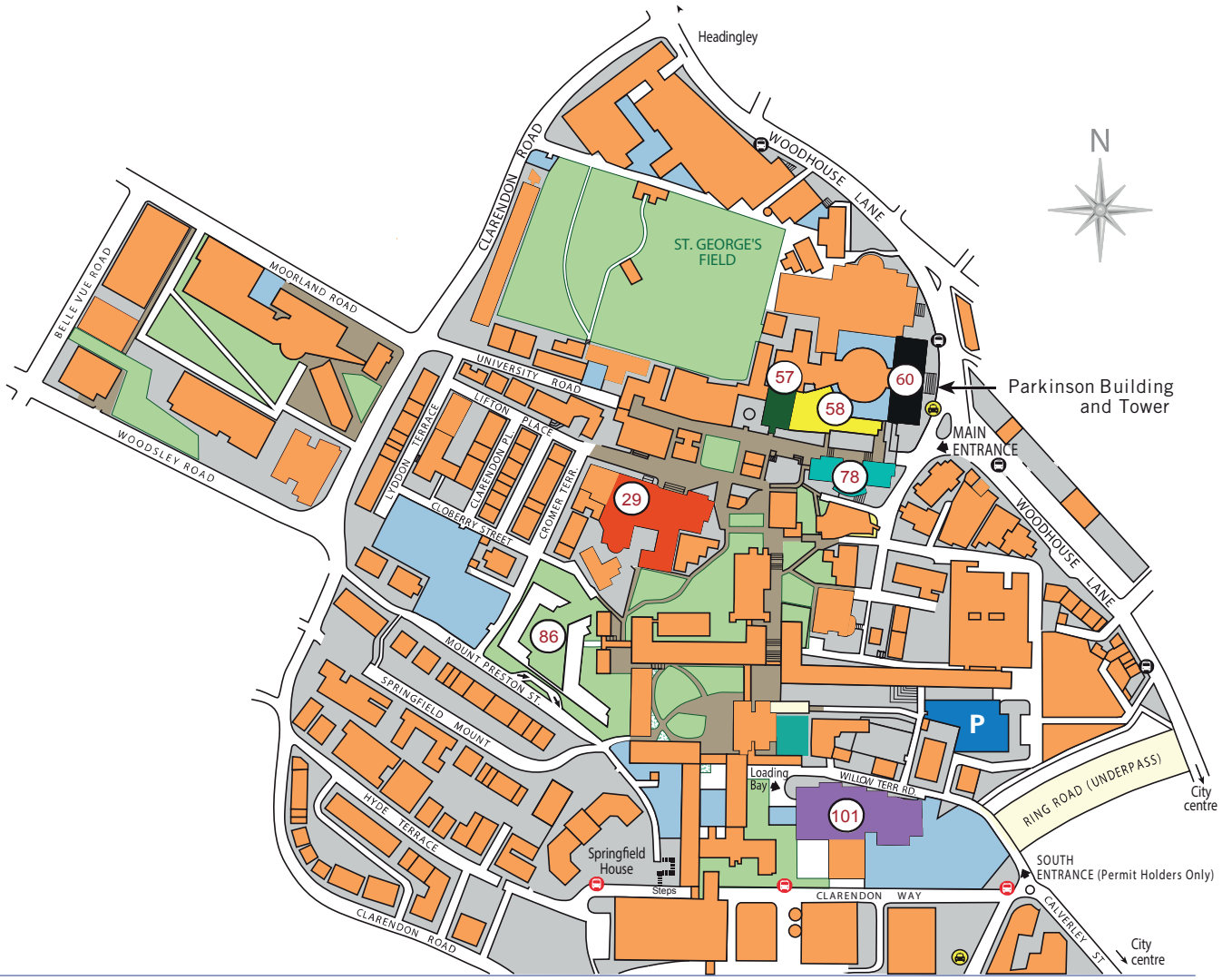

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