BSODR 2021
Scientific Programme

Scientific Programme

Wednesday 1st September
Pre-conference meetings

09.00 - 10.45	Oral Microbiology and Immunology Group (OMIG) Symposium
09.00 - 11.55	Mineralised Tissue Group Symposium (MINTIG) Symposium
11.00 - 12.00	BSODR MC Meeting
12.00 - 12.45	Lunch (OMIG/MINTIG/BODR MC)

Wednesday 1st September
OMIG meeting, Edgbaston Park Hotel

09.00	**Introduction** Professor Graham Stafford, OMIG President
09.05	**NBIC- introduction to activities** Dr Shi Qi-An: University of Southampton, NBIC fellow
09.15	**"The oral microbiome: dynamic communities and interactions"** Dr Shi Qi-An: University of Southampton, NBIC fellow
09.45	**"The oral microbial resistome"** Dr David Moyes, Centre for Host-Microbiome Interactions, KCL, UK
10.15	Break
10.40	**"Host glycan metabolism by human gut microbes and pathogens"** Dr Lucy Crouch, Institute of microbiology and infection, University of Birmingham
11.10	**"The Type IX Secretion System: a mechanism for virulence factor export in dental pathogens"** Professor Ben Berks, Dept of Biochemistry, University of Oxford
11.55	Closing Remarks
12.00	Lunch

Wednesday 1st September
MINTIG meeting, Edgbaston Park Hotel

09.00	**Biomaterials for craniofacial tissue repair and disease modelling** Eileen Gentleman, King's College London
09.25	**The effect of osteoporosis on bone regeneration** Elena Calciolari, Queen Mary University of London
09.50	**The role of FGF signalling in syndromic craniosynostosis** Erwin Pauws, University College London
10.15	**Clinical aspects of Molar Incisor Hypomineralisation (or enamel defects) in children** Richard Balmer, University of Leeds
10.45	Close
12.00	Lunch

Scientific Programme

Wednesday 1st September
Leonard Deacon Lecture Theatre

12.30	Registration, exhibition and lunch
13.30	**Senior Colgate Award** Chair: Professor Marcello Riggio, University of Glasgow
	Valuation of CARIES-QC-U: a child-centred caries-specific preference-based measure Helen Rogers, Newcastle University
13.45	**Incorporating Macrophages into Tissue-Engineered Oral Mucosal Equivalents Improves Inflammatory Response** Bethany Ollington, University of Sheffield
14.00	**Wnt Signalling in The Apical Papilla is Essential for Tooth Root Development** Rupali Lav, King's College London
14.15	**Examining the Role of Extracellular DNA in Oral Biofilm Formation** Hannah Serrage, University of Bristol
14.30	**Parotid Saliva 1H-NMR Analysis for Colon Cancer Salivaomics** Angela Rovera, Queen Mary University London
14.45	**The Longitudinal Effect of Rituximab in Primary Sjögren's Syndrome** Farzana Chowdhury, Queen Mary University of London
15.00	**Junior Colgate Award** Chair: Professor Rachel Waddington, Cardiff University
	Artificial Neural Networks Can Reliably Predict the Presence of Periodontitis Nasir Bashir, University of Birmingham
15.15	**Three-dimensional Analysis Reveals Significant Variability in Undergraduate Full-veneer-crown Preparation Quality** Har-Amrit Singh, University of Birmingham
15.30	**The Effect Of Maternal Pregnancy Smoking On Offspring Molar-Incisor Hypomineralisation** Qui-Yi Lim, University of Bristol

Wednesday 1st September
Leonard Deacon Lecture Theatre

15.45	**Dental students' perceptions of research** Devki Shah, University of Sheffield
16.00	**Investigating the Impact of Neutrophils on Biofilm Development** Basmah Almaarik, King Saud University
16.15	**President's Prize Lecture: Chair Professor Marcello Riggio** Dr Elena Calciolari, Queen Mary University of London
17.00	**Septodont Poster Prize** Wolfson Common Room
18.00	Close
18.30	**Welcome Reception** Winterbourne House and Gardens, University of Birmingham

Thursday 2nd September
Leonard Deacon Lecture Theatre

08.00	ECR Breakfast Sponsored by Colgate
09.00	**Opening Ceremony** Chair: Professor Marcello Riggio, BSODR President
	Professor Marcello Riggio, BSODR President, University of Glasgow
9.10	Dr Josette Camilleri, Chair of LOC, University of Birmingham
9.20	Professor David Adams, Head of College, College of Medical and Dental Sciences, University of Birmingham
9.30	Dr Kirsty Hill, Head of School, School of Dentistry, University of Birmingham
9.40	**Heroic Industrialisation: the origins of the 'City of a Thousand Trades'** Dr Malcolm Dick, Invited Speaker
10.00	**Graham Embery Lecture** **Chair: Professor Rachel Waddington, Cardiff University**
	Regenerative dentistry - a partnership between science and the clinic Professor Anthony Smith, University of Birmingham

Scientific Programme

Thursday 2nd September
Leonard Deacon Lecture Theatre

10.45	Refreshments
11.00	**Parallel Session** **MINTIG Award** Chair: Professor Paul Anderson, Queen Mary University of London
	Importance of Dexamethasone in Mineralised Matrix Production in Saos-2 Cells Olga Yevlashevskaya, University of Birmingham
11.15	**Identifying Internal Changes in the teeth in response to external challenges using X-ray Microtomography** Yousaf Jamil, Queen Mary University of London
11.30	**Characterisation of SDF-HAP Reactions Under Remineralising Conditions: An NMR Study** Mandeep Kaur, Queen Mary University of London
11.45	**The Effect of Diabetes on Osteogenic Differentiation of MSCs** Nancy Hussein, University of Leeds
12.00	**Investigation Of Effects Of Glass Ionomer Cements On Dentinal Lesions Treated Using Atraumatic Restorative Technique** Mridula Malik, Queen Mary University of London
12.15	**Human Dental Enamel Crystallite Orientation Varies Periodically Within Prisms** Mohammed Al-Mosawi, University of Leeds
12.30	**Chemical Speciation Analysis of Influence of Parotid Saliva on Demineralisation** Paul Anderson, Queen Mary University of London

Thursday 2nd September
Forum Lecture Theatre

11.00	**Parallel Session** **Oral Session 1** Chair: Professor Will Palin, University of Birmingham
	Synthesis of twofold LAS-Nepheline glass-ceramics for dental applications Ali Alzahrani, Saudi Arabia
11.15	**Are Inert Glasses Really Inert?** Saroash Shahid, Queen Mary University London
11.30	**Interaction of Pulp Capping Materials with Caries Affected Dentine** Kawthar Bukhari, University of Manchester
12.00	**SARS-CoV-2, Dental Aerosols and Electric Handpieces at 200,000 rpm** David Wood, University of Leeds
12.15	**High-Precision Surface Metrology of sub-80 µm Enamel Lesions using Intra-Oral Scanning** Polyvios Charalambous, King's College London
12.30	**Radiopacities of Novel Radiopaque Infiltrants for Early Enamel Caries** Mahmoud Hasan, Queen Mary University of London

Main Session

12.45	Poster Session 1, Lunch and Exhibition
13.30	**Dental Materials Keynote** Chair: Dr Josette Camilleri, University of Birmingham **The journey of an innovative idea: from lab bench to clinical practice.** Dr Gilles Richard, Septodont

Scientific Programme

Thursday 2nd September
Leonard Deacon Lecture Theatre

14.30	**Parallel Session** **VOCO Prize** Chair: Professor David Wood, University of Leeds
	(Non-prize/virtual presentation) **Improving the surface properties of Nickel-Titanium endodontic files** Beliz Ozel, Queen Mary University of London, Yeditepe University, Turkey
14.45	**Fluoride-releasing Glasses Based on Sodium Fluoride-modified 45S5 Bioglass** Hasan Merie, Newcastle University
15.00	**A Comparative evaluation of "House of Cards" and "Cabbage Head" fluormica glass-cramics** Maher Mohamed, Queen Mary University of London
15.15	Refreshments
15.30	**Characterisation of Fluoride Containing Bioactive Glass Composites for Dental Restoratives** Melissa Tiskaya, Queen Mary University of London
15.45	**Characterization of Bioactive Restorative Materials for Restoration of Root Caries** Diana Abduallah, University of Birmingham
16.00	**Bioactivity analysis of novel fluoride releasing bioactive glass based Dental restorative composites** Hina Khalid, Queen Mary University of London
16.15	**Radiopacity of CAD/CAM Materials and Resin-based Composites** Rua Babaier, University of Manchester
16.30	**Cell Derived Matrices as Models to Study Gingival Reintegration** Fauzia Quadir, Queen Mary University of London
16.45	**Assessment of different toothpastes on root caries using X-ray Diffraction** Haoran Chen, Queen Mary University of London

Thursday 2nd September
Forum Lecture Theatre

14.30	**Parallel Session** **Oral Session 2** Chair: Dr Vehid Salih, University of Plymouth
	Effects of Blue Light on Oxidative Stress Responses in Gingival Fibroblasts Edward Gait-Carr, Cardiff University
14.45	**Cell Culture Vessels Affect the Evaluation of Ultrasound on Cells** Dhanak Gupta, University of Birmingham
15.00	**Thermal Effect of Ultrasound Excitation on Culture Medium** Lisa Shriane, University of Birmingham
15.15	Refreshments
15.30	**Oral Session 3** Chair: Dr Ryan Moseley, Cardiff University
	Sustained release of extracellular vesicles using electrospun scaffold as novel approach for cell-free tissue engineering Hatim Alqurashi, University of Sheffield
15.45	**The Chemokine Landscape in Murine Gingiva** Robert Reilly, University of Glasgow
16.00	**The Ability of Resin Modified Glass Ionomer Cements to Mineralise and Form Apatite** Bandar Alshehri, Queen Mary University of London
16.15	**Nanostructural Analysis of Dentine using 3D SAXS Tensor Tomography** Tayyaba Rabnawaz, University of Surrey
16.30	**Biomimetic self-assembling peptides as a treatment for hypomineralised dental enamel** Essra Zawia, University of Leeds

Main Session
Leonard Deacon Lecture Theatre

17.00	AGM
19.00	**Gala Dinner** Edgbaston Park Hotel

Scientific Programme

Friday 3rd September
Leonard Deacon Lecture Theatre

09.00	**MINTIG Keynote** Chair: Professor Marcello Riggio, University of Glasgow **Molecular and Developmental Analysis of Craniofacial Morphogenesis** Professor Mike Dixon, University of Manchester
10.00	**Oral Session 4** Chair: Dr Melissa Grant, University of Birmingham
	Systemic inflammation and the relationship between periodontitis, edentulism and all-cause mortality Lewis Winning, Trinity College Dublin
10.15	**Epithelial-Mesenchymal Inhibitors May Have A Role In Inhibiting Pathogen-Induced EMT** Satvir Shoker, University of Birmingham
10.30	**Epigenetic Regulation in Peri-implantitis Correlates with Disease Severity** Annika Kroeger, University of Birmingham
10.45	Refreshments
11.00	**An analysis of aerosol emissions from dental procedures** Mark Gormley, University of Bristol
11.15	**Lifestyle Traits are Associated with Oral Microbiota Composition and Function** Shirleen Hallang, University of Bristol
11.30	**Clinical Keynote** Chair: Dr Josette Camilleri, University of Birmingham **Dentistry - sit down you're rocking the boat** Professor Farida Fortune, Queen Mary University of London
12.45	Poster Session 2, Lunch and Exhibition

09.00	**ASEID Committee Meeting**
10.00	**MRC Keynote** Chair: Professor Paul Anderson, Queen Mary University of London **How MRC supports oral and dental research** Dr Kerry McLaughlin, Medical Research Council
10.45	Refreshments
11.00	**MRC Workshop:** **MRC support for early career researchers** Dr Kerry McLaughlin
11.45	**Oral Session 7** Chair: Dr Paul Ryan, Queen Mary University of London
	The Influence of Strain Rate on Benex Vertical Tooth Extraction Mohamed Abughalia, University of Birmingham
12.00	**Sentiment Analysis of Reviews Compared to Friends and Family Test** Matthew James Byrne, University of Manchester
12.15	**Early socioeconomic disadvantage predicts less dental care utilization in adolescencea** Amira Mohamed, University of Bristol
12.30	Close of Session
12.45	Poster Session 2, Lunch and Exhibition

Scientific Programme

Friday 3rd September
Leonard Deacon Lecture Theatre

13.30 **OMIG Keynote**
Chair: Professor Marcello Riggio, University of Glasgow

Stick with me: Adhesion and cohesion in dental plaque
Dr Nick Jacubovics, Newcastle University

14.30 **Parallel Session**
Oral Session 5
Chair: Professor Graham Stafford, University of Sheffield

Broad-spectrum Antimicrobial Effects of a Novel Quaternary
Ammonium Compound
Alexander Brezhnev, Hong Kong

14.45 **Response of Salivary Glucose and pH in the Oral Microbiome**
Nailê Damé-Teixeira, Brazil/Leeds

15.00 Biodegradation of zirconia by Fusobacterium nucleatum
James Kit-Hon Tsoi, Hong Kong

15.15 **Parallel Session**
Oral Session 6
Chair: Dr Anousheh Alavi, GSK

TiO2/CaO Effects on Crystallization and Flexural Strength of
Leucite Glass-ceramics
Mustafa Al Musali, Queen Mary University of London

15.30 **Stability of Veneered and Implant-supported PEEK FDPs with**
Free-end Unit
Danka Micovic Soldatovic, Germany

15.45 Characterisation of the film thickness and the bond strength
reliability of a bioactive Calcium Aluminate/Glass-Ionomer cement
(CaAl/GIC) to lithium disilicate (LD) and dentine
Angelle Lonnia Esparon, Queen Mary University of London

16.00 **Multi-scale Synchrotron X-ray Study of Dentine Demineralisation**
Nathanael Leung, University of Surrey

16.15 Biocompatibility of Silver Nanoparticles Gel as an Endodontic
Intra-Canal Medicament
Ahmed Mahmoud, Egypt/Leeds

16.30 **Desmoglein-3 Induces Phospho-YAP Expression and Controls**
Oral Cancer Cell Migration
Usama Ahmad, Queen Mary University of London

16.45 4NQO-Induced Oral Carcinogenesis in Wistar Rats: A Systematic
Literature Review
Vivian Petersen Wagner, University of Sheffield

Friday 3rd September
Forum Lecture Theatre

14.30 **Parallel Session**
Oral Session 8
Chair: Professor Robert Allaker, Queen Mary University of London

The effect of bee propolis mouthwash on markers of oral health
Zoe Brookes, University of Plymouth

14.45 Adipocytes stimulate tumour cell motility though secreted factors
including adipokines
Basma H. Ali, University of Sheffield

15.00 **Effects of Sphingosine-1-phosphate Receptor 2 (S1PR2) on the**
Behaviour of Three Oral Squamous Cell Carcinoma (OSCC) Lines
Adjabhak Wongviriya, University of Birmingham

15.15 Refreshments

15.30 **Parallel Session**
Oral Session 9
Chair: Dr Sarah Kuehne, University of Birmingham

Copper-containing Implant Materials offer Antimicrobial and
Pro-osteogenic Properties
Javeria Khalidt, Queen Mary University of London

15.45 **Impact of Hyperglycaemia and Hyperkalaemia on Fusobacterium**
Nucleatum Polymorphum Behaviour
Ruba Abusurur, University of Birmingham

16.00 Interplay of Streptococcus gordonii Adhesins in the Pathogenesis
of Endocarditis
Angele Nobbs, University of Bristol

16.15 **The Impact of C. albicans and Sucrose on Polymicrobial**
Cariogenic Biofilm Development
Khulood Almansour, King's College London

16.30 Modulation of Oral Bacterial Metabolism by Proline
Leanne Cleaver, King's College London

Poster List

Septodont Poster Prize
Chair: Professor Graham Stafford, University of Sheffield

01	**Diabetes Risk Assessment In Dental Settings: Model Development and Validation** Zehra Yonel, University of Birmingham
02	**Optimisation of Printing Parameters to Improve Properties of 3D Printed Dental Products** Alice Parr, University of Birmingham
03	**Early Childhood Caries Subtype Predicts Subsequent Disease Experience** Alexander Gormley, University of Bristol
04	**Virtual: Error Analysis in Digital Workflow: from Scanning to 3D Printing** Pobploy Petchmedyai, Thailand/QMUL
05	**Parental acceptance of silver diamine fluoride for caries management** Laura Timms, University of Sheffield
06	**Invasive Dental Treatment and Acute Vascular Events: A Systematic Review and Meta-Analysis** Shailly Luthra, University College London
07	**Fusobacterium nucleatum Subspecies Differ in Biofilm Forming Ability In Vitro** Maria Muchova, University of Birmingham
08	**Synergistic Effects of Sodium Hypochlorite on SDF Treated Primary Dentine** Alexei Mogilevski, Queen Mary University of London
09	**Is Periodontitis a risk factor for Gestational Diabetes Mellitus? A Systematic Review and Meta-Analysis of Cross-sectional and Prospective Studies** Syed Hussain, University College London
10	**Effectiveness of a Bioactive glass with Strontium for acid-induced demineralization** Syeda Ambreen Zehra, Queen Mary University of London

Non-prize Posters

11	**Virtual: Paediatric dentistry specialty training: oral medicine and the medically-compromised child** Philip Atkin, Cardiff University
12	**Prediction of Salivary Proteases in Patients Undergoing Orthodontic Treatment** Fidaa Wazwaz, King's College London
13	**Compositional changes in organic matrix of dentin by post-sequential irrigation** Jukka Matinlinna, Hong Kong
14	**How do Ti Based Nanoparticles Alter Chemoattractant Properties of Chemokines?** Joanna Batt, University of Birmingham
15	**2D Texture Mapping of Dental Enamel Affected by MMP-20 Mutation** Asmaa Harfoush, University of Leeds
16	**In Vivo Evaluation of Cotton-Wool-Like Bioactive Glasses for Bone Regeneration** Soher Jayash, University of Birmingham
17	**The mechanisms that explain dental erosion in athletes remain unclear. We assessed effects of physical training on salivary parameters as a potential mechanism of dental erosion** Hesham Matabdin, University College London
18	**Virtual: Use of Stabilization Splints by Croatian Dental Practitioners** Samir Cimic, Croatia
19	**Mathematical model for polymerising bisGMA/TEGDMA resins with different initiators** Madeline Jun-Yu Yon, Hong Kong/Birmingham
20	**Studying the Effect of Curing Time on the Properties of 3D Printed Denture Base Material** Ahmed Altarazi, University of Manchester
21	**Analysing Early Wear Lesions On Curved Surfaces Using Novel Methods** Sagar Jadeja, King's College London
22	**Virtual: Regeneration of Palatal Cleft-Like Surgical Defects in Rabbits Using Poly (glycerol sebacate) Elastomer Scaffold** Ayat Abdullah, Egypt

BSODR BIRMINGHAM 2021

British Society for Oral and Dental Research, Annual Meeting 2021
1 - 3 September, University of Birmingham

BSODR 2021
Keynote Abstracts

Colgate

GC

Queen Mary
University of London

British Endodontic Society

JOURNAL OF **MEDICAL MICROBIOLOGY**
The full breadth of clinical microbiology

Graham Embery Lecture

Regenerative dentistry - a partnership between science and the clinic
Professor Anthony Smith, University of Birmingham

Extensive progress in our understanding of the biology and behaviour of dentine-pulp had led to exciting clinical translational opportunities in regenerative dentistry. Identification of a range of bioactive molecules sequestered within dentine, their release either during carious disease or its management and their subsequent interactions with stem and other cell populations in the dental pulp have driven these translational advances. Clinically, the emphasis can now move from 'drill and fill' towards tissue regeneration and minimal intervention approaches. New emerging research techniques are further impacting on how we exploit our scientific understanding clinically and emphasise the close interplay of disease, regenerative and inflammatory events in caries management. Throughout all of this research, the partnership between and scientists and clinicians has helped to shape the advances achieved and are fundamental to successful future strategies for the prevention, treatment and management of dental disease.

Dental Materials Keynote

The journey of an innovative idea: from lab bench to clinical practice
Dr Gilles Richard, Septodont

Practicing the Dental Art requires high scientific and technical qualifications as well as sharp technical skills. Dental offices are full of various professional products to cover the whole range of clinical situations. To provide the highest quality of care to their patients, dental professionals constantly seek for the best therapeutic options and often tend to test or adopt new innovative products designed by the dental industry.

At the forefront of dental science, academic teams compete in the worldwide race for discovering undescribed biological mechanisms with the aim to improve current treatments and shape the future of dental care. Often, academic researchers want to convert their inventions and discoveries into approved therapeutic products to be daily used in the clinical practices.

But designing, industrializing, registering, and distributing a new medical product demands multiple skills, knowledge and organization which are specific to the pharmaceutical or medical devices manufacturers.
We will share some insights of key features to be considered through the whole development process to bring an innovation from the early steps of discovery at lab scale to a mature status of a product which can be used in clinical practices. Through this journey, several pitfalls and risks need to be identified and overcome.

MINTIG Keynote

Molecular and Developmental Analysis of Craniofacial Morphogenesis
Professor Mike Dixon, University of Manchester

Facial development involves a complex series of events that are frequently disturbed resulting in a wide variety of craniofacial anomalies. There are numerous craniofacial syndromes each of which provides an opportunity to study a particular aspect of morphogenesis. The inheritance patterns that underlie these conditions are variable and include Mendelian and non-Mendelian modes of transmission. Dissection of the molecular events underlying such conditions has provided insights into the fundamental mechanisms driving normal facial development and how these are disrupted in congenital anomalies. The progress that has been made in recent years is amply illustrated by consideration of: Treacher Collins syndrome; cleft lip/palate; and amelogenesis imperfecta.

Treacher Collins syndrome is an autosomal dominant disorder characterised by a combination of bilateral downward slanting of the palpebral fissures, colobomas of the lower eyelids with a paucity of eyelashes medial to the defect, hypoplasia of the facial bones, cleft palate, malformation of the external ears, atresia of the external auditory canals and bilateral conductive hearing loss. A high degree of inter- and intra-familial variation in the affected phenotype is observed. The majority of TCS patients are heterozygous for a mutation in TCOF1; however recent evidence has indicated that some cases of TCS arise from mutations in two genes encoding subunits of RNA polymerases I and III: POLR1D and POLR1C. Treacle, the protein encoded by TCOF1, co-localises with upstream binding factor (UBF) and RNA polymerase1 in nucleolar organizing regions where it functions in ribosomal DNA gene transcription implying that Treacle is involved in governing specific stages of ribosome biogenesis. Consistent with its nucleolar localization, Treacle has been shown to play key roles in ribosome maturation and in so doing regulate neuroepithelial survival and neural crest cell proliferation.

In contrast, cleft lip and/or cleft palate (CLP) are common birth defects of complex aetiology. CLP can occur in isolation or as part of a broad range of chromosomal, Mendelian, or teratogenic syndromes. There has been substantial progress in identifying genetic and environmental triggers for syndromic CLP; however, the aetiology of the more common non-syndromic (isolated) forms remains poorly understood. Mutations in the gene encoding Interferon Regulatory Factor 6 (IRF6) were first shown to underlie the autosomal dominant Van der Woude syndrome with subsequent research indicating that common alleles of IRF6 were associated with non-syndromic CLP. A strategy integrating the identification of regulatory elements, analysis of animal models and biochemical analyses, resulted in the discovery of a specific sequence variant located within an enhancer ~10 kb upstream of the IRF6 transcription start site that was significantly over-transmitted in non-syndromic cleft lip. Importantly, this risk allele disrupts a binding site for AP-2⍺, a transcription factor mutated in the autosomal dominant CLP disorder branchio-oculo-facial syndrome.

A role of IRF6 in CLP is further supported by analysis of animal models. Recent research has shown that Irf6 mutant mice exhibit a hyper-proliferative epidermis that fails to undergo terminal differentiation leading to multiple epithelial adhesions which can occlude the oral cavity and result in cleft palate. While these results demonstrated IRF6 is a key determinant of the keratinocyte proliferation/differentiation switch, subsequent research indicated that IRF6 also plays a key role in the formation of oral periderm, spatio-temporal regulation of which is essential in ensuring appropriate palatal adhesion.

Amelogenesis imperfecta refers to a group of common inherited disorders of enamel bio-mineralisation that show autosomal dominant, autosomal recessive and X-linked patterns of inheritance with hypoplastic, hypomineralised, and hypomaturation forms described clinically. Genetic studies have identified causative mutations in genes including: AMELX; ENAM, DLX3; MMP20; KLK4; FAM83H; CNNM4; and WDR72. Using mouse models, we have shown that a subset of cases of AI results from endoplasmic reticulum stress and that the dental phenotype can be partially rescued using chemicals that inhibit this process.

In summary, integration of molecular biology, cell biology, experimental embryology, human and mouse genetics has allowed the molecular pathology underlying an increasing number of craniofacial conditions to be elucidated.

Clinical Keynote

Dentistry - sit down you're rocking the boat
Professor Farida Fortune

Dentistry and dentists have weathered many storms and always demonstrated strength, persistence, and resilience.
The pandemic and personal circumstances have changed our perceptions and expectations.

We should 'rocking the boat' , 'standing up' individually and collectively to highlight our individual research, teaching multitude administration.

Reflection on your journey, personal and collective will assist Use Margaret Sewards motto .. don't forget your family and fun'.

OMIG Keynote

Stick with me: Adhesion and cohesion in dental plaque
Dr Nick Jacubovics, Newcastle University

The formation of microbial biofilms on teeth, known as dental plaque, is responsible for dental caries and periodontitis, two of the most prevalent diseases of humans. In addition, biofilms develop on prosthetic materials such as dental implants, braces or dentures, potentially leading to infection of the soft tissues or irreversible hard tissue damage. Strategies to control the formation of oral biofilms include targeting the adhesion of micro-organisms to oral tissues or disrupting key cell-cell interactions and extracellular matrix structures that stabilise more mature biofilms. This talk will present examples of cell surface adhesins that enable bacteria to recognise receptors in the acquired enamel pellicle that coats tooth surfaces. New approaches for prosthetic materials with anti-biofilm properties based on physical surface modifications such as nanostructures or superhydrophobicity will be described. In addition, the talk will cover recent work on targeting biofilm matrix molecules such as extracellular DNA for dental plaque control. Overall, this talk aims to demonstrate the key steps involved in the formation of oral biofilms such as dental plaque and show how interfering with the adhesion of microbes or the cohesion of biofilms may help to reduce oral diseases.

MRC Keynote

How MRC supports oral and dental research
Dr Kerry McLaughlin, Medical Research Council

This lecture will give an overview of how MRC funding is structured and the different pathways to access funding for dental research. We will cover MRC's range of personal awards, including Fellowships, New Investigator Research Grants and Clinical Academic Research Partnerships, as well as responsive-mode funding and any strategic initiatives. We will consider what makes a competitive application and how to access support from MRC Head Office staff, followed by an open Q&A session.

MRC Workshop: MRC support for early career researchers
Dr Kerry McLaughlin

Following on from the earlier lecture, we will take a closer look at opportunities for early career researchers, from those considering a PhD to those looking to make the transition to independence. We will consider what the different schemes provide, how to go about building a proposal and some hints and tips for strengthening your application. This workshop will be interactive with plenty of opportunities for asking questions.

Foundation Nakao for Worldwide Oral Health

Dental academics and clinicians are invited to apply for Foundation Nakao Grant from 21 September 2021. This is the third round of funding made available by the prestigious foundation, since its launch in 2018. The organization supports clinical trials and research in important topics such as minimum intervention dentistry and oral health of the elderly.

Successful applications will receive fully funded projects of CHF 50,000.00/per year in addition to wide exposure among dental professionals, dental industry as well as the general public of each study's outcomes and achievements. (Max 2 years and up to CHF 100,0000. If the project budget is over CHF 50,000 in two years, the applicant needs to submit applications for the second year as well).

BSODR 2021
Senior Colgate Award Abstracts

Valuation of CARIES-QC-U: a child-centred caries-specific preference-based measure

Helen Rogers, Newcastle University

Objectives: Dental caries has significant impacts on children's daily lives. Whilst interventions are available to improve children's oral health, there is a clear need for a preference-based measure (PBM) that is able to generate Quality Adjusted Life Years (QALYs) in economic evaluations of these interventions. This study aimed to develop a child- centred PBM, through adaptation of CARIES-QC (Caries Impacts and Experiences Questionnaire for Children), a caries-specific measure of oral health-related quality of life.

Methods: Ethical approval was obtained for this study. A five-item classification system that the authors derived from CARIES-QC using Rasch analysis, psychometric testing and involvement of stakeholders, and validated with children, was used as the basis for the PBM. Two online surveys were created to elicit preferences for the classification system; a best-worst scaling (BWS) survey for completion by adolescents aged 11-16 years and a modified discrete choice experiment (DCETTO) survey for completion by adults over 18 years. Preferences were modelled using the conditional logit model. Mapping regressions were used to anchor the adolescent BWS data onto the QALY scale using adult DCETTO values, since the BWS survey data alone cannot generate anchored values.

Results: Representative samples of 723 adolescents and 626 adults from across the UK completed the surveys. Fully consistent (as health worsened, health state value worsened) and robust models were produced for both BWS and DCETTO data. The BWS preferences were mapped onto the DCETTO values, resulting in an algorithm able to estimate a utility value for each health state defined by the classification system, enabling QALYs to be generated.

Conclusions: This PBM, known as CARIES-QC-U (for Utility), is the first to be developed specifically for use in child oral health research. The mapped estimates can be used to generate QALYs in economic evaluations of interventions to improve children's oral health.

Incorporating Macrophages into Tissue-Engineered Oral Mucosal Equivalents

Bethany Ollington, University of Sheffield

Objectives: Macrophages play a key role in the detection and phagocytosis of invading organisms or foreign molecules and help orchestrate an inflammatory immune response within oral tissues. This study aimed to develop a tissue-engineered model of buccal oral mucosa containing primary macrophages to better model the immune response in this tissue.

Methods: Primary human monocyte-derived macrophages (MDM) isolated from blood were incorporated into a type 1 collagen hydrogel alongside oral fibroblasts. The apical surface was seeded with immortalised (FNB6) oral keratinocytes and then cultured at an air-to-liquid interface for 10 days to generate an MDM-oral mucosal equivalent (OME). Model histology and cell viability were assessed, then MDM-OME challenged with E. coli lipopolysaccharide (LPS) ± dexamethasone to examine changes in inflammatory gene expression and secretion of the proinflammatory cytokines TNF-⍺, CXCL8 and IL-6.

Results: Addition of MDM into an OME had no effect on tissue structure and MDM within the OME were immune- positive for macrophage-specific marker CD68. CD11c-positive MDM isolated from models by collagenase treatment were 68% viable when analysed by flow cytometry. MDM-OME responded to LPS with increased gene expression of CXCL8 and IL-6 that was inhibited by dexamethasone when compared to OME. Secretion of TNF-⍺ was increased 10-fold in LPS treated MDM-OME compared to all other conditions, while CXCL8 expression was increased by LPS compared to all OME regardless of treatment.

Conclusions: MDM-OME responded to inflammatory stimuli by shifting to a pro-inflammatory phenotype which could be dampened by treatment with a clinically used anti-inflammatory steroid. In future studies MDM-OME can be used to provide an improved platform to test immune responses against infectious agents and biomaterials and to examine anti-inflammatory drug efficacy.

Wnt Signalling in The Apical Papilla is Essential for Tooth Root Development

Rupali Lav, King's College London

Objectives: Wnt signalling has been shown to play an essential role during different stages of dental organogenesis. Although disturbances in Wnt signalling have been shown to adversely affect odontogenesis, little is known about its role specifically in root development. The objective of this study is to investigate the role of the Wnt signalling pathway in the proliferation and differentiation of odontogenic stem/precursor cells of the developing root. For this, we have targeted different components of the pathway including the source of Wnts, their responding cells as well as the downstream targets influencing radicular hard tissue formation.

Methods: To localize Wnt activity during different stages of radicular development, we used Axin2LacZ reporter mice. We take advantage of transgenic Wntlessfl/fl and Sox9fl/fl mice to conditionally knock down production in apical stem cells by placing cre under the Gli1 specific promoter. A candidate approach was employed to identify downstream targets through immunofluorescence and in-situ hybridisation. Morphometric analysis was carried out through histology and microCT reconstructions of the involved teeth.

Results: Active Wnt signalling was observed at the advancing front of the developing root. Coincidently, this region is known to harbour the stem/progenitor cells that are specified to form radicular tissues. Targeted cessation of Wnt secretion in specific cell populations resulted in root deformity with short roots and wide apices.

Conclusions: We demonstrate the vital role of Wnts in radicular hard tissue formation. A clearer understanding of the molecular mechanisms of root development will help us decipher the etiopathogenesis of developmental anomalies affecting roots and perhaps, develop targeted biological solutions for truncated root development.

Examining the Role of Extracellular DNA in Oral Biofilm Formation

Hannah Serrage, University of Bristol

Objectives: Extracellular DNA (eDNA) is an integral component of dental plaque-associated biofilm, with potential to be targeted for the therapeutic manipulation of plaque development to promote oral health. However, this approach is currently hindered by a lack of reliable methods for the quantification of biofilm eDNA networks in situ. Here, we detail a high-throughput imaging analysis technique to address this gap. This is applied to characterisation of eDNA networks within Streptococcus gordonii mono- and poly-microbial biofilms and of the potential impact of S. gordonii DNase, SsnA.

Methods: S. gordonii wild-type or ssnA monospecies biofilms or polymicrobial biofilms with addition of P. gingivalis, F. nucleatum ± Prevotella nigrescens, Actinomyces oris and Veillonella dispar were formed on salivary pellicle in 24-well plates over 5 h. Networks of eDNA were immunolabeled, visualised by widefield microscopy and quantified using the modular image analysis plugin on Fiji. Biofilm and eDNA composition were assessed via species-specific qPCR. Biomass was quantified by crystal violet staining.

Results: S. gordonii produced significant eDNA networks during early biofilm formation. SsnA modulated these eDNA networks and this activity was impaired by glucose. The capacity to produce eDNA networks was seen for several oral microbes and was found to be species-specific. Overall eDNA network levels were significantly influenced by biofilm community composition. Within polymicrobial biofilms, there was evidence that SsnA could modulate biofilm community development and potentially affect eDNA networks produced by other bacterial species.

Conclusions: These studies have demonstrated that a microscopy-based approach can be used to assess the interplay of eDNA networks and DNase activity in situ within oral biofilm communities. This approach can now be used to better understand these dynamics within dental plaque and how they may be exploited to promote the maintenance of an oral community predisposed to health.

Parotid Saliva 1H-NMR Analysis for Colon Cancer Salivaomics

Angela Rovera, Queen Mary University of London

Objectives: A key priority in colon cancer research is the identification of molecular biomarkers to improve early diagnosis, guide prognosis, and design new therapeutic approaches. Saliva is a powerful diagnostic biofluid that can be used to detect systemic alterations. This study aimed to report the parotid saliva metabolic 1H-NMR profile of a patient diagnosed with colon cancer, and the subsequent changes one year after the end of chemotherapy.

Methods: Metabolic profiling of parotid saliva (salivaomics), using Proton Nuclear Magnetic Resonance spectroscopy (1H-NMR) was used to characterise the components of parotid saliva from a 65-year-old woman diagnosed with colon cancer (G3 pT3 pN1c) (T0). The subsequent spectrum changed one year after the end of chemotherapy (XELOX: capecitabine plus oxaliplatin) (T1) when the patient was in remission. The data was co-analysed with blood test cancer antigens (S-CEA; S-CA19-9) and thyroid peroxidase antibody (TPOAb) measurements obtained at the same time in order to identify peaks and interpret the spectra.

Results: At T0, the blood cancer antigens (S-CEA; S-CA19-9) and the parotid saliva 1H-NMR peaks for fatty acids, lactate, acetate, N-acetyl sugars, citrate, tyrosine, saccharides, and formate were substantially increased compared to T1. Whereas, thyroid peroxidase antibody (TPOAb) blood components increased from T0 to T1, commensurate with the changes in the 1H-NMR spectral window (1- 3.5 ppm).

Conclusions: Parotid saliva 1H-NMR profiling identified modified metabolites that revealed cancer cells metabolism disturbances that subsequently decreased with time throughout treatment. These altered metabolites are potential biomarkers, providing a molecular diagnostic approach for clinical diagnosis and prognosis of human colon cancer.

The Longitudinal Effect of Rituximab in Primary Sjögren's Syndrome

Farzana Chowdhury, Queen Mary University of London

Objectives: Assess the effects of rituximab on salivary gland (SG) histopathology and systemically on the T-cell compartment in the Trial for Anti-B-Cell Therapy in patients with primary Sjögren's Syndrome (TRACTISS) cohort.

Methods: 26 subjects randomised to rituximab or placebo consented for SG biopsy at baseline, weeks 16 and 48. Biopsies were fluorescently assessed for B-cells (CD20+), T-cells (CD3+), follicular dendritic cells (FDCs) (CD21+) and plasma cells (CD138+). Digital imaging analysis and semi-quantitative grading quantified SG inflammation. RNA extracted from matched SGs underwent sequencing and gene signature-based analysis (xCell) to infer 64 immune cell types. Matched sera were assessed for T-helper cytokines and B-lymphocyte chemoattractant (CXCL13) using LEGENDplexTM and ELISA immunoassays, respectively.

Results: Two cycles of rituximab prevented new B-cell infiltration, development of FDC networks within SG inflammatory aggregates and ectopic GC organisation at 48 weeks. Gene enrichment analysis (xCell) demonstrated a prevention of class-switched- and memory B-cell infiltration by rituximab, with no effect on T-cells or plasma cells. The reduction of ELS organisation was confirmed by transcriptomic analysis showing a downregulation of lymphocyte recruitment and ectopic GC organisation genes, such as CXCL13, CCR7, CCL19 and LTβ. The analysis of placebo SGs transcriptomics at week 48 showed a higher expression of ectopic GC organisation genes in females compared to male subjects, suggesting a gender-driven difference in SG inflammation progression. Peripheral markers of salivary gland inflammation and SG GC organisation, such as CXCL13, were reduced after Rituximab, together with T-cell cytokines IFN-g, IL-4, IL-17F, IL-21, known to be involved in ectopic lymphomagenesis.

Conclusions: Rituximab preserves residual SG function by preventing worsening SG inflammation and ELS formation compared to placebo, by affecting FDC network development and downregulating genes involved in B-cell migration and organisation. These results reflect the clinical improvement of unstimulated whole salivary flow observed at week 48 in rituximab-treated patients in the TRACTISS trial.

BSODR 2021
Junior Colgate Award Abstracts

Artificial Neural Networks Can Reliably Predict the Presence of Periodontitis

Nasir Bashir, University of Birmingham

Objectives: This study aimed to train machine learning classifiers on population-based data from the 2009 – 2014 National Health and Nutritional Examination Surveys (NHANES), in order to develop and validate predictive models for periodontitis.

Methods: Adult participants who had received a periodontal examination, with ≥ 6 teeth examined, and had data collected on various risk factors (socio-demographic, smoking status, biochemical data) qualified for inclusion for model development and validation. Two types of machine learning classifiers were fit: (i) multivariate logistic regression, and (ii) artificial neural networks (ANNs). For each classifier, two types of models were developed: (i) utilising only patient-reported variables, and (ii) incorporating biochemical data. The predictive models were validated using bootstrap sampling, with replacement (n = 1,000). Four outcome measures were used to assess predictive validity: area under the curve for the receiver operator characteristic (AUROC), accuracy, sensitivity, and specificity.

Results: 4,373 participants qualified for inclusion in this study. For both logistic regression and ANNs, models with and without biochemical data were comparable across all four of the outcome measures assessed.
Model 1. Logistic regression, without biochemical data (95% CI); AUROC: 0.800 (0.749 – 0.852), accuracy: 71.08% (69.42 – 72.74), sensitivity: 66.74% (64.73 – 68.76), specificity: 75.38% (72.83 – 77.93).
Model 2. Logistic regression, with biochemical data (95% CI); AUROC: 0.779 (0.730 – 0.827), accuracy: 69.55% (67.98 – 71.10), sensitivity: 67.93% (65.95 – 69.92), specificity: 71.13% (69.02 – 73.24).
Model 3. Artificial neural network, without biochemical data (95% CI); AUROC: 0.801 (0.746 – 0.857), accuracy: 72.70% (70.93 – 74.48), sensitivity: 68.43% (66.29 – 70.56), specificity: 76.99% (74.76 – 79.21).
Model 4. Artificial neural network, with biochemical data (95% CI); AUROC: 0.783 (0.732 – 0.832), accuracy: 69.94% (68.50 – 71.42), sensitivity: 67.22% (65.06 – 69.38), specificity: 72.64% (70.42 – 74.85).

Conclusions: Using variables which may be obtained in a non-clinical setting, ANNs offer the best performance for predicting presence of periodontitis. Additional biochemical data does not improve predictive validity.

Three-dimensional Analysis Reveals Significant Variability in Undergraduate Full-veneer-crown Preparation Quality

Har-Amrit Singh, University of Birmingham

Objectives: The aim of this cross-sectional study was to determine the quality of full-veneer-crown (FVC) preparations produced by supervised undergraduate students at a UK dental teaching hospital.

Methods: One hundred and eighty-five stone dies of FVC preparations (126 full-metal, 39 metal-ceramic and 20 ceramic; 16 anterior and 169 posterior; 87 mandible and 98 maxilla); produced between October 2019 and March 2021 by dental students; were scanned into 3D imaging software (Exocad). Using cross-sections obtained in the mesio-distal (M-D), bucco-lingual (B-L), mesiobuccal-distolingual (MB-DL), and distobuccal-mesiolingual (DB-ML) planes, the following parameters were evaluated: total angle of convergence (TOC), abutment height and margin design and depth. Statistical comparisons were made by plane, location, material type, tooth type, and inter- and intra- arch positions using Mann-Whitney U and Kruskal-Wallis with post-hoc Bonferroni-corrected Dunn's tests, as appropriate (⍺ = 0.05). Assessor reliability was evaluated with intra- and inter-class correlation coefficients.

Results: Across all preparations the mean TOC was 24.8° ± 11.7°, with the DB-ML plane displaying the greatest taper (26.6° ± 15.0°) (p <0.05). Mandibular and molar teeth were significantly more tapered (p <0.001) and exhibited significantly shorter abutment heights (p <0.001). The mean abutment height was 3.6mm ± 1.0mm, with the mesial location illustrating the shortest abutment height (2.8mm ± 1.1mm) (p <0.001). Full-metal (3.4mm ± 0.8mm) and ceramic (3.4mm ± 1.3mm) preparations were significantly shorter than metal-ceramic preparations (4.1mm ± 1.0mm) (p <0.001). No significant difference in TOC or abutment height was observed for FVC preparations on the left or right. Chamfer margins were the most frequently observed and mean margin depths ranged from 0.49–1.06mm.

Conclusions: The findings from this study suggest that undergraduate students in a dental school teaching environment produce sufficient FVC preparations for incisor, canine and premolar teeth, but over-tapered molar preparations with short abutment heights.

The Effect Of Maternal Pregnancy Smoking On Offspring Molar-Incisor Hypomineralisation

Qui-Yi Lim, University of Bristol

Objectives: Molar-incisor hypomineralisation (MIH) is a developmental, qualitative enamel defect, prevalent worldwide. Its aetiology is largely unknown and is an arising topic of interest. Previous research has found several modifiable maternal characteristics associated with increased risk of MIH; however, evidence for smoking, a putative factor of disease, is limited and conflicting. This study aimed to:
(1) Explore associations between maternal pregnancy smoking and offspring MIH.
(2) Explore for the presence of residual confounding variables using negative control analyses.

Methods: This study used data obtained through questionnaires from the Avon Longitudinal Study of Parents and Children (ALSPAC), an ongoing, prospective birth cohort. Logistic regression was performed to explore associations between maternal smoking during pregnancy and offspring MIH at age 7. Analyses were performed unadjusted and adjusted for relevant confounders: age, education, parity, alcohol consumption and mutual parent smoking. To detect potential unmeasured confounding variables, findings were compared with a negative control exposure (paternal smoking during pregnancy), and negative control outcome (dental trauma at age 10).

Results: Prevalence of offspring MIH was found to be 5.4% (297/5536), and a high proportion of mothers (21.4%) and fathers (31.6%) smoked during pregnancy. There was a positive association between maternal smoking and MIH (OR: 1.41, 95%CI: 1.06, 1.86). However, after adjusting for confounders, results were attenuated to the null (OR: 0.98, 95%CI: 0.68, 1.38). In comparison, negative controls showed small positive associations in the adjusted models; paternal smoking (OR: 1.16 95%CI: 0.81, 1.64), and dental trauma (OR: 1.20, 95%CI: 0.93, 1.53).

Conclusions: This prospective negative control study found no strong evidence of an effect of maternal smoking on offspring MIH. Future studies with larger numbers, prospectively collected data and advanced epidemiological methods (eg. negative control analyses) are warranted to further investigate the aetiology of MIH.

Dental students' perceptions of research

Devki Shah, University of Sheffield

Objectives: The application of research in the dental field has been crucial in developing new technologies, expanding knowledge of oral diseases and improving patient care. However, there has been debate on how the actual process of conducting research is perceived and the effect this has on undergraduate students.
The proposed hypothesis was 'Being taught in an active research environment has significant benefits for undergraduates'. The objectives of the research project were to investigate and develop an understanding of the value students hold of research and how this impacts their studies.

Methods: Previous literature on university students' perceptions on research were analysed. The information was compared to the data collected from the mixed-design questionnaire which interrogated students' prior experience and perceptions regarding the importance of research, the skills and opportunities available and the faculty's involvement in research activity. This was sent with ethical permission to undergraduate dental students at Sheffield University. SPSS Statistics was used to carry out non-parametric tests such as chi-squared tests to analyse the data gathered and identify themes.

Results: A total of 64 responses were received. Although many students expressed eagerness and awareness of the value research had on their education, they lacked significant research experience. Further analysis showed there was no significant difference in the responses to questions relating to prior research tasks by students in earlier years compared to later years. Common themes were identified such as the barriers to conducting research, the impact of research on clinical experience and the integration of research projects into the teaching curriculum. Many of these perceptions correlated with previous research literature carried out with students in the scientific field.

Conclusions: Although dental students held a high value for research, the barriers for conducting research as undergraduates have prevented many from taking an active role in research themselves.

Investigating the Impact of Neutrophils on Biofilm Development
Basmah Almaarik, King Saud University

Introduction: Understanding the multiple elements controlling the dynamic interaction between the host and biofilm development is essential in understanding periodontal disease pathogenesis. Biofilms are complex bacterial communities that develop on the tooth surfaces and elicit a host inflammatory response driven by neutrophils. Neutrophils have a number of antimicrobial mechanisms, including the release of neutrophil extracellular traps (NETs), which consist of DNA and proteins.

Objective: To investigate the interactions between neutrophils and two oral biofilm models, in terms of NET production and the impact on biofilm maturation.

Methods: A model of early coloniser biofilm was used (Streptococcus oralis, Streptococcus mitis, and Streptococcus intermedius). Two conditions were utilised (a) Dynamic flow cell model (Biosurface technologies) and (b) Static biofilm model (24-well plates coated with poly-L lysine). Neutrophils were harvested from healthy donors and were added to biofilms at different time points (1-day,2-day, and 3-day) of biofilm development. Biofilm thickness was evaluated using crystal violet technique and scanning electron microscopy, and NET release was visualised by immunofluorescence.

Results: Although the dynamic model better mimics the in vivo situation there are a number of technical challenges making data interpretation difficult (shear stress, contamination over time). In contrast, static biofilms were shown to be more reproducible with less variability in the data generated. Neutrophils were found to produce NETs and decrease biofilm thickness after 2 hours of incubation.

Conclusions: Neutrophils appear to interact with the three species biofilm by producing NETs and decrease biofilm thickness. Furthermore, among the three tested species S.oralis seems to produce the thickest biofilm, and induce highest NETs response. Since extracellular DNA is known to be an integral part of bacterial biofilms, our model will be used to further investigate whether NETs may aid or prevent the formation and maturation of early oral biofilms.

BSODR 2021
MINTIG Award Abstracts

Importance of Dexamethasone in Mineralised Matrix Production in Saos-2 Cells

Olga Yevlashevskaya, University of Birmingham

Objectives: A mature osteoblast-like human osteosarcoma cell line, Saos-2, was selected as a model to study the effects of osteogenic media components on the production of mineralised matrix in vitro. A combination of ß-glycerophosphate (ß-Gly), dexamethasone (Dex) and ascorbic acid (Asc) is routinely used to induce osteogenic differentiation and mineral production by cells, where ß-Gly acts as an organic phosphate ion source for mineral deposition, Dex induces osteoblastic differentiation and Asc is involved in collagen-I synthesis, required for extracellular matrix production. The aim of this study was to determine whether Dex was necessary to stimulate relatively differentiated Saos-2 cells to synthesise mineralised bone matrix.
(10 M) and 0.5% Asc (10 mg/ml) for 7 days. Cells were counted, and the mineralised matrix production was measured using alizarin red staining. The gene expression of osteocalcin, a late marker for bone formation and collagen-I was analysed using reverse transcription PCR.

Results: Addition of Dex did not significantly affect the expression of osteocalcin, collagen-I or mineral deposition of Saos-2 cells. Treatment of cells with ß-Gly increased the production of mineralised matrix by approximately 94% and decreased cell numbers by 63% compared with the cells receiving no ß-Gly supplementation. Asc did not have a significant impact on the mineral deposition, but upregulated the expression of collagen-I.

Conclusions: Our results suggested that Dex does not play role in the osteogenic behaviour of the Saos-2 cell line. However, ß-Gly and Asc appear to have an impact on the amount of matrix produced and collagen-I expressed respectively. Further analysis using quantitative wavelength-dispersive X-ray spectroscopy of the deposited matrix is necessary to exclude the possibility of dystrophic mineralisation in the absence of Dex.

Identifying Internal Changes in the teeth in response to external challenges using X-ray Microtomography

Yousaf Jamil, Queen Mary University of London

Objectives: To study the defence mechanism in teeth using X-ray Microtomography which is sensitive to detect any mineral changes Whitelockite (Tricalcium phosphate) with traces of magnesium in cracks.
Raman Spectroscopy, Scanning electron microscopy (RDX-SEM) and synchrotron X-ray diffraction will also be used to study the reactive mineral responses.

Methods: The collection of 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 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 is used to determine the nature of the formed mineral. Although the mechanism for 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: Pulp responds to any damage done to the surface of the tooth and it is very clearly evident from the XMT images in the form of patterns of hypermineralization. From initial results, It appears that mineral originates in the pulp and propagates through the dentine tubules towards the enamel, forming peritubular dentine (Tri-calcium phosphate - magnesium substituted) in the process, and possibly contributing to remineralization or mineral formation within enamel cracks that could reduce or inhibit crack-propagation. This was further investigated using Raman Spectroscopy and SEM -XRD that what are the minerals formed in between the cracks. This is based on anonymized teeth, we cannot rule out the hypothesis that is related to age, gender, and ethnicity at the time of extraction.

Conclusions: In addition to XMT, SEM will be used to compare the surfaces of the tubule and the site of mineral formed and synchrotron X-ray diffraction will be used to determine the nature of the mineral. Collecting a detailed dental history prior to extraction using anonymized data, is beneficial in determining the responses from any previous dental insult. Increasing the current understanding of the natural defences will, in turn, enable therapeutic developments to take advantage of these processes.

Characterisation of SDF-HAP Reactions Under Remineralising Conditions: An NMR Study
Mandeep Kaur, Queen Mary University of London

Objectives: To use NMR to characterise the chemical interactions between 38% Silver Diammine Fluoride (SDF) and hydroxyapatite (HAP) powder during remineralisation.

Methods: 2g HAP powder was immersed in 10ml 0.1M acetic acid pH=4.0 solution in a centrifuge tube and placed in a shaking-incubator at 37C for 2hrs to mimic demineralisation. The powder was collected, washed, and then dried for 24hours in an incubator at 37C. Then, the demineralised powder was mixed with 1.5ml 38% SDF (SDI, Aus) for one minute, and air-dried for 3 minutes. The demineralised powder mixture was divided equally into seven parts and each part was immersed in 10ml remineralisation solution (composition- 2mMol $CaCl_2$, 1.2mMol KH_2PO_4, 150 mMol NaCl, pH=7.0) in individual centrifuge tubes and placed in a shaking-incubator at 37C for 10, 120, 240, 360, 480, 600 and 1440 minutes, respectively. At the end of these times, the powders were collected, washed, dried (as described previously) and then analysed using 19F NMR.

Results: 19F NMR results indicated the formation of CaF_2 within 10 minutes depicted by a broad short peak at - 107ppm. At 120mins, there was an increase in CaF_2 formation followed by a decrease at 240mins. There was a further reduction in CaF_2 at 360min but a new peak at -105.8ppm appeared indicating the presence of fluoride substituted hydroxyapatite (FSHA). At 480 and 600mins there was a further reduction in CaF_2 formation, but a concomitant increase in FSHA formation. At 1440mins, the FSHA peak downshifted to -104ppm and became sharper.

Conclusions: Initially, a larger proportion of CaF_2 was formed during remineralisation following SDF treatment. With time, there is an increase in the proportion of FSHA indicating a chemical transformation from CaF_2 to the more stable FSHA phase, slowing progression of dental caries.

The Effect of Diabetes on Osteogenic Differentiation of MSCs
Nancy Hussein, University of Leeds

Objectives: This study aims to investigate the effect of type 2 diabetes mellitus on proliferation rate, clonogenicity and osteogenic differentiation potentials of bone marrow mesenchymal stromal cells (BM-MSCs).

Methods: BM-MSCs were isolated from osteoarthritic knee joints of type 2 diabetic and non-diabetic donors using collagenase digestion method. Cultured cells were compared for their proliferative capacities using colony forming unit (CFU) and population doubling time (PDT) assays. The osteogenic potentials of BM-MSCs were investigated under osteogenic conditions (OC) and compared for calcium deposition using Alizarin Red staining and quantification and also alkaline phosphatase staining after 1, 2 and 3 weeks in culture.

Results: Diabetic BM-MSCs in average contained 16% fewer CFUs compared to non-diabetic cells at passages 1-2 and the median PDT of diabetic cells was 20% higher than that of non-diabetic BM-MSCs up to passage 5.

Diabetic BM-MSCs calcification at all time points under OC was on average 39% of that shown by non-diabetic cells. The intensity of alkaline phosphatase staining of both diabetic and non-diabetic cells showed subtle increase in OC vs basal conditions and through different time points which correlated with Alizarin Red staining intensity.

Conclusions: These preliminary results show that osteoarthritic BM-MSCs from type 2 diabetic patients have weaker proliferative and osteogenic capacities compared to osteoarthritic non diabetic cells. This work can have future clinical implications for autologous stem cells based regenerative therapies in type 2 diabetics including periodontal regeneration.

Investigation Of Effects Of Glass Ionomer Cements On Dentinal Lesions Treated Using Atraumatic Restorative Technique

Mridula Malik, Queen Mary University of London

Objectives: The aim of this research study is to investigate and monitor the effects of fluoride remineralization at the cement-cavity interface. For this experiment, high fluoride releasing strontium free G338 glass has been used as a restorative material. The interfacial mineral density variations, are being monitored using X-ray Microtomography.

Methods: Two teeth with moderately deep dentinal lesions were cleaned and restored with high fluoride G338 glass ionomer cement using ART. These restored teeth were then immersed in artificial saliva (pH 7) at 370C for which data was obtained after 1 week.

Results: Data depicts remineralization of the dentinal lesion at the cement-lesion junction. Just adjacent to the remineralized area, a thin area of demineralization is observed in the XMT scan. It seems that the calcium and phosphate ions have dissociated from the deep demineralized region and precipitated onto the subjacent almost equally remineralized area.

Conclusions: The findings seem conclusive that high fluoride releasing GICs used in ART may only result in remineralization at the cement-lesional interface while subsequently preventing remineralization (and possibly causing demineralisation) of the deeper part of the underlying lesion.

Human Dental Enamel Crystallite Orientation Varies Periodically Within Prisms

Mohammed Al-Mosawi, University of Leeds

Objectives: Presently, very little is known about the variation or organisation of crystallite orientations within individual prisms in human dental enamel. This intra-prismatic hierarchical structural level warrants investigation to understand how crystallites grow to dictate the overall hierarchy. This study aimed to map the spatial variation in the direction of dental enamel crystallites within prisms to better understand the role of intra-prismatic structural variations.

Methods: Fast scanning synchrotron X-ray nanodiffraction microscopy (S-XRDM) at the ID01 beamline of the European Synchrotron Radiation Facility was utilised to map the spatial distribution of enamel integrated (0 0 2) Bragg reflection intensity and crystal lattice-tilt. Bragg intensity and lattice-tilt mapping provide information regarding the relative quantity of crystallites oriented along the long axes of prisms and the angular deviation of crystal plane(s) from this orientation, respectively. The S-XRDM results were compared with micrographs obtained by quantitative backscattered electron microscopy.

Results: We identified periodic intra-prismatic bands of high Bragg intensities (HIs) and high tilt angles (HTs) oriented along the long axes of prisms and measuring 1.33 ± 0.26 μm and 2.10 ± 0.28 μm in width, respectively, indicating periodic deviations in the direction of crystallites within prisms. The dimensions, quantities and locations of the HI and HT bands varied as a function of tooth location. These intra-prismatic structural features were more prominent near the dentine and enamel surface compared to the enamel bulk.

Conclusions: The results documented here indicate that, contrary to previous established assumptions, groups of crystallites may change directions periodically within prisms. These results open new possibilities for modelling this hierarchically oriented and aligned mineralised tissue, that may aid optimisation of design and development of high-performance dental materials with identical physical and chemical properties to dental enamel.

Chemical Speciation Analysis of Influence of Parotid Saliva on Demineralisation

Paul Anderson, Queen Mary University of London

Objectives: Parotid saliva (PS) contributes over 50% of salivary secretion under stimulated conditions and contains inorganic components in single ion and complex ion form both of which influence the chemistry of caries process. This study aimed to correlate the degree of saturation with respect to various calcium phosphates of PS inorganic components with caries scores in healthy adults.

Methods: Stimulated PS was collected from 21 adults using a Lashley cup. Caries scores were classified using the International Caries Detection and Assessment System (ICDAS). The PS flow rate and pH were recorded. Total concentrations of inorganic elements (K^+, Pi, Na^+, Ca^{2+}, Mg^{2+}, Al^{3+}, Sr^{2+}, Zi^{2+}, Li^+) were measured using Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES). The activity of each inorganic element was calculated by chemical speciation calculations. Pearson's correlation coefficients (r) were calculated to determine bivariate relationship and statistical significance ($p < 0.05$).

Results: PS flow-rates were 0.07-0.56 ml/min, pH 5.9-7.6, and ICDAS scores 0.03-2.48. The PS pH was significantly correlated with the caries score (r -0.536; $p < 0.05$); whereas the flow rate was not. A statistically significant correlation was found between caries score and PS activity of bicarbonate ions $\{HCO_3^-\}$ (r -0.495, $p < 0.05$), hydrogen phosphate ions $\{HPO_4^{2-}\}$ (r 0.806; $p < 0.05$), and dihydrogen phosphate ions $\{H_2PO_4^-\}$ (r 0.438; $p < 0.05$). The activity of calcium hydrogen carbonate ions $\{CaHCO_3^+\}$ was negatively correlated with subjects' caries score, however the correlation was not statistically significant. The activities of ionised calcium $\{Ca^{2+}\}$ and aluminium $\{Al^{3+}\}$ were statistically significantly correlated with the caries score (r 0.425, $p < 0.05$; and r -0.423, $p < 0.05$) and with the pH of PS (r -0.426, $p < 0.05$; and r 0.852, $p < 0.05$).

Conclusions: The analysis of PS identified inorganic components involved in the caries process. Chemical species calculations of PS have the potential to improve approaches for clinical caries prevention.

BSODR 2021
Non-prize Oral Session 1
Abstracts

Synthesis of twofold LAS-Nepheline glass-ceramics for dental applications
Ali Alzahrani, Saudi Arabia

Objectives: Twofold synthesis of glass-ceramics result in materials with superior chemical, physical and mechanical properties. Outside dental application, it has been reported that glass-ceramics systems based on Li2O–Al2O3–SiO2(LAS) or NaAlSiO4 (Nepheline) led to the development of crystalline phases with unique chemical, physical and mechanical properties (i.e. controlled thermal expansion and ion exchange ability to improve mechanical properties). Glass-ceramics containing both crystalline phases (LAS-Nepheline) have not been investigated previously for dental applications. This study aimed to explore the potential of synthesizing twofold dental glass-ceramics based on a multicomponent glass system containing chemical composition of both Li2O–Al2O3–SiO2(LAS) and NaAlSiO4 (Nepheline).

Methods: Novel glasses based on multicomponent lithium sodium potassium calcium aluminosilicate system were synthesized using melt-quench methods. Glasses were characterized using differential scanning calorimetry and dilatometry. Experimental glass powders were heat treated to produce glass-ceramics. The crystalline phases and microstructures of the glass-ceramics were analysed using X-ray diffraction, solid state nuclear magnetic resonance and scanning electron microscopy. The mechanical properties of the glass-ceramics were evaluated using the biaxial flexural strength test according to the dental ceramics ISO 6872:2015.

Results: Preliminary results showed glass-ceramics containing fine crystalline structures with desirable mechanical properties based on the twofold LAS-Nepheline glass-ceramics system and has the potential to be used for dental applications.

Conclusions: The end glass-ceramic obtained from the novel glass system designed in this study may add to the knowledge of twofold glass-ceramics syntheses and have the potential to be developed and used as a glass-ceramics material for dental application

Are Inert Glasses Really Inert?
Saroash Shahid, Queen Mary University of London

Objectives: Inert glasses are widely used as structural fillers in composite resins to reduce shrinkage and improve mechanical properties. These glasses are assumed to be chemically stable when in contact with oral fluids and are not expected to result in significant ion release and degradation. The aim of this study was to investigate the degradation and ion release of a typical "inert glass".

Methods: An inert SiO -Al O -BaO-B O -F glass (75mg) particle size @1micron typical of those used commercially 223 23 was immersed into 50 mL of Tris Buffer (pH 7.3) for times up to 28 days. The glass was filtered off after each time point and dried overnight for characterisation. ATR-FTIR and XRD was used to investigate glass degradation. Solid state 19F, 27Al and 11B-NMR was used to investigate the glass structure before and after immersion. The supernatant solution after filtration was characterised using ISE and ICP-OES to quantify the ion release.

Results: ATR-FTIR and XRD confirmed the glass was amorphous and did not show any evidence for degradation after immersion. However, there was significant release of boron, silicon barium and fluoride upon immersion of up to 17, 85 and 17 ppm respectively. There was also evidence for silicon release, suggesting degradation of the glass. There were no significant changes in the 27Al and 11B-NMR spectra, before and after immersion. However, the 19F- NMR spectra showed evidence of significant changes after immersion.

Conclusions: The inert glass exhibited glass degradation and ion release, suggesting that not all inert glasses are completely inert. Glass suppliers should not claim inert properties if the glass presents significant ion release upon immersion. Clinically glass particles in the surface of composite resin restorations that are prone to glass degradation are likely to adversely influence the wear behaviour. Furthermore, increased glass degradation would be expected under acidic conditions compared to pH 7.3 investigated here.

Interaction of Pulp Capping Materials with Caries Affected Dentine

Kawthar Bukhari, University of Manchester

Objectives: To assess (i) mechanical, chemical and microstructural characteristics of sound coronal dentine and caries affected dentine (CAD) using different dentine conditioning protocols, and (ii) structural changes of dentine- material interface following application of pulp capping materials on conditioned CAD.

Methods: Five dentine conditioning protocols: 2.5% sodium hypochlorite (NaOCl), 17% ethylene diamine tetraacetic acid (EDTA), 37% phosphoric acid gel, 10% polyacrylic acid or distilled water, were used to aid smear layer removal. Dentine sections obtained from the coronal part of human teeth were assessed pre- and post-conditioning by Vickers microhardness (VH), scanning electron microscopy (SEM), and energy dispersive spectroscopy (EDS). Five pulp capping materials were used (MTA ANGELUS®, Biodentine®, Bio-C PULPO, GC Fuji IX GP® and Endosequence® BC linerTM) on CAD sections following application of conditioning protocols. After 28 days in Hank's balanced salt solution, the material interaction with conditioned CAD was assessed by SEM, elemental mapping, and microhardness of dentine at 25 and 100 microns from the interface. Statistical analysis was conducted using ANOVA followed by Bonferroni post hoc to detect the difference between groups (p-value < 0.05).

Results: SEM/EDS analysis showed that the use of NaOCl and distilled water did not remove the smear layer while other protocols resulted in depletion of calcium. Elemental mapping showed that calcium was found in the materials and dentine, and silicon migrated from material to dentine, in all groups. Regardless of the conditioning protocol, MTA, Fuji IX and BC liner exhibited aluminium migration, and BC liner showed fluoride migration to dentine. There was an increase of CAD microhardness at 25 microns after material placement (52 - 65 HV).

Conclusions: EDTA conditioning can be used as an alternative to acids as it leaves a smear-free dentine surface. The interaction of pulp capping material with conditioned CAD occurred through minerals exchange. The presence of a smear layer did not impede the interaction.

SARS-CoV-2, Dental Aerosols and Electric Handpieces at 200,000 rpm

David Wood, University of Leeds

Objectives: The mitigation of bioaerosols during dental procedures is paramount to the reduction of viral transmission risk. The use of a high-speed contra-angle handpiece (HSCAH) at 60,000 rpm has been demonstrated to minimize bacteriophage aerosolization, acting as a SARS-CoV-2 surrogate. Nonetheless, to enable improved cutting efficiency and reduce procedural time, this study assessed the aerosolization of a bacteriophage marker from the oral cavity, with HSCAHs at increased speeds.

Methods: Here we used a bacteriophage phantom head model for bioaerosol detection, as previously developed by our group. Triplicate full crown preparation procedures were performed on the upper left lateral incisor with an NSK
-1
Z95L Contra Angle 1:5 handpiece (water flow rate 60 mL min) and a Bien Air Contra Angle 1:5 Nova Micro Series
-1
handpiece (flow rate 32 mL min), with chip air turned off. Cutting speeds of 60,000, 100,000 and 200,000 rpm were
investigated. Bioaerosol dispersal was measured with ∅6 bacteriophage settle plates, Microbio MB2 air sampling and Kanomax 3889 GEO∅ particle counters.

Results: Minimal bacteriophage was detected on settle or air sample plates, with no significant differences observed between the different speeds for either handpiece (p>0.05). With the NSK, settled aerosol detection was 0.00 (±0.00), 1.00 (±1.00) and 1.00 (±0.00) plaque forming units (pfu) at 60,000, 100,000 and 200,000 rpm, respectively. Average air sample detection was 0.08 pfu/m3 for all speeds. Zero bacteriophage was detected during fallow periods, except for 0.67 (±0.67) pfu at 200,000 rpm on settle plates. No bacteriophage was detected outside the splatter zone with the Bien Air at any speed.

Conclusions: These data, from a biological marker model, suggest that the use of HSCAHs at 200,000 rpm pose minimal additional risk to viral spread in the dental surgery. The increased flow rate of the NSK HSCAH likely contributed to slight increases in phage detection.

High-Precision Surface Metrology of sub-80 µm Enamel Lesions using Intra-Oral Scanning

Polyvios Charalambous, King's College London

Objectives: To validate a surface-registration and surface-subtraction metrology algorithm for depth (µm) quantification on natural enamel surfaces using intra-oral scanning (IOS).

Methods: A software algorithm combining iterative-closest-point (ICP) surface-registration and surface-subtraction was developed for surface metrology of natural enamel. Firstly, software errors (%) for measuring a simulated 80 µm deep lesion were quantified for surface-registration (with and without reference areas) and surface-registration plus surface-subtraction, using softgauges (digital measurement standards for testing the numerical correctness of metrology software). Softgauges were created using spreadsheet software by taking a non-contacting laser profilometry (NCLP) scan of a natural enamel sample and mathematically creating an 80 µm deep simulated lesion on the surface. Secondly, the precision (µm) of repeated (n=5) scans of a natural enamel sample was quantified for the IOS in comparison to the NCLP using surface-registration software. Finally, the IOS's depth measurement threshold was quantified using the combined surface-registration and surface- subtraction algorithm for measurement of lesions with depths, 11 µm to 81 µm, in natural enamel samples (n=14).

Results: Firstly, the software errors for measuring the 80 µm softguage using surface-registration alone ranged from a 29.75% underestimation of the lesion depth without reference areas to 2.69% underestimation with reference areas. When surface-registration and surface-subtraction were combined, these errors reduced: from a 0.05% underestimation without reference areas to finally a 0.00% software error using reference areas.
Secondly, the mean (SD) precision of repeated surface-registration using surface-registration software was 1.2 (1.0) µm for the IOS scans compared to 0.1 (0.2) µm for the NCLP scans.
Finally, the depth measurement threshold of IOS was determined to be 73 µm whereas the NCLP successfully quantified all lesion depths from 11 µm onwards.

Conclusions: This study validated a novel surface metrology algorithm combining surface-registration and surface subtraction. Intra-oral scanning has a 73 µm threshold for measuring depths in natural enamel.

Radiopacities of Novel Radiopaque Infiltrants for Early Enamel Caries

Mahmoud Hasan, Queen Mary University of London

Objectives: An infiltrant for early enamel carious lesion should have a radiopacity ≥ enamel. The aim is to assess the radiopacities of some new infiltrant resins containing bromine methacrylate (BrM) as a radiopaque agent.

Methods: Resin infiltrant containing triethylene glycol dimethacrylate (TEGDMA), urethane dimethacrylate (UDMA), 3MTM ScotchbondTM Universal Plus Adhesive (SUPA), and 2,3-dibromopropyl methacrylate (BrM) were mixed in different composition as listed in Table 1. The mixed resins were poured into a rubber base mould and light polymerised (40s) to form uniform disks (1 mm thick and 10 mm diameter). Each disk was imaged using an x-ray machine with an aluminium step wedge beside it as a reference (Fig. 1). All images were analysed using Image JTM software to calculate the mean grey value of each disk, which was then converted to aluminium thickness with equivalent radiopacity.

Results: The radiopacities of each composition are summarised in Table 1. Radiopacity increased with increased concentrations of BrM. When the BrM concentration exceeded 50%, the radiopacity was more than 2mm aluminum thickness which is the radiopacity of dental enamel. However, phase separation could be observed except for the mixture with SUPA.

Conclusions: BrM is a promising material to tune the radiopacity of the enamel infiltrant especially when it is mixed with the 3M SUPA adhesive. The physical properties of the newly formed resins need to be further investigated.

BSODR 2021
Voco Prize
Abstracts

Improving the surface properties of Nickel-Titanium endodontic files

Beliz Ozel, Queen Mary University of London

Objectives: Current technology has evolved of various treatments to enhance the surface properties of dental instruments for improving their efficacy during clinical use. In endodontics, shaping systems with a flexible core and a hard surface has developed technologies with increasing flexibility and increased cutting efficiency. Physical vapor deposition (PVD) is used to produce thin films and coatings on various surfaces. This study presents a novel surface treatment using a Boron/Nitride (B/N) layer applied onto the surface of endodontic files using PVD, and evaluation of the surface topography compared with non-coated files by AFM, SEM and surface profilometry.

Methods: A non-coated MTwo (VDW, Munich, Germany) 0.06 taper size 25 endodontic file was coated with 0.5 µm thick Boron/Nitride (B/N) layer using the PVD technique. The surface topographies were analysed and compared with a non-coated MTwo size 25, 0.06 using atomic force microscopy (AFM), laser surface profilometer, and scanning electron microscopy.

Results: AFM showed an average Ra of 29.1 µm for the B/N coated file, and 36.9 µm for the uncoated file. The laser profilometer showed an average roughness of 7.4 µm for the coated file, and 14.1 µm for the uncoated file. SEM and AFM showed that the B/N coated files had a cellular-like coating distributed on the surface. SEM elemental analysis showed for the coated files a ratio of Ni/Ti (wt%): 21/40, whereas for the uncoated sample was 39/40.

Conclusions: A B/N PVD coating creates a layer on a file with significantly reduced surface roughness. The applications of PVD coatings such as B/N can be an effective option for the improvement of NiTi endodontic instruments.

Fluoride-releasing Glasses Based on Sodium Fluoride-modified 45S5 Bioglass

Hasan Merie, Newcastle University

Objectives: Fluoride-releasing filling materials can potentially protect restored teeth from secondary caries. Dental composites are the most common aesthetic filling materials but the majority of products currently do not release fluoride. Bioglass 45S5 (BG) has recently been incorporated in dental composites as a smart filler with promising results. However, BG does not contain any fluoride. This study aims to develop novel fluoride-releasing glasses, by modifying the BG composition with different percentages of sodium fluoride NaF (5, 10 and 20wt%).

Methods: Glasses were synthesised by a conventional melt-quenching technique, then characterised for physical, morphological and chemical properties. X-ray diffraction (XRD) was used to confirm their amorphous nature, and differential thermal analysis (DTA) to analyse glass characteristic temperatures (glass transition T_g, crystallisation T_c and melting T_m). Ion-selective electrode (ISE) was used to measure the cumulative release of fluoride ions. Glass particles (≤45µm) were immersed in deionised water (DI) for 84 days at 37°C. The cumulative fluoride release was measured after 1, 3, 7, 14, 28, 56 and 84 days of immersion. Statistical significance of fluoride release was assessed using one-way ANOVA with Tukey's post-hoc test.

Results: All samples were amorphous. The DTA characteristic temperatures and the cumulative fluoride release of BG and modified BGs are shown in Table 1. Modified BGs showed a second crystallisation peak, compared to the original BG. The addition of sodium fluoride decreased all DTA characteristic temperatures (T_g, T_c and T_m). The pattern of fluoride release was similar for all modified BGs, being highest on the first days of immersion and diminishing subsequently, and it was proportional to the square root of time. The highest amount of fluoride was released by 20NaF (20wt% NaF) and it was statistically significantly higher ($p<0.001$) than 5NaF (5wt% NaF) and 10NaF (10wt% NaF) at each time point. Also, 10NaF was statistically significantly higher ($p<0.001$) than 5NaF at each time point.

Conclusions: 20NaF showed the potential to be used in fluoride-releasing dental filling materials.

A Comparative evaluation of "House of Cards" and "Cabbage Head" fluormica glass-cramics

Maher Mohamed, Queen Mary University of London

Objectives: Fluormica glass-ceramics are well known for its excellent machinability, which is attributed to its unique ''House of Cards" microstructure. Another interesting microstructure ''Cabbage Head" has been developed claiming better mechanical and machinable properties. MACOR® (MAC) and VITRONIT®(VIT) are two commercially available examples of both microstructures.This work studies the effect of different microstructures on properties of fluormica glass-ceramics.

Methods: Both glass-ceramics were characterized using X-ray diffraction (XRD), Scanning electron microscope (SEM), 19F and 27Al MAS-NMR. MAC and VIT were then tested using Knoop hardness test (KH), Biaxial flexural strength test (BFS) and their machinability has been evaluated.

Results: XRD of both showed crystallisation of potassium fluorophlogopite with almost no difference in number or intensity of diffraction lines, SEM of MAC showed plate-like crystals forming '' House of cards" microstructure while that of VIT showed curved crystals aggregates with amorphous centre forming ''Cabbage head" microstructure. Knoop hardness of VIT was significantly higher than that of MAC, same as forces needed to machine them. The BFs of MAC was significantly higher than that of VIT.

Conclusions: Commercial fluormica glass-ceramics with House of Cards microstructure has a better machinability and biaxial flexural strength than the with Cabbage head microstructure. However, the latter has higher hardness.

Characterisation of Fluoride Containing Bioactive Glass Composites for Dental Restoratives

Melissa Tiskaya, Queen Mary University of London

Objectives: Bioactive glasses (BAGs) have been incorporated into resins to overcome the issue of polymerisation shrinkage and subsequent caries by forming a mineral apatite layer in the marginal gap to prevent secondary caries.
The aim of this study was to characterise the effect of network connectivity (NC) on ion release, pH changes and apatite formation of fluoride-containing bioactive glasses.

Methods: BAG powders (<38 μm) with varying NCs (from 1.45 to 2.70) were synthesised and immersed into artificial saliva pH 7 (AS7) to investigate the effect of NC on bioactivity. One selected composition was silylated and mixed with a Bis-GMA and TEGDMA based resin to form a composite disc and was immersed into AS7 for timepoints up to 3 months. The powders and discs were characterised using ATR-FTIR, XRD, 31P-NMR and 19F NMR to detect fluorapatite (FAp) formation. The supernatant solution was characterised using ICP-OES and ISE to quantify the ion release and the pH changes were measured.

Results: ATR-FTIR and XRD showed that as the NC decreases, there is more rapid degradation of the glass powders. ICP-OES and ISE showed oscillations in the ion concentration, suggesting release and consumption of the 31 19 ions to form apatite. P and F-NMR confirmed that the apatite formed is FAp. Similar results were found when the BAG was incorporated into the resin, however the effects were less pronounced, due to the presence of resin. The ATR-FTIR carbonyl vibration from the resin also decreased upon immersion, suggesting apatite formation occurs preferentially on the surface of the discs.

Conclusions: NC has been shown to affect the rate of degradation, apatite formation, ion release and pH rise of fluoride containing BAGs in artificial saliva. These glasses are attractive components for inclusion in composite resins with potential clinical benefits.

Characterization of Bioactive Restorative Materials for Restoration of Root Caries

Diana Abduallah, University of Birmingham

Objectives: Restoration of root surface carious lesions is challenging due to the heterogenicity of the substrate to which the material needs to be bonded to. Furthermore, the material needs to have specific characterics and thus be both antimicrobial and also encourage periodontal tissue regeneration. The aim of this study was to develop and characterize novel bioactive materials that can prevent biofilm adhesion.

Methods: Three commercial resin-based materials and two prototypes with a hydrophilic resin matrix incorporating a Sr or 45S5 bioglass were tested. The set materials were characterized using scanning electron microscopy and energy dispersive spectroscopy (SEM-EDS), Fourier transform infrared spectroscopy (FT-IR), and X-ray diffraction (XRD) analysis. Surface characterization was performed by SEM-EDS, profilometry, and contact angle measurements after immersion in Hank's balanced salt solution at different time periods. The degree of conversion (DC) was evaluated for the tested materials using FTIR-ATR method. Material eluates were assessed for ion release and pH.

Results: Both prototypes exhibited a significantly higher DC, pH and release of Sr, Ca and Si in the solution which was maintained over the testing period. SEM-EDS analysis revealed cracks in the interface between fillers and matrix as well as within the filler particles after immersion. The roughest surface was observed in the Sr-prototype which was significantly higher than the other tested materials. For the contact angle measurements, RMGI and both prototypes were the most hydrophilic among the studied materials. The KBr-FTIR analysis of the prototypes revealed that with the increase in the immersion period, peaks related to the polymer matrix decreased in intensity while bands corresponded to PO4 increased and sharpened.

Conclusions: The novel composite materials exhibit promising bioactive and wetting properties; however further optimization is necessary to improve filler to resin interaction and to tailor make these materials to be both antimicrobial and enhance periodontal tissue regeneration.

Bioactivity analysis of novel fluoride releasing bioactive glass based Dental restorative composites.

Hina Khalid, Queen Mary University of London

Objectives: Dental restorative materials that release calcium, phosphate and fluoride ions helps in remineralisation and can contribute to the prevention of secondary caries, which is one of the main reasons for failure of contemporary dental restorations. The aim of this study is to develop a novel bioactive glass based dental composite with better remineralisation properties.

Methods: Two Bioactive Glasses (BAG4, BAG6) containing SiO -P O -CaO-CaF -Na O-K O-MgO-SrO-ZnO 225 222 prepared via the melt quench route at 1400C. The Network Connectivity was calculated as 2.43, 2.62 and Refractive Index are 1.56,1.55 respectively. Glass powder added in the resin matrix composed of BisEMA, UDMA and TEGDMA and light cured for 20s. Samples were stored at 37C in different Artificial Saliva pH=7 and pH=4 (AS7 and AS4) for varying time intervals. All synthesized samples were characterized using Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Radio-opacity analysed by aluminium step-wedge, pH measurement, Release of bioactive ions recorded by ICP-OES technique and release of Fluoride evaluated by ISE studies.

Results: FTIR spectra and XRD patterns of both bioactive composites showed characteristic peaks for the formation of apatite both in AS4 and AS7 which increases with time. Degree of conversion of dental composite ranges between 70-81%. Radio-opacity of the glass found to be 2.22 and 1.84. All samples showed an increase in pH with time. It has been observed that BAG4 release more fluoride than BAG6. ICP results showed the release of bioactive ions i.e Ca and P within 24h for the formation of apatite which relates with XRD and FTIR results.

Conclusions: These novel BAG composite has shown promising results and can be used successfully in the field of conservative dentistry for repair, remineralisation, and reconstruction. However, further investigations are required for clinical application.

Radiopacity of CAD/CAM Materials and Resin-based Composites
Rua Babaier, University of Manchester

Objectives: This study investigated radiopacity versus chemical composition of CAD/CAM restorative materials and their underlying resin-based materials such as core build-up, base and luting cements.

Methods: One- and two-mm thick specimens (n=3) prepared from five CAD/CAM and six resin-based materials were radiographed adjacent to an aluminium step wedge and a section of a tooth. The digital images were analysed, and the radiopacity of each specimen was determined according to ISO 1311-2014. Scanning electron micrographs (n=1) of the material surface at 1000x and 5000x magnifications were imaged coupled with an energy dispersed x-ray detector for elemental mapping and quantitative chemical analysis. Statistical analyses of radiopacity expressed in mm Al (n=15) were carried out using the Kruskal-Wallis test followed by pairwise comparisons at a significance level of 0.05.

Results: The radiopacities of the CAD/CAM materials in ascending order were: Vita Enamic (VE), Vita Mark II (VM II), CeraSmart (CS), Lava Ultimate (LU), Grandio blocs (GB). At 1-mm thickness, VE and VM II showed significantly lower median radiopacities (0.72±0.01and 0.79±0.02 mm Al, respectively) compared to enamel and other CAD/CAM materials. While at 2-mm thickness, no statistically significant difference in radiopacity was detected between VE, enamel, dentin and various resin composites except Filtek Z250 (FZ) and Tetric-N Ceram (TN). The EDS elemental analysis revealed variable levels of zirconium distributed among all tested specimens, while barium and strontium were found in some materials as radiopacifying elements.

Conclusions: The investigated materials showed variable differences in radiopacity in comparison to tooth structure, as assessed in two thicknesses. Material composition and thickness affected the radiographic results. The nearly radiolucent hybrid ceramics meant that the radiopacity level of the underlying bonding resin materials was critical for the detection of the restoration margins.

Cell Derived Matrices as Models to Study Gingival Reintegration
Fauzia Quadir, Queen Mary University of London

Objectives: 1. Developing a simple cell-culture technique to recapitulate the ECM, which mimics aspects of the native tissue microenvironment.
2. Generation of cell-derived matrices on various substrates including hydroxyapatite, gelatin, and polymer brushes.
3. Characterisation and quantification of resulting cell-derived matrices by immunofluorescence, confocal microscopy and scanning electron microscopy.

Methods: 1. Human gingival fibroblasts were cultured for 10 days in defined supplemented media, at the surface of the various substrates studied.
2. The cells were denuded and DNA was digested to ensure complete cell lysis by biochemical methods.
3. The resultant matrix was then quantified via immunofluorescence and confocal and scanning electron microscopy and the impact of substrate chemistry correlated.

Results: 1. The data was quantified by calculating and comparing fibre density, thickness and fluorescence intensity of the ECM deposited on various substrates using ImageJ.
2. Gelatin, hydroxyapatite, polysulfopropyl methacrylate and polymethyl and ethyl acrylate brush-coated substrates show thick mature ECM deposition compared to polylysine-graft-poly ethylene glycol (PLL-PEG)-coated and, poly(oligo(ethylene glycol) methyl ether methacrylate (POEGMA)-coated substrates.
3. ECM deposition is enhanced by the use of defined supplements in the cell-culture medium during CDM generation.

Conclusions: CDMs offer the opportunity to produce microenvironments with customizable biological and biophysical properties in a controlled setting. As a result, CDMs can improve cellular functions and can be utilized as biomaterials to engineer tissues de-novo or facilitate endogenous healing and regeneration. This research provides a brief overview of the methodologies used to facilitate CDM manufacturing and explores the versatile uses of CDMs in fundamental research and particularly its therapeutic approach following gingival injury.
In conclusion, CDM-based research advancements in methodologies, as well as innovative interdisciplinary approaches, are needed to pave the way for an exciting next generation of CDMs for basic research and therapeutic approaches

Assessment of different toothpastes on root caries using X-ray Diffraction

Haoran Chen, Queen Mary University of London

Objectives: To assess the structural characteristics of artificial root caries (ARC) following the use of toothpaste either containing 5000 ppm or 540 ppm fluoride with bioglass.

Methods: The crowns of 23 extracted sound teeth were cut by leaving the root surfaces and divided into four pieces (n=84). 70 samples were used to develop ARC using a demineralisation solution (pH 4.8) for a period of five days, whilst 14 samples were left untreated as baseline. The pH cycling including the demin-remin solution (pH 4.8 and pH 7) for 13 days. 56 out of 70 samples with ARC received toothbrushing twice daily with assigned toothpastes. These samples were randomly allocated into six groups (n=14 for each group). Group 1. No ARC treatment, Group 2. ARC treatment alone, Group 3. Bioglass with 540 ppm CaF, Group 4. 5,000 NaF, Group 5. 1,450 ppm NaF, and Group 6. Deionised water. X-ray diffraction (XRD) was carried out to detect apatite formation.

Results: The XRD pattern revealed strong diffraction lines at 26.0°, 31.9° 2θ for the Group 1. These peaks were representative of hydroxyapatite. Group 2 exhibited a substantial decrease in these diffraction line and loss of 41% mineral intensity compared to Group 1. The diffraction lines at 26.0°, 31.9° and 32.9° 2θ reappeared following the use of assigned toothpastes confirming the evidence of remineralisation on root dentine in Groups 3, 4 and 5, however there was loss of 33%, 39% and 38% mineral intensity respectively when compared to Group 1. There was lack of prominent peaks with a loss of 49% mineral intensity in Group 6.

Conclusions: This laboratory-based study provided an evidence that using different toothpastes can potentially promote remineralisation on ARC. Toothpaste containing 540 ppm CaF with bioglass showed less mineral intensity loss compared to toothpastes containing 5,000 ppm and 1,450 ppm NaF.

BSODR 2021
Non-prize Oral Session 2 Abstracts

Effects of Blue Light on Oxidative Stress Responses in Gingival Fibroblasts

Edward Gait-Carr, Cardiff University

Objectives: Photobiomodulation describes the application of light to influence cellular responses. UV-free blue light has been assessed as a potential periodontal disease therapy, due to its bactericidal effects on periopathogenic bacteria. However, few studies to date have elucidated the effects of UV-free blue light on cells of the periodontium. Therefore, this study investigated the effects of UV-free blue light irradiation on the viability and oxidative stress responses in gingival fibroblasts.

Methods: Primary human gingival fibroblasts were cultured in collagen type 1 gels (1mg/mL) and serum starved for 24h, prior to irradiation. Irradiation doses ranged from 3-90J/cm2 generated from combinations of radiant power (mW) and treatment duration. Collagen gels were digested with collagenase A (2mg/mL) to release gingival fibroblasts, prior to RNA extraction and cell counting. Cell cultures were assayed immediately (superoxide radical generation via fluorescent imaging) or 24h post-irradiation (lactate dehydrogenase release; caspase-3 activity; metabolic activity; proliferation; morphology). Enzymic antioxidant (SOD1, SOD2, CAT, NRF2, KEAP1) expression were quantified by RT-qPCR.

Results: Irradiation doses >9J/cm2 induced a significant dose-dependant reduction in metabolic activity and modulated superoxide radical generation. LDH release was significantly elevated, while caspase-3 activity was 2significantly reduced, at irradiation doses >60J/cm . Changes in cell morphology and membrane disruption were also 2 present at irradiation doses >36J/cm . Cell counts revealed a dose-dependent reduction in fibroblast viability and total cell number, compared to untreated controls. Differential antioxidant gene expression was shown in treated samples (>3J/cm2).

Conclusions: There is clear evidence of metabolic alterations in human gingival fibroblasts irradiated with UV-free blue light, as a likely consequence of elevated oxidative stress. These observations are most apparent at irradiation 22doses >9J/cm. As expected, high doses (>36J/cm) induced potent cytotoxic responses and support a negative correlation between cell health and irradiation doses. As doses <30J/cm2 induced limited adverse effects, these doses should be investigated further as potential periodontal therapies.

Cell Culture Vessels Affect the Evaluation of Ultrasound on Cells

Dhana Gupta, University of Birmingham

Objectives: The lack of standardisation to study ultrasound exposure conditions has led to inter-study variation and prevents meaningful comparisons. The given study aimed to investigate the effect of low-frequency ultrasound exposure on osteogenic differentiation in vitro.

Methods: A Duoson device at 45 kHz frequency (continuous wave at 10, 25 or 75 mW/cm2 intensity) was used to treat Saos-2 cells, cultured in 6-well plates or 35 mm Petri dishes. The distance between the transducer and cells through the culture medium was 5 mm. The vibration and amplitude at the above acoustic intensities were measured, and the effect on osteogenic differentiation, metabolic activity and cell attachment was studied.

Results: Higher vibration amplitude was identified at the inner edge of the culture vessels than the outer edge. Increasing the intensity from 10 to 75 mW/cm2 increased the average vibrational amplitude by 127 %. Vibrometer and modelling data showed that standing waves existed in both culture platforms. Within 6-well plates, higher vibration amplitudes and acoustic pressures were recorded compared with the 35 mm dishes. Following ten days of exposure to ultrasound, cells seeded in 6-well plates showed reduced total well cell metabolic activity and reduced matrix mineralisation compared with 35 mm dishes. Furthermore, a dose-dependent response was observed within 35 mm dishes. Transmission electron microscopy demonstrated higher ultrasound intensities resulted in reduced cell attachment, damaged mitochondria and endoplasmic reticulum.

Conclusions: The ultrasound dose generated by the same transducer is propagated differently according to the culture system used, which may lead to different biological responses. This work highlighted the need to develop a standardised culture system to generate reliable data to allow direct inter-study comparisons.

Thermal Effect of Ultrasound Excitation on Culture Medium

Lisa Shriane, University of Birmingham

Objectives: It has long been established that ultrasonic excitation initiates a biological response in a wide range of cells. These cellular responses are considered a result of the thermal and non-thermal effects associated with ultrasound (US) exposure. The aim of this preliminary study was to investigate the thermal effects of US excitation on cell culture medium.

Methods: Endothelial cell growth medium (Promocell, Heidelberg, Germany) was exposed to low frequency 45kHz continuous wave US from a DuoSon US therapy device (SRA Developments Ltd, Ashburton, UK). The DuoSon transducer was submerged into a 35mm culture dish containing 5ml culture medium, held in a fixed position 5mm away from the bottom of the dish. The temperature of the culture medium exposed to a range of US intensities (10, 25 and 75mW/cm2) was recorded every second for 30 minutes using a k-type thermocouple.

Results: Temperature measurements demonstrated that US excitation resulted in culture medium heating in relation to the intensity applied, with the highest intensity causing a significant temperature increase of 12.6% after 30 min. The lowest intensity did not cause a significant temperature increase after 30 min. Temperature increase was shown to be time-dependent as no significant increase in temperature was detected after only 5 min exposure across all conditions.

Conclusions: These findings indicated that acoustic energy from continuous low frequency ultrasound application resulted in thermal effects in cell culture dishes. It should be noted that the heating effects could also in part be due to the heating of the transducer itself or frictional heating associated with the use of thermocouples. Future work on the biological response of US on cells should take into consideration the duration of US excitation to factor in this heating effect as part of the experimental protocol.

Cell Culture Vessels Affect the Evaluation of Ultrasound on Cells

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BSODR 2021
Non-prize Oral Session 3
Abstracts

Sustained release of extracellular vesicles using electrospun scaffold as novel approach for cell-free tissue engineering

Hatim Alqurashi, University of Sheffield

Objectives: This project aimed to examine the ability to functionalise electrospun scaffolds with extracellular vesicles (EVs) for their future use in cell-free tissue engineering, drug delivery and antimicrobial applications.

Methods: EVs were isolated from the conditioned media of normal oral fibroblast and human dental pulp mesenchymal stem cells in culture using ultracentrifugation (UC) and size exclusion chromatography (SEC). After characterising the size, zetapotential and protein abundance of EVs, they were incorporated into polycaprolactone (PCL) electrospun scaffolds using conventional adsorption and covalent-attachment based methods. EV-modified scaffolds were characterized using SEM, TEM and fluorescence microscopy. The number of EVs attached to the scaffolds and their release kinetics was examined using nanoparticle-tracking analysis (NTA).

Results: EVs were successfully isolated by UC and SEC as assessed by NTA and determination of presence of EV marker proteins (CD9, CD63 and CD81). Our functionalisation comparative study showed that the use of conventional adsorption (achieved after PCL activation) increased the number of EVs attached to the scaffold amd provide homogeneous incorporation with fibrous scaffold. Release kinetic study using NTA showed sustained release of 40% of EVs from the scaffolds over 21 days.

Conclusions: Here we provide evidence that electrospun scaffolds can be functionalised with EVs and provide sustained slow release over 21 days. Owing to the promising role of EVs in cell communication and tissue regeneration, this modification offering an opportunity to develop novel, cell-free and tuneable approaches to tissue engineering.

The Chemokine Landscape in Murine Gingiva

Robert Reilly, University of Birmingham

Objectives: Oral mucosa is a unique barrier tissue that is exposed to masticatory forces, microbial insult as well as food and airborne antigens. To maintain homeostasis in this dynamic environment a bespoke immune network is essential. Leukocytes play a key role in maintaining oral health and are pivotal in oral disease pathogenesis, but we have limited insights into the molecular mechanisms that regulate their recruitment to the oral mucosa. These studies sought to identify molecules that may direct leukocyte recruitment to healthy and inflamed murine oral mucosa. We also sought to compare the chemokine landscape in healthy oral mucosa to other barrier sites, such as skin and gut, which have histological and functional similarities.

Methods: Healthy murine palate, skin and gut tissue was harvested from B6 mice (n=10). Gingiva was harvested from mice with ligature induced periodontitis and from non-ligated control gingiva(n=10). mRNA was isolated from the tissue, reverse transcribed and analysed using a qPCR array for chemokine and chemokine receptors.

Results: We demonstrate that the primordial chemokine CXCL12 and its receptors CXCR4 and ACKR3 are highly expressed in both resting and inflamed oral mucosa in mice, suggesting this axis is a key contributor to cellular recruitment to the oral mucosa. We also show the chemokine landscape in health and during inflammation is broadly similar, which may reflect the necessity for continued immune surveillance in oral mucosa. Whilst there were similarities in the chemokine landscape between barrier tissues CXCL5 and CXCL17 were uniquely highly expressed in oral mucosa and CCL25 and CCL27 demonstrated low expression compared to gut and skin respectively.

Conclusions: These data suggest the chemokine landscape in oral mucosa is distinct from skin and gut and the CXCL12/CXCR4 axis may be important in regulating leukocyte recruitment to the oral mucosa.

The Ability of Resin Modified Glass Ionomer Cements to Mineralise and Form Apatite

Bandar Alshehri, Queen Mary University of London

Objectives: This study aims to evaluate the capability of resin-modified glass ionomer cements (RMGICs) to mineralise and form apatite on immersion in media similar to the oral environment.

Methods: Two synthetic RMGICs with relatively low phosphate content and different hydroxyethyl methacrylate (HEMA) concentrations (30% and 15%), with and without incorporation of 10 wt% experimental sodium-free bioactive glass (BAG), an experimental glass ionomer cement (GIC), and a commercial restorative material (ACTIVATM BioACTIVE-RESTORATIVETM) were examined. Set cement discs (n=3) were immersed in artificial saliva (AS) for 2- 31 31 weeks, 1-month, 3-months, 6-months, and 12-months. P Magic-Angle-Spinning-Nuclear-Magnetic-Resonance (P MAS-NMR), (19F MAS-NMR), Fourier-Transform-Infrared (FTIR) and X-ray-diffraction (XRD) were used to determine the ability of these cements to form apatite.

Results: 31P MAS-NMR, 19F MAS-NMR, FTIR, and XRD of the experimental compositions demonstrated evidence of increasing apatite formation over time. There was no significant difference in the apatite formation between the experimental RMGICs incorporating two different HEMA concentrations. The incorporation of 10 wt% BAG into the glass ionomer accelerated the apatite formation. On the contrary, the commercial restorative material showed no signs of apatite formation, even up to a 12-month immersion period.

Conclusions: The results demonstrate that experimental RMGICs and GICs are capable of forming apatite on immersion in AS, with time. The potential of RMGICs to mineralise was higher than what was observed with GICs under the same circumstances. This could be beneficial to occlude microleakage at the tooth restoration interface and to prevent secondary caries development.

Biomimetic self-assembling peptides as a treatment for hypomineralised dental enamel

Essra Zawia, University of Leeds

Objectives: Dental caries are reported to be one of the oldest and most common oral health issues. It is a chronic condition caused by a specific tooth-adherent bacteria: Streptococcus mutans. Bacteria metabolise dietary sugars to produce acids, which compromise dental hard tissues by dissolving hydroxyapatite (HAp) crystallites, affecting the micro- and nano-structure of the tooth and changing their mechanical properties. To investigate the alteration in dentine mechanical properties and structure at the nanoscale, a recently developed advanced imaging technique termed 3D SAXS tensor tomography (3D-SASTT) at Beamline I22, Diamond Light Source was used to examine dentine samples. We utilised 3D-SASTT to elucidate, and visualise, the intensity distribution, orientation and degree of orientation of the collagen fibrils and HAp crystallites within our dentine samples.

Methods: For the 3D-SASTT measurements, five dentine sample groups were selected, consisting of healthy non- carious dentine, carious dentine, and different degrees of artificially demineralised dentine. In the experimental setup, each sample was mounted on a goniometer and grid scanned through an X-ray beam to collect the data from each oo point to form a projection; grid scanning the x and y translation axes at different rotational angles α (0 - 180) and tilt 00 angles β (0 -45). After collecting the projections for each sample, a 3D image reconstruction algorithm was used to investigate the orientational variations in collagen fibrils and HAp crystallites by the study of specific q-ranges.

Results: Both natural carious and artificially demineralised dentine showed structural changes compared with healthy non-carious dentine. However, the orientational change of the collagen fibrils and HAp crystallites in the natural carious dentine were more prominent compared with artificially demineralised dentine.

Conclusions: Dentine structural alterations were observed at the nanoscale made possible by utilising 3D-SASTT.

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Non-prize Oral Session 4 Abstracts

Systemic inflammation and the relationship between periodontitis, edentulism and all-cause mortality
Lewis Winning, Trinity College Dublin

Objectives: The aim of this 17-year prospective cohort study was to investigate the role of systemic inflammation in the relationship between periodontitis, edentulism and all-cause mortality in a group of men from Northern Ireland, aged 58–72 years.

Methods: A representative sample of 1558 men had a detailed dental examination between 2001 and 2003. Periodontal status was defined according to the Centres for Disease Control and Prevention and the American Academy of Periodontology classification. The primary end point was death from any cause. Cox's proportional hazards model was used to assess the longitudinal relationship between periodontitis, edentulism and all-cause mortality. Accelerated failure time modelling was performed to investigate the mediating role of C-Reactive Protein (CRP).

Results: Mean age of the men at baseline was 64.3 (SD 2.9) years. 809 (51.9%) of the men had no/mild periodontitis, 297 (19.1%) had moderate periodontitis, 294 (18.9%) had severe periodontitis, and 158 (10.1%) were edentulous. During a median follow-up of 17 years, 500 (32.1%) men died. After adjustment for confounding variables, compared to men with no/mild periodontitis, the hazard ratio for all-cause mortality amongst edentulous men was 1.52 (95% CI 1.16-1.99) $p<0.01$, and for those with severe periodontitis was 1.34 (95% CI 1.06-1.70) $p=0.01$. The CRP inflammatory pathway only accounted for a minor mediating pathway effect of 10%.

Conclusions: There was evidence in this group of men, that those who were edentulous or had severe periodontitis had a significantly increased risk of all-cause mortality. Systemic inflammation, via the CRP inflammatory pathway, was not a major explanatory mediator of this association.

Epithelial-Mesenchymal Inhibitors May Have A Role In Inhibiting Pathogen-Induced EMT
Satvir Shoker, University of Birmingham

Objectives: Subgingival plaque bacteria can initiate periodontitis by eliciting a persistent, excessive host inflammatory response caused by bacterial invasion into host tissue. This may induce an epithelial-mesenchymal transition (EMT) that compromises the epithelial barrier. This study aimed to determine the effects of periodontal pathogens on potential induction of oral keratinocyte EMT, migration and gene expression changes and to investigate potential EMT inhibitors for prevention or management of disease.

Methods: Porphyromonas gingivalis (PG), Fusobacterium nucleatum (FN) and Treponema denticola (TD) were cultured anaerobically, then oxygen-killed (OK) in atmospheric conditions at 37oC and applied to oral keratinocyte cultures in a 100:1 bacterium to epithelial cell ratio. 5µM curcumin was dissolved in 0.15M sodium hydroxide (NaOH) and sterilised PBS before addition to cell cultures. Cell counts were determined manually and cell migration was assessed in a 500µm wound area formed by Ibidi® 2-well inserts. Quantitative real-time polymerase chain reaction (qRT-PCR) was performed for epithelial and mesenchymal markers after 8-days in culture.

Results: Cell numbers of keratinocytes grown in the presence of OK TD were significantly increased ($P<0.01$) but increased keratinocyte cell numbers were significantly reduced by addition of curcumin after 8-day exposure ($P<0.05$). Curcumin significantly reduced OK TD induced % wound gap closure from 56.15% to 29.54% ($P<0.001$) after 48hrs. Significant down-regulation of epithelial markers E-cadherin, Cytokeratin-5 and Desmoplakin-1 after 8-day exposure to OK PG, FN and TD were significantly inhibited by curcumin addition after qRT-PCR analysis ($P<0.05$ to $P<0.001$). Simultaneously, up-regulation of mesenchymal markers, Snail-1, N-cadherin, Vimentin and MMP-9 were significantly inhibited by curcumin ($P<0.05$ to $P<0.001$).

Conclusions: OK periodontal pathogens promote an EMT response in oral keratinocytes through gene expression changes leading to increased cell growth and migration. Curcumin appears to inhibit the responses eliciting EMT by periodontal pathogens, providing a potential therapeutic role in preventing or managing periodontitis progression by maintaining epithelial barrier integrity.

Epigenetic Regulation in Peri-implantitis Correlates with Disease Severity

Annika Kroeger, University of Birmingham

Objectives: DNA methylation is an epigenetic effect which can alter the activity of the genome without affecting the DNA sequence. Therefore, this may be a relevant regulator of inflammatory and destructive processes underlying a peri-implant disease. We used DNA methylation arrays to investigate methylation patterns of tissues obtained from peri-implantitis sites.

Methods: We obtained a total of 47 tissue samples of untreated peri-implantitis sites [probing depths (PD) ≥ 5mm, positive bleeding on probing (BoP), radiological bone loss ≥ 3mm] from 30 systemically healthy non-smoking individuals [mean PD=8.04mm, range 5-11mm]. DNA-methylation was investigated using Illumina Infinium MethylationEPIC BeadChips and the IlluminaEPIC (850K) platform. Pre-processing, normalization, and subsequent differential methylation in correlation with disease severity analysis was conducted on a R platform utilizing established R-packages (e.g., limma, minfi, DMRcate, missMethyl). Potential confounding factors, such as age, gender, multiple testing per individual were addressed in our regression analysis design.

Results: A total of 121500 differentially methylated positions (DMPs) in correlation with disease severity were identified, corresponding to 6562 differentially methylated regions (DMRs) considering a threshold of FDR<0.05. The analysis of genes correlating with differentially methylated CpGs exhibited over-representation of a variety of pathways including those related to MAPK signalling, osteoclast differentiation and choline metabolism in cancer.

Conclusions: Severity of peri-implantitis is correlated with significant differences in DNA methylation signatures. This is an indicator for epigenetic regulatory pathways in this inflammatory disease. Further studies of DNA methylation, other epigenetic regulatory processes and gene expression may clarify underlying pathophysiological processes in more depth.

An analysis of aerosol emissions from dental procedures

Mark Gormley, University of Bristol

Objectives: In this study, we aimed to quantify total aerosol concentration (TAC) produced during different dental procedures. Where aerosol was detected, we assessed whether the aerosol size distribution from patient procedures was explained by the non-salivary contaminated instrument source, using phantom head controls.

Methods: This study obtained ethical approval as part of the AERATOR grant. Patients were recruited consecutively via telephone and written consent was obtained. Both an optical and an aerodynamic particle sizer were used to measure aerosol, attached to a 3D-printed polylactide funnel 22cm from the patients face. A range of periodontal, oral surgery and orthodontic treatments were captured using sample time-stamped protocols. High-fidelity phantom head control experiments for each procedure were also performed, under the same conditions.
TAC was measured for each procedure. For those which registered above background, phantom control and patient procedure aerosol size distributions were compared, with the assumption that if the distributions were the same, all aerosol detected from the patient could be explained by the instrument source. To further assess if size distributions differed other than by chance, a two-sided unpaired t-test was used, with a Bonferroni corrected p-value of <0.002 considered significant.

Results: 41 patients underwent 12 different dental procedures. Aerosol was detect for 5 procedures and for these the percentage of procedure time that aerosol was observed above background ranged from 12.7% for ultrasonic scaling to 42.9% for 3in1 air+water (Table 1). High-speed drilling produced 10-fold greater TAC compared to the other procedures. No differences were detected between phantom control and patient procedure size distributions for ultrasonic scaling, 3in1 air/air+water, or surgical drilling. However, there was a statistically significant difference in size distributions for high (p=1.10x10^{-5}) and slow-speed drilling (p=5.54x10^{-8}), with additional unexplained aerosol also present (Figure 1).

Conclusions: It is evident that several common dental procedures generate aerosol, but for most this can be explained by the non-salivary contaminated instrument source. However, aerosol from slow speed drilling could not be fully explained and so risk here cannot be excluded.

Lifestyle Traits are Associated with Oral Microbiota Composition and Function

Shirleen Hallang, University of Bristol

Objectives: Modifiable lifestyle traits including oral hygiene behaviours may affect the function or composition of the oral microbiota. The study aimed to test for associations between lifestyle traits and oral microbiota composition and function.

Methods: The study included Swedish volunteers aged 16 to 79 years, who completed a questionnaire on lifestyle traits including oral health behaviours and attitudes. Bacterial 16S rDNA amplicons were generated from salivary DNA, then sequenced and classified according to genera and species. 16S rDNA was used to predict molecular functions of the oral microbiota. Partial least squares and linear regression models were used to identify associations between lifestyle traits and measures of microbiota composition and function. P-values were adjusted for multiple testing.

Results: The study included 401 participants. A total of 463 species were detected in the study group, of which 233 were detected in at least 10% of participants and were used in the main analysis. The questions "do you think caries is a disease" and "do you use floss or a toothpick" were strongly associated with overall microbiota composition. Participants who answered "no" had enriched relative abundance of species in the Actinomyces, Campylobacter, Dialister, Fusobacterium, Peptidophaga and Scardovia genera (all p < 0.05 after adjustment for multiple testing). Participants who answered "no" to these questions had differences in the predicted functional profile, with enrichment of carbohydrate related functions. Other traits which were associated with microbiota composition or function included socio-demographic traits (highest educational level and nature of occupation) and other oral hygiene behaviours (tooth brushing frequency and use of fluoride supplements).

Conclusions: Favourable oral health behaviours are associated with healthier oral microbiota composition and predicted functions. Results of the study could be used to prioritise modifiable risk factors for possible interventions.

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Broad-spectrum Antimicrobial Effects of a Novel Quaternary Ammonium Compound

Alexander Brezhnev, Hong Kong

Objectives: Human diseases in general, and oral infections in particular, are caused by several biofilm-forming bacteria and yeasts. Benzyl-dimethyl-[3-(tetradecanoylamino) propyl]azanium chloride (miramistin/MIR), is a novel quaternary ammonium compound. Little is known about its effects on biofilms. The aim of this work was to determine the antimicrobial and antibiofilm effects of MIR against purposely selected oral pathogens.

Methods: The antimicrobial effects of MIR were determined against planktonic cells of Streptococcus mutans, Actinomyces naeslundii and Candida albicans by measuring the minimum inhibitory concentration (MIC) and minimum bactericidal/fungicidal concentration (MBC/MFC). Monospecies biofilm eradication by MIR was determined against 24h using the standard XTT reduction assay. The effects of MIR against mature (72h) biofilms were determined and compared with untreated controls. GraphPad Prism 9 software was used to plot dose-response curves. For 72h biofilms, the data were analysed using one-way ANOVA with Tukey's HSD post-hoc test and one-sample t-test at significance of α=0.05.

Results: MIR potently killed planktonic cells at low micromolar concentrations (MIC for S. mutans, A. naeslundii and C. albicans = 9.11 μM). The minimum biofilm eradication concentration (MBEC80) was determined to be 86.23 μM for S. mutans, 88.03 μM for A. naeslundii and 64.18 μM for C. albicans. MIR (145.75 μM) significantly reduced biofilm viability of 72h biofilms compared to untreated control for all the 3 organisms (p<0.001).

Conclusions: This study provides evidence that MIR potently kills planktonic and biofilm cells of bacterial and fungal species, highlighting the potential to develop MIR into a broad-spectrum anti-infective agent.

Response of Salivary Glucose and pH in the Oral Microbiome

Nailê Damé-Teixeira, Brazil/Leeds

Objectives: We recently published a metanalysis showing that poor glycemic control makes individuals with type 2 Diabetes Mellitus (T2D) more prone to caries. Our hypothesis is that higher levels of salivary glucose are more likely to predispose to dental caries. This study aimed to investigate the association between the salivary microbiome, pH and glucose levels.

Methods: A cross-sectional study was carried out, including adults with and without a diagnosis of T2D. Coronal and root caries, periodontitis, fasting blood glucose (FBG), and glycated hemoglobin (HbA1c) were evaluated. Saliva was collected for salivary glucose, pH measurements, and microbial DNA sequencing. Amplicons of the V4 region of the 16S rRNA gene were submitted to high throughput sequencing. The amplicon sequence variants were identified by the DADA2 pipeline, and the association of microbial taxa with the salivary and blood glucose levels were verified using Spearman correlation.

Results: Salivary glucose was positively associated with FBG and HbA1c (p<0.05). The Actinobacteria phylum showed higher abundance in the group of individuals with salivary glucose <35 than the group with salivary glucose >35mg/dl (17.6±6.8% vs. 13.1±5.1%). The Firmicutes/Bacteriodota ratio was higher in the group of patients with saliva at pH8 than in the pH6 group (16.8±10.1 vs. 81.8±120.4), while Proteobacteria phylum was in lower abundance (15.6±12.3% vs. 3.9±3.8%). At the genus level, Veillonella was depleted in individuals with alkali saliva. Several organisms in abundance lower than 0.01% were prevalent in at least 50% of the samples, such as Absconditabacteriales (SR1) that was positively associated with root caries extent. Significant differences were found for the Shannon diversity index regarding the salivary pH.

Conclusions: Salivary glucose and pH are associated with the salivary microbiome composition that predisposes to dental caries. Further studies on Firmicutes/Bacteriodota ratio might be suggested as a promising predictor of oral disease.

Biodegradation of zirconia by Fusobacterium nucleatum
James Kit-Hon Tsoi, Hong Kong

Objectives: The current study was to investigate the degradation of zirconia with Fusobacterium nucleatum.

Methods: Eighty of polished and sintered zirconia discs (IPS e.max®ZirCAD MT A2, Ivoclar Vivadent, Liechtenstein) in round shape (20mm in diameter) with Ra=0.55±0.04μm were prepared. Fusobacterium nucleatum (F.n.) was inoculated on the zirconia discs for either 3 or 7 days. Specimens without bacteria incubation were served as control group. Inductive coupled plasma-optical emission spectroscopy (ICP-OES) test was applied to quantify the Zr element concentration in the medium with and without F.n. bacteria incubation. The surface characteristics of zirconia were evaluated by water contact angle (WCA), biaxial flexural strength (BFS) test and X-ray diffraction (XRD) measurements. The statistical analysis was performed with one-way ANOVA with α=0.05.

Results: The BFS values of the zirconia after incubated with F.n. for 3 (654.50±112.18MPa) and 7 (660.02±106.64MPa) days were significantly lower (p<0.05) than zirconia without any bacteria incubation (765.01±20.12MPa), and stored in pure broth for 3 (719.02±32.01MPa) and 7 (716.11±58.12MPa) days. XRD showed no tetragonal (T) to monoclinic (M) phase change of zirconia in all the groups. ICP-OES detected no significant difference (p>0.05) for Zr release for broth only or with F.n. groups. WCA of zirconia surfaces after incubated in the broth with F.n. for 3 (10.51±4.13°) and 7 (10.35±1.14°) days were higher than zirconia surfaces after immersed in pure broth without bacteria (15.72±2.12° and 21.15±4.43° for 3 and days, respectively); however, they were significantly lower (p<0.05) than those on the zirconia surfaces without any treatment in the control group (73.46±8.57°).

Conclusions: Fusobacterium nucleatum might lead to zirconia biodegradation, and the reasons are yet to be found.

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Non-prize Oral Session 6 Abstracts

TiO2 /CaO Effects on Crystallization and Flexural Strength of Leucite Glass-ceramics

Mustafa Al Musali, Queen Mary University of London

Objectives: The aim of this study was to investigate the effect of titanium dioxide (TiO2) and calcium oxide (CaO) on the crystallization of new leucite glass-ceramics and to test their flexural strength.

Methods: Experimental aluminosilicate glasses were batched containing; 1 mol % CaO/TiO2 (B1); 2 mol % CaO/TiO 2 (B2) and 3 mol % CaO/TiO2 (B3), then prepared using fusion methods. All glasses were characterised using dilatometry. Heat treatment of the glasses was carried out and they were characterized using secondary electron microscopy (SEM) and biaxial flexural strength (BFS). BFS test groups were compared using a one-way ANOVA and Tukey's multiple-comparison test ($p < 0.001$). Characteristic strength and Weibull m-values were compared for the overlap of their double-sided confidence intervals at the 95% level.

Results: Mean BFS (MPa/SD) of experimental glass-ceramics were; B1: 224.9/ 24.9; B2: 211.2 /26; B3: 234.8/15.3. Glass-ceramic B3 had the highest Mean BFS compared with other test groups ($p<0.001$). Characteristic strength (σ_0) and Weibull m-Values (m) were (σ_0, m): B1: σ_0=235.6, m=10.9; B2: σ_0=222.5, m= 9.4, B3: σ_0=241.5, m=18.9. The m value of Glass-ceramic B3 was significantly different to the other test groups ($P<0.001$). Secondary electron microscopy (SEM) revealed a high area fraction of leucite crystals in the glassy matrix and no matrix microcracking.

Conclusions: Glass compositions with 3 mol % CaO/TiO2 led to the crystallisation of high aspect ratio leucite glass- ceramics with high BFS and reliability.

Stability of Veneered and Implant-supported PEEK FDPs with Free-end Unit

Danka Micovic Soldatovic, Germany

Objectives: To determine the fracture load of implant-supported 4-unit cantilever fixed dental prostheses (FDP) with frameworks made of two different filled polyetheretherketone (PEEK) compounds and veneered using three different techniques before and after artificial aging.

Methods: A total of 120 congruent in shape 4-unit FDP frameworks were produced (n=60 milled from PEEK, filled 20% TiO2 and n=60 pressed from PEEK, filled 30% TiO2) and veneered using three different techniques: (i) digital veneerings, (ii) prefabricated veneerings, and (iii) conventional resin composite veneerings (n=20 per subgroup). Afterwards, FDPs were adhesively bonded to titanium abutments and the fracture load was measured in a Universal testing machine (1mm/min) before and after artificial aging in a chewing simulator (1,200,000x, 50 N, TC: 5/55°C, 6,000x). Fracture patterns were analyzed using digital microscopy. Data were analyzed using Kolmogorov-Smirnov- 2 test, one-way ANOVA, post-hoc-Scheffé, Chi -test ($p < 0.05$), and Weibull modulus m as well as fracture patterns using Ciba-Geigy table (a<0.5).

Results: Veneering technique and filler content significantly affected the fracture load ($p < 0.001$). Prefabricated veneers showed higher fracture load (p £ 0.001) whereas digital and conventional veneerings were in the same value range (p = 0.451). PEEK with 30% filler content presented higher fracture load ($p < 0.001$) compared to PEEK with 20%. Aging showed no effect on fracture load (p = 0.176). Regarding fracture types, there were no significant differences between the groups (p = 0.055).

Conclusions: Filler content of PEEK compound as well as veneering technique influenced fracture load while aging presented no impact on fracture load.

Characterisation of the film thickness and the bond strength reliability of a bioactive Calcium Aluminate/Glass- Ionomer cement (CaAl/GIC) to lithium disilicate (LD) and dentine

Angelle Esparon, Queen Mary University of London

Objectives: Firstly to determine the effect of temperature (5° C, 23 °C, 30° C) on the film thickness of a new CaAL/GIC, self-adhesive resin cement (SARC), resin cement (RC) and glass-ionomer cement (GIC) in comparison to the ISO 9917-1:2007 and ISO 404:2009 standards. Secondly, to assess the bond strength of CaAL/GIC (Ceramir C & B), SARC (RelyX Unicem 2), RC (Panavia V5) and GIC (Fuji I) to LD and dentine. Thirdly, to test the influence of water storage on the bond quality and, fourth, analyse the fracture interface microscopically for bond reliability and fracture type.

Methods: The ISO 1977-1:2003 protocol was used to determine the film thickness of the dental cements at 5 °C, 23 °C and 30 °C. For the bond strength test, eighty dentine surfaces and eighty monolithic lithium were divided into four groups, each with a different type of dental cement. Within each group, 20 LD discs were luted onto 20 dentine surfaces with a specific dental cement. Then 10 specimens were stored in water at 37 °C for 24 hours and 10 specimens for 28 days. Each specimen was then subjected to a macro shear bond strength test at a 0.5 mm/min crosshead speed, fractography and data analysis (one-way (ANOVA) analysis of variance and Tukey Honestly Significant Difference test and at a significance level of 5%).

Results: The results for the film thickness test indicate that all the luting cements at the three specific temperatures had a film thickness below 25 µm and meets the ISO standards. The temperature and type of cement had no statistical effect on the film thickness. There was a significant difference between the SBS of the polymer-based cement (RelyX Unicem 2 (13.17 ± 3.80) and Panavia V5 (12.95 ± 2.62)) compared to acid-based cement (Ceramir C & B (3.06 ± 1.73) and GIC Fuji I (2.91 ± 1.07) (p <0.05.). The effect of water storage as a mode of aging had a significant effect (P<0.05) on RelyX Unicem 2 and no statistically effect on the other dental cements. Dentine surfaces showed 79% of mixed failure, 16% cohesive failure and 5% complete adhesive failure with dentine. LD surfaces showed 57% mixed failure, 14% cohesive failure and 29% complete adhesive failure.

Conclusions: Within the limitation of this study, Ceramir C & B has comparable bond strength to GIC (Fuji 1), and its film thickness is within the ISO standard.

Multi-scale Synchrotron X-ray Study of Dentine Demineralisation

Nathanael Leung, University of Surrey

Objectives: Synchrotron X-ray techniques are excellent for acid demineralisation studies of dentine allowing non- destructive exploration of the lattice, nano- and microstructure of samples in bulk in relatively short experimental times and with fine spatial resolutions. To study the microstructural changes of dentine during demineralisation at sub- micron scales, advanced high-speed synchrotron X-ray microtomography (SXM) was used to conduct the first in vitro, time-resolved 3D study. To study the lattice-scale changes in the crystalline component of dentine, i.e., hydroxyapatite (HAp), combined micro- X-ray diffraction tomography (µ-XRD-CT) and scanning transmission tomography (STXM-CT) were used on dentine samples with varying degrees of artificial demineralisation, to bbe comparedwith healthy dentine and natural carious lesions.

Methods: SXM, performed on the I13-2 beamline at Diamond Light Source (DLS), was used to continuously scan dentine samples at ~0.325 µm spatial resolution and ~15 min temporal resolution, while exposed to 10%v/v lactic acid. Combined µ-XRD-CT and STXM-CT, with 2 µm resolution, were performed on the I18 beamline at DLS. 10% v/v formic acid was used to create various stages of artificially demineralised samples. XRD analysis was focussed on the (002) lattice plane of HAp crystallites, measuring d-spacing, peak intensity, and peak width to assess the changes in crystallite quality with demineralisation.

Results: From the SXM study, different demineralisation rates and profiles in intertubular (1.79 µm/min) and peritubular dentine (1.94 µm/min) were quantified. Reconstructions of µ-XRD-CT and STXM-CT showed diminishing (002) peak intensity, characterising the areas of demineralisation. Artificial demineralisation showed a steeper transition from the intact dentine and more mineral removal.

Conclusions: Here we have demonstrated the use of different Synchrotron X-ray techniques to study the structural changes across different length scales and dentine subtypes during acid demineralisation, providing high spatial and temporal resolution insights into the demineralisation mechanisms in dentine.

Biocompatibility of Silver Nanoparticles Gel as an Endodontic Intra-Canal Medicament

Ahmed Mahmoud, Egypt/Leeds

Objectives: This study aimed to evaluate the effects of a synthesized silver nanoparticles (AgNPs) gel with different concentrations as an intra-canal medicament for regenerative endodontics on viability, attachment and proliferation of dental pulp stromal cells (DPSCs).

Methods: Ninety-five standardized dentin discs (4x4x1 mm) were prepared from extracted human single-rooted teeth for periodontal reasons following institutional ethical approval. Samples were cleaned, autoclaved, and treated with: 1.5%NaOCl, Saline and 17% EDTA then randomly assigned into 5 groups that received 50μl of: 0.01%AgNPs, 0.015%AgNPs, 0.02%AgNPs, Calcium hydroxide (Ca(OH)2) or no treatment for 1 week. Discs were washed with Saline and 17%EDTA then seeded with DPSCs (1x104 cells/well) in non-treated low attachment 24-well culture plates. Seeded dentin discs were incubated for 3 and 7 days, media was collected after 24h of seeding for LDH assays and to count unattached cells. At each time point cytotoxicity (LDH assay), cell viability (live/dead staining with Confocal microscopy), and cell proliferation (WST1 assay) were assessed. Statistical analysis was done using One- Way ANOVA followed by post-hoc comparisons with Bonferroni correction.

Results: After 24 hours, DPSCs attachment percentage ranged between 92.66% ±4.54 and 95.08% ±1.44 without significant difference between groups (P=0.126). Cell viability was ≥92% at 24 hours for all groups which barely dropped to less than 60% at 3 days then started to rise again at 7 days. There was no significant difference at any- time point except for 0.01%AgNPs which had the highest cytotoxicity of 7.26% ±10.89, 40.32% ±2.92 and 32.11% ±2.55 at 24hrs, 3 and 7 days, respectively. DPSCs proliferation increased significantly from 3 to 7 days except for Ca(OH)2 which showed 45.89% ±12.12 and 79.25% ±51.68 proliferation percentage at 3 and 7 days, respectively.

Conclusions: AgNPs gel showed comparable biocompatibility to Ca(OH)2 when used as an intra-canal medicament however, its effects may be concentration-dependent warranting further investigation.

Desmoglein-3 Induces Phospho-YAP Expression and Controls Oral Cancer Cell Migration

Usama Ahmad, Queen Mary University of London

Objectives: Alterations of the Hippo-YAP pathway are potential targets for oral squamous cell carcinoma (OSCC) therapy but heterogeneity in this pathway could be responsible for therapeutic resistance. The downstream effectors of this pathway, YAP/TAZ, are overexpressed in various cancers, including OSCC. However, the upstream regulators and their role in cancer progression remain not fully understood. Recent studies have revealed that Desmoglein-3 (DSG3) can regulate YAP, but on the other hand, YAP is also found to be able to influence DSG3 expression. Nevertheless, little is known about the role of this pathway in cell motility. This study aimed to investigate the molecular signatures of the Hippo-YAP pathway in a cohort of authenticated oral cell lines of normal, dysplasia and carcinoma, and the role of YAP in the metastatic potential of OSCC cells.

Methods: The expression of a panel of the genes and proteins in the Hippo-YAP pathway was evaluated in ten authenticated oral keratinocyte lines derived from the buccal and floor of mouth, by qPCR, Western blotting, and immunofluorescence. Cell migration was monitored by Oris migration/scratch wounding assays in cells with transient YAP knockdown or stable transduction of DSG3 (hDsg3.myc), with/without mitomycin C treatment.

Results: Heterogeneity of the Hippo-YAP pathway was detected in OSCC lines, including overexpression of YAP/TAZ and the major Hippo signalling components as well as the overall loss of intercellular junctional components. YAP depletion significantly suppressed cell migration ability with concomitantly enhanced DSG3 expression. Concordantly, DSG3 overexpression inactivated YAP via induction of phospho-YAP leading to repression of collective cell migration. Thus, this study identified mutually exclusive regulation between YAP and DSG3 in OSCC cells.

Conclusions: Our findings suggest that YAP is required for efficient OSCC cell migration via suppressing DSG3, a novel key component in the Hippo pathway that controls the contact inhibition of locomotion in OSCC cells.

4NQO-Induced Oral Carcinogenesis in Wistar Rats: A Systematic Literature Review

Vivian Petersen Wagner, University, of Sheffield

Objectives: To establish a guide for best practice on the use of 4NQO-induce oral carcinogenesis model in Wistar rats by critically reviewing the available literature.

Methods: A systematic search were carried out in the Medline Ovid, PubMed, Web of Science, and Scopus databases. Only studies performed with Rattus norvegicus (Wistar), with histological assessment and results from the 4NQO group presented individually were included.

Results: Of the 2,544 studies initially filtered, 35 met all selection criteria. In 22 (62.9%) studies 4NQO was offered systemically in the animals' drinking water, at a mean concentration of 30.2 (SD±15.9) ppm, for a mean of 20.8 (SD±7.8) weeks. The other 13 (37.1%) studies used topical administration of 4NQO diluted in propylene glycol, painting the oral mucosa of the rat with the carcinogen, three times a week (100%) during 16.8 (SD±7.0) weeks. Clinical assessment was poorly described and consisted mostly of qualitative description. Histological evaluation varied, but overall epithelial hyperplasia was reported in 23 (65.7%) studies, epithelial dysplasia in 29 (82.9%), carcinoma in situ in 5 (14.3%), and invasive carcinomas in 27 (77.1%). In studies with multiple evaluation times, epithelial hyperplasia was observed between 2 and 3 weeks, dysplasia between 7 to 16 weeks, and invasive tumors with at least 8 weeks and at most 26 weeks of 4NQO administration. Two (9.1%) systemic studies and three topics (23.1%) studies achieved 100% of carcinoma incidence. In general, care with 4NQO application, preparation, adverse effects and loses were poorly reported.

Conclusions: Considering the heterogeneity of the results presented here, this review confirms the efficiency of 4NQO in inducing oral carcinogenesis at certain time intervals and dosages. Care with solution preparation and adverse effects reporting needs to be improved and standardization of clinical and histopathological results is desired

BSODR 2021
Non-prize Oral Session 7 Abstracts

The Influence of Strain Rate on Benex Vertical Tooth Extraction

Mohamed Abughalia, University of Birmingham

Objectives: To evaluate the effect of different strain rates on:
-The Maximum extraction force and its associated untoward sequelae.
-Incidence of root fracture.

Methods: Study design: Randomised Experimental Study
-The decision has been made to test four strain rates (0.1, 2.5, 5, 7.5 mm/min) based on a previously performed preliminary study.
-Sample size calculation was performed (22 teeth for each strain rate with a total of 88 teeth).
-Redcap software was used to generate the randomisation process.
-Central incisors of the lower pigs' jaws were chosen because they have single long conical roots without significant curvatures or undercuts.
-The Benex extractor was attached to the load frame of an Instron machine with 2kN load cell and the pig jaw was fixed in an adjustable grip and mounted to the lower table of the Instron machine.
-Each tooth was randomly allocated to one of the four strain rates. Axial pull-out force was applied by the Instron machine until failure of the specimen occurs either by successful extraction or by other causes such as tooth fracture or loss of screw retention.
-Failure load (maximum applied force), time required for extraction, successful or failed extraction, reason of failure and tooth length were recorded.

Results: At a strain rate of:
0.1 mm/min, the success rate was (91 %), mean Fmax=231.5N (95% CI: 198.2N-264.8N)
2.5 mm/min, the success rate was (63.6 %), mean Fmax=317.5N (95% CI: 259.2N-375.8N).
5 mm/min, the success rate was (59 %), mean Fmax=365N (95% CI: 306.7.2N- 423.6N).
7.5 mm/min, the success rate was (50 %), mean Fmax=397N (95% CI: 358.6N- 435.2N).

Conclusions: longer periods of sustained input of force (slower extraction) during the Benex vertical tooth extraction would result in a reduction in the maximum extraction force and its associated untoward effects

Sentiment Analysis of Reviews Compared to Friends and Family Test

Matthew Byrne, University of Manchester

Objectives: NHS dental practices use the Friends and Family Test (FFT) to routinely record and report patient experience. Online reviews allow dental patients a way of expressing their opinions outside of the constraints of a single question. Automatic sentiment analysis of online reviews may offer a new method by which patient rated experience may be determined, which can in turn be used to assess the quality of service in a region. This study aims to compare the outcomes of the Friends and Family Test and sentiment analysis of online reviews when assessing patient rated experience in England.

Methods: Reviews for dental practices on the NHS.uk website the period March 2019-February 2020 were analysed with the Amazon Web Services DetectSentiment API and assigned sentiment scores of positive, negative, neutral and mixed. Reviews were linked to individual practice V codes and compared against outputs of the Friends and Family Test over the same period. Analysis was performed using chi square to compare responses.

Results: Of 15650 NHS.uk online reviews 82% were positive. The FFT over the same period showed positive sentiments in 96% of cases. There was a statistically significant difference between the proportion of patient recommendations displayed in the FFT compared to online reviews ($\chi2$=5025.375 df =1 p =<0.01), with significantly fewer recommendations seen in online reviews. No statistically significant difference in sentiment was detected across the different commissioning regions of England in either FFT or NHS.uk reviews.

Conclusions: Online reviews are more likely to express negative sentiment compared to the Friends and Family Test. The information gathered by continuous assessment of the sentiment of online reviews could be utilised as a tool to measure quality from the perspective of patients and to assess the regional variation in performance of primary care dentists.

Early socioeconomic disadvantage predicts less dental care utilization in adolescence

Amira Mohamed, University of Bristol

Objectives: To assess the effect of early socioeconomic disadvantage on dental care utilization and perceived oral health in adolescence.

Methods: Secondary analysis of the Avon Longitudinal Study of Parents and Children dataset using structural equation modeling of Andersen's behavioural model of heath service utilization. Family socioeconomic disadvantage (predisposing factor) was assessed from pregnancy to 2y9m. All other variables were self-reported at 17 years. Enabling factors included dental anxiety using the Corah Dental Anxiety Scale and whether the adolescent received any advice on oral health. Perceived dental need was assessed on an ordinal scale. Regular dental care utilization assessed the time and reason for the last dental visit. Self-rated oral health was assessed on 5 point-scale (very poor, poor, fair, good, very good) as was satisfaction with oral health (not at all satisfied, reasonably satisfied, satisfied, very satisfied, fully satisfied).

Results: Data were analysed for 2468 adolescents who completed the dental questionnaire. The model showed a good fit (RMSEA=0.05, CFI=0.983, TLI=0.974, SRMR=0.29). Adolescents who experienced socioeconomic disadvantage early in life, were less likely to receive dental advice, were more dentally anxious, had higher perceived dental need and were less likely to visit the dentist regularly. Those who received previous oral health advice or were anxious were more likely to perceive their dental treatment need as high and their oral health as poor. High perceived need for dental treatment predicted less regular dental care utilization and poor perceived oral health. Regular dental care was associated with better perceived oral health.

Conclusions: The results support associations between early life influences and oral health behavior later in life. Addressing underlying social inequalities and ensuring universal access to oral health care services are potential ways to reduce oral health inequalities.

BSODR 2021
Non-prize Oral Session 8 Abstracts

The effect of bee propolis mouthwash on markers of oral health
Zoe Brookes, University of Plymouth

Objectives: Propolis is produced by honeybees, being a natural source of polyphenols and terpenoids. Recent studies have demonstrated that propolis may be antibacterial in vitro (Przybylek et al, 2019), and propolis mouthwash may have beneficial effects on biofilm formation in vivo, but more original research is needed (Halboub et al, 2020). Chlorhexidine can impact plaque formation, but not gingivitis (James et al, 2017), being a useful adjunct for managing certain oral diseases (Brookes et al, 2020). Thus this study aimed to determine whether, compared to chlorhexidine, propolis mouthwash had any further beneficial effects on markers of oral health, such as plaque and mild gingival inflammation (bleeding on probing, BOP).

Methods: This study was a randomised, controlled, double-blind trial, including healthy participants (Bescos et al, 2020), without clinical signs of oral periodontal disease (n=10), using a 7-day intervention of either propolis or chlorhexidine (0.2%) mouthwash twice daily (10 ml for 1 minute), in addition to tooth brushing with standardised toothpaste twice daily (Bescos et al, 2020). O'Leary plaque and bleeding scores were completed before and after the intervention, with no other changes to oral hygiene regimens made between visits. Patients taking antibiotics within the last 3 months and/or those using an existing mouthwash were excluded.

Results: Plaque scores reduced with use of either 7 days of chlorhexidine or propolis mouthwash. BOP also reduced with propolis mouthwash. These are preliminary data and the clinical trial will continue to include more patients, also assessing the oral microbiome and investigating patients with oral disease, including gingivitis and periodontitis.

Conclusions: This study provides some early suggestions that propolis mouthwash may be an effective adjunct to oral hygiene for controlling plaque and reducing gingival bleeding; being at least as effective as chlorhexidine for reducing biofilm formation and managing mild gingival inflammation.

Adipocytes stimulate tumour cell motility though secreted factors including adipokines
Basma H. Ali, University of Sheffield

Objectives: Oral squamous cell carcinoma (OSCC) displays high rates of metastasis to cervical lymph nodes. The mechanism of this local spread is poorly understood; in particular the role of the interaction between malignant cells and stromal adipocytes in the tumour microenvironment (TME). Adipocytes can act as a source of energy for tumour cells and also represent a reservoir of chemical signals such as adipocytokines.
The present study aims to investigate whether adipocytes can influence oral cancer cell growth and motility in vitro.

Methods: The effect of adipocyte conditioned media (ACM) from differentiated mouse 3T3-L1 cells, and the most abundant secreted adipocytokines, adiponectin (APN) and leptin (LEP), on oral cancer cell (H357 and SCC9) proliferation and migration was assessed using MTS proliferation and Transwell migration assays. The presence of adipocyte ligands and their receptors on the selected OSCC cell lines and oral cancer tissue sections was assessed using flow cytometry and immunohistochemistry.

Results: Our results show that neither ACM or adipokines (up to 100 μg/ml) significantly influenced OSCC cell proliferation. However, ACM increased cell migration (cells/field) in H357 and SCC9 cell lines by 15 and 16 fold respectively compared to the media negative control (contr., p<0.0001, n=3 for all comparisons). Adiponectin (1mg/ml) increased cell migration in H357 and SCC9 cell lines by 9 and 5 fold respectively (p<0.0095 & p<0.0446) and leptin by 7 and 5 fold respectively (p<0.0001 & p<0.0446). FACS results show that APN and LEP receptors are widely expressed on the surface of the selected cell lines. IHC results reveal a high expression of LEP receptors, while there was no expression of APN receptors on the selected OSCC tissue sections.

Conclusions: Adipocytes may therefore influence tumour cell motility by secreting factors including adipocytokines. Further investigations will examine the expression of other adipocytokines in different histological grades of oral cancer tissue and metastatic lymph nodes. Adipocytes will also be co-cultured with OSCC cell lines to mimic the TME and model the interaction between adipocytes and tumour cells.

Effects of Sphingosine-1-phosphate Receptor 2 (S1PR2) on the Behaviour of Three Oral Squamous Cell Carcinoma (OSCC) Lines

Adjabhak Wongviriya, University of Birmingham

Objectives: This study aimed to determine the effects of S1PR2 on proliferation, migration and invasion in three OSCC lines.

Methods: H357, H400 and H413 cell lines were treated with 10µM JTE013 (S1PR2 antagonist) and CYM5478 (S1PR2 agonist). Relative expression levels of S1PR1-5 genes were determined using semi-quantitative reverse transcriptase polymerase chain reaction (RT-PCR). Cell counts and the BrdU assay were used to determine cell growth and proliferation in response to treatments. Scratch-wound and transwell migration assays were used to examine the influence of the treatments on migration and invasion. Statistical analysis of the differences observed between experiments was undertaken using a one-way ANOVA.

Results: RT-PCR revealed that the three cell lines expressed all five S1PR subtypes. Inhibition of S1PR2 by JTE013 treatment caused a significant decrease in cell proliferation: the growth curves revealed an increase in the doubling time, whilst the BrdU assay also showed a decrease in the proportion of BrdU+ cells. JTE013 treatment also significantly reduced migration and decreased invasion ($p < 0.05$) in all three cell lines. In contrast, stimulation of S1PR2 by CYM5478 did not significantly increase cell proliferation and resulted in varying effects on migration, depending on the cell line and experimental assays used. H400 cells showed an increased in migration (scratch- wound assay, $p < 0.01$), whilst the transwell migration assay revealed increased migration in H357 and H413 cells ($p < 0.05$). S1PR2 stimulation increased invasion ($p < 0.01$) in all cell lines.

Conclusions: S1PR2 influences the proliferation, migration and invasion of the three OSCC cell lines, but its effects are cell-line specific. The results suggest S1PR2 as a potential target for OSCC treatment development and provide a further start point to unravel the pathways that dictate tumour proliferation, migration and invasion in OSCC. Migration variability after SP1R2 stimulation depending on assay types used suggests that tumour cell migration is multi-factorial process.

BSODR 2021
Non-prize Oral Session 9 Abstracts

Interplay of Streptococcus gordonii Adhesins in the Pathogenesis of Endocarditis

Angela Nobbs, University of Bristol

Objectives: Oral commensal bacterium Streptococcus gordonii is a causative agent of severe cardiac disease infective endocarditis (IE). These pathogenic capabilities are due, in part, to the ability of S. gordonii to bind and activate platelets, driving the formation of thrombotic vegetations on heart valves. Previous work has shown that S. gordonii surface adhesins Hsa and PadA engage platelets via integrin receptors GPIbα and GPIIbIIIa, respectively. This study aimed to better define the molecular basis of these interactions and their downstream effects.

Methods: Deletion mutants for Hsa, PadA or combinations thereof were generated by allelic exchange in Streptococcus gordonii DL1. These were compared against wild-type for capacity to modulate the behaviour of human platelets, including surface receptor expression (flow cytometry), platelet signalling (Western immunoblot), adhesion (ELISA) and thrombosis (microscopy). Alanine substitutions were made in putative integrin-binding motifs of PadA via site-directed mutagenesis. The role of these motifs in pathogenesis was investigated using a rabbit model of IE.

Results: Engagement of platelets by Hsa, but not PadA, was found to upregulate expression of platelet integrin GPVI. This occurred via both direct binding of Hsa to GPVI and an indirect mechanism via GPIbα. Enhanced GPVI expression resulted in a hyper-responsive platelet phenotype, that was exacerbated by PadA to drive thrombosis. Moreover, the importance of PadA and its integrin-binding motifs RGT, AGD and NGR to IE pathogenesis was confirmed by the severe attenuation in virulence of these mutants in vivo relative to wild-type.

Conclusions: Taken together, these studies provide further insights into how the coordinated functions of adhesins Hsa and PadA enable S. gordonii to exacerbate platelet capture, adhesion and activation to drive the thrombosis associated with IE.

The Impact of C. albicans and Sucrose on Polymicrobial Cariogenic Biofilm Development

Khulood Almansour, King's College London

Objectives: To assess the impact of C. albicans and sucrose on the cariogenic potential of polymicrobial plaque biofilm models.

Methods: Biofilms were developed using a combination of "commensal" (Streptococcus oralis, Actinomyces oris, Actinomyces viscosus) and caries-associated (Streptococcus mutans, Lactobacillus acidophilus) oral bacteria as well as the fungus Candida albicans. A selection of biofilm communities were prepared (4 bacteria (4), 5 bacteria (5L), 5 bacteria with L. acidophilus added 3rdday (5L3)) with/without C. albicans and grown on hydroxyapatite discs for 10 days, with artificial saliva (AS) ± 0.2 % sucrose. AS was changed daily days 1-5, then left day 5-10. Biomass, metabolic activity and microbial abundance were measured using crystal violet, XTT assays and qPCR respectively. To determine cariogenic activity, 5L3 biofilms ± C. albicans were grown on polished human enamel and characterized by non-contact profilometry to measure surface roughness (Sa) and Raman spectroscopy.

Results: Biofilms formed successfully on both substrates. Sucrose affected the species composition, with S. mutans and C. albicans being more abundant in biofilms with sucrose versus non-sucrose media. However, in the absence of sucrose, S. mutans was reduced in Candida-containing versus Candida-free biofilms. A. oris and A. viscosus were reduced in Candida-containing biofilms in sucrose versus non-sucrose media. S. oralis abundance was higher in Candida-containing versus Candida-free biofilms and further increased in sucrose-containing media. In all biofilms and media, there was an increase Sa of enamel. However, the 5L3 community with sucrose but without Candida resulted in significantly higher Sa. Raman spectroscopy indicated a loss of mineral content, with the greatest loss in sucrose- containing biofilms.

Conclusions: Polymicrobial biofilms created in this study formed cariogenic communities on enamel surfaces within 10 days. The presence of C. albicans and sucrose drives changes in biofilm species composition, impacting biofilm cariogenicity. Whilst sucrose increases demineralisation, C. albicans decreases it

Modulation of Oral Bacterial Metabolism by Proline

Leanne Cleaver, King's College London

Objectives: Proline has been shown previously to inhibit salivary protein degradation by oral bacteria grown in vitro as biofilms (saliva inoculated-saliva grown), but it is unclear which bacteria degrade proline and are involved in this process.
The current study aimed to identify if, and in turn which, bacteria within a defined consortium (DC) are responsible for the degradation of proline.

Methods: Eight bacterial isolates (Streptococcus gordonii, S.mutans, S.oralis, Veillonella dispar, Lactobacillus rhamnosus, Neiserria subflava, Fusobacterium nucleatum and Prevotella nigrescens) were grown, either combined (DC) or monoculture, as biofilms on hydroxyapatite discs for 7 days. Nutrient broth growth-medium was supplemented with 10mM, 25mM and 50mM proline for DC or with 10mM 13C-labelled proline for monoculture, which was refreshed at day 1 or day 4 of biofilm growth. Metabolic activity was assessed by nuclear magnetic resonance (NMR) spectroscopy.

Results: Proline concentrations were reduced in all DC biofilm samples at day 4, but did not reduce at day 7 suggesting that immature biofilms grown in nutrient-limited media will utilise proline for growth. There were significant changes in metabolites produced and used up by monoculture bacteria, with V.dispar and N.subflava displaying the greatest difference.

Conclusions: It is shown here that proline is readily metabolised by oral bacteria, but the mechanism for this still remains unknown. Further work is required to assess salivary protein degradation by bacteria in DC and monoculture, in combination with proline supplementation. This is further evidence to show proline as a prebiotic, but the health benefits are not yet determined.

BSODR 2021
Septodont Posters Abstracts

Diabetes Risk Assessment In Dental Settings: Model Development and Validation

Zehra Yonel, University of Birmingham

Objectives: To develop and externally validate a risk assessment tool for early diabetes detection in dental settings using data routinely available to dental teams, including dental risk factors.

Methods: The prediction tool was developed and validated using population-based cohort studies conducted in Northeast Germany, "Studies of Health in Pomerania" (SHIP). SHIP-TREND (n=3339) had 329 events and relevant medical and dental data for model development. An HbA1c level ≥6.0% was employed as the dependent variable, with no prior diabetes diagnosis. Missing data were multiply imputed. Variables were selected using backward elimination. Internal validation was undertaken to allow adjustment for optimism. A second independent dataset was used for external validation (SHIP-0, n=2381, 403 events).

Results: The final model included: age, sex, body mass index, smoking status, parent or sibling with diabetes, dental prosthesis, mobile teeth, history of periodontal treatment within the last 5 years and probing pocket depths ≥5mm. Pre-specified interaction terms were included in the model. After adjusting for optimism (shrinkage factor, 0.91) the final model had an AUC of 0.72 (95%CI 0.69-0.75) and calibration of 0.91. In the validation set AUC was 0.69 (95%CI 0.67-0.72), calibration was 0.91. A paper-based score was created without interaction terms for ease of use in the clinical setting with sensitivity of 0.76 and specificity of 0.53 at a threshold ≥ 22.

Conclusions: Dental variables may be utilised within a prediction tool to aid dental teams identify those at high risk of type 2 diabetes. The model's performance is comparable to the current recommended tool (Leicester risk score: AUC 0.72, sensitivity 81%, specificity 45%). However, the newly developed model is potentially more clinically acceptable as it uses data routinely available to dental teams. Further validation is required to determine the viability of using such a model on a UK population.

Optimisation of Printing Parameters to Improve Properties of 3D Printed Dental Products

Alice Parr, University of Birmingham

Objectives: To investigate the effects of post cure temperature and time on the spatial degree of conversion (DC) in specimens produced with stereolithographic (SLA) printing.

Methods: Tensile test bars (ASTM D638) were sketched using CAD software (Fusion 360, Autodesk) and printed using a photocurable resin (Clear v4, Formlab) in a SLA printer (Form2, Formlab). Specimens were post- cured with 405nm floodlight light (Form Cure, Formlab) for exposure times of 0-60 minutes and temperatures of 21°C to 60 °C. Spatial mapping of DC was assessed using a FTIR-microscope (Nicolet iN10 MX, Thermo-Scientific in attenuated total reflectance mode in 50 µm increments within the gauge length of the tensile test bar (2x2mm2) in X-Y directions. The aliphatic/amide II (isosbestic peak) peak height ratio of cured specimens was normalised against uncured materials measured on a Nicolet 6700 (Thermo-Scientific). Printed tensile test bars were tested using a universal testing machine (MTS Criterion) to calculate tensile strength and Young's Modulus at a strain rate of 1mm/min. Data was analysed using regression, Analysis of Variance and post-hoc Tukey comparisons (p=0.05). Results:

Results: Specimens post-cured for 60 minutes at 60°C showed significantly higher DC than those cured at lower temperatures and times. Spatial mapping of DC demonstrated local effects of DC relating to printing parameters (layer thickness, print direction and specimen height). Tensile strength was significantly dependent on print direction and post cure conditions (p<0.05).

Conclusions: Conclusion: Parameters affecting 3D printing quality is multifactorial and if not controlled may affect clinical and mechanical performance of 3D printed products. Printing conditions require optimisation to achieve adequate physical / mechanical properties.

Early Childhood Caries Subtype Predicts Subsequent Disease Experience

Alexander Gormley, University of Birmingham

Objectives: Early childhood caries (ECC) has heterogenous clinical presentation and recent data suggest ECC can be classified into different subtypes of disease. The study aimed to test whether ECC subtypes are associated with subsequent caries experience in Swedish children.

Methods: The study samples included Swedish children aged between 3 and 5 years at entry into the study. Dental records were retrieved from the Swedish Quality Registry for caries and periodontal disease (SKaPa) for baseline and subsequent dental visits with up to 6 years of longitudinal follow-up. ECC subtypes were assigned at the first visit using latent class modelling of tooth surface-level caries experience obtained from dental charts. Caries experience at subsequent visits was quantified using the number of decayed, missing due to caries or filled permanent tooth surfaces (i.e., the DMFS index) and was compared between ECC subtype groups using logistic and negative binomial regression models.

Results: The study included 128,616 children with 3 or more dental visits, of whom 29,091 (22.6%) had ECC at the first visit. Children with all forms of ECC had more incident disease than those who were caries-free at baseline; however, caries risk differed between ECC subtypes. At age 6, incidence rate ratios for DMFS were 12.8 for ECC subtype V (wherein posterior and anterior teeth are affected) versus no ECC, and 2.6 for ECC subtype II (wherein pits and fissures of posterior teeth are mostly affected) versus no ECC (p<0.001 for both results).

Conclusions: In this study children with all types of ECC at their first visit had high levels of incident caries in primary and permanent teeth over a 6-year period, but at different rates in the different ECC subtypes. This suggests that development of a validated classification system for ECC may help identify children at highest risk of future disease.

Error Analysis in Digital Workflow:from Scanning to 3D Printing

Pobploy Petchmedyai, Thailand/QMUL

Objectives: To analyse the error in the printed implant model fabrication process from scanning, CAD to 3D printing.

Methods: A stone model with four implant analogues with scanbodies and three reference spheres was fabricated as a master model. Six printed models were fabricated in three steps: 1). Model scanning using an intraoral scanner 2). Model design using computer-aided design (CAD) software 3). Model fabrication using a 3D printer. The master model and printed models were digitised by a coordinated measuring machine (CMM). All obtained files were imported into reverse engineering software for error analysis. The relative implant positions to the reference spheres, in terms of the angular deviations of the implant axis and orientation, as well as the linear deviations in both horizontal and vertical implant positions, were analysed and compared between step as demonstrated in Figure1.

Results: In terms of the linear deviation of horizontal implant positions, the propagation error from scanning, CAD, and 3D printing was shown in the printed model, with 3D printing being the major error source. At least two implant positions, the errors in the CAD step were significantly lower than in the other steps. In two implant positions, scanning error was significantly less than 3D printing error, while there was no significant difference when comparing 3D printing error and overall error in all implant positions. In two of four implant positions, the vertical distances between the reference sphere's centre and scanbody position in the printed model were significantly greater than in the master model.

Conclusions: 1. Printed implant model should not be used for complete-arch implant prosthesis fabrication as an accumulated error was shown in the printed implant model. 2. The definitive prosthesis adjusted based on the printed implant model could present underocclusion.

Parental acceptance of silver diamine fluoride for caries management

Laura Timms, University of Sheffield

Objectives: To discover the attitudes of parents of children with caries in their primary dentition towards the use of silver diamine fluoride (SDF) as a caries management option.

Methods: A cross-sectional questionnaire-based study was undertaken with parents of children aged between 1 and 8 years-old who had caries involving their primary dentition. The questionnaire investigated parental acceptability of SDF and attitudes towards different elements of treatment. It was designed with patient and public representatives and was self-administered.
Data collection took place in a UK dental hospital, 24/03/2021-28/04/2021. Data were analysed using simple descriptive statistics and logistic regression analysis.

Results: One hundred and thirteen parents were recruited with a response rate of 77%. Parental age range was 24- 70 years (mean=36), and child range was 1-8 years (mean=6). Families living in differing areas of deprivation were represented, with 55% living in the most deprived areas of England. The number of decayed, missing and filled primary teeth ranged from 1-16 (mean=7).
Parents were asked whether they would accept SDF for anterior teeth or posterior teeth and whether they felt the appearance of SDF was "ok with them". The levels of agreement with these statements are shown in table 1.

The only parameter that had a statistically significant effect on acceptance of SDF for posterior teeth was parents having lower concern over posterior aesthetics (p=0.006).

Conclusions: This study demonstrated parental acceptability for SDF as a caries management option, with a preference for use in posterior teeth . Some participants would accept SDF for their child despite dissatisfaction with the aesthetic result.

Funding information: Funded by RCS England Faculty of Dental Surgery and British Society of Paediatric Dentistry Pump-priming grant

Invasive Dental Treatment and Acute Vascular Events: A Systematic Review and Meta-Analysis.

Shailly Luthra, University College London

Objectives: Acute infection/inflammation is linked with increased risk of acute vascular events. Invasive dental treatments are a common cause of acute inflammation. Our aim was to critically appraise the evidence linking invasive dental treatments and acute vascular events.

Methods: Medline, Embase, CINAHL, Cochrane, Web of Sciences, SIGLE and hand search was done up to up to 30 thApril 2021, to find articles in English language only. A systematic review following PRISMA guidelines was performed. Intervention studies: randomised controlled trials (RCT), controlled clinical trials (CCT), pilot trials, and observational studies: cohort studies, case-control and cross-sectional studies which reported any acute vascular events following invasive dental treatments. Two reviewers independent extracted data and rated the quality of studies using Newcastle-Ottawa Quality Assessment Scale and the Cochrane Handbook –Rob 2.0 tool.

Results: Sixteen studies including 15 observation studies and one randomised control trial were assessed. The primary outcome was any measure of prevalence of acute vascular events including myocardial infarction, stroke, peripheral arterial disease, or death within 8 weeks from the intervention. Heterogeneous study designs and timepoint assessments influenced the number of studies used for quantitative analyses. Two out of the final 16 clinical studies examined, recruited 533,175 participants and reported 124,344 myocardial infarctions and 327,804 ischemic strokes events. Quantitative analysis confirmed that invasive dental treatment was associated with an incidence ratio of 1.02 at 1-4 weeks (p=0.722; 95% CI: 0.92, 1.13) and of 1.04 at 5-8 weeks (p=0.191; 95% CI -0.97;1.10) for combined vascular events.

Conclusions: These findings suggest that patients undergoing common invasive dental procedures do not exhibit an increased risk of acute vascular events during the first 8 weeks after treatment. Since large number of dental procedures are performed worldwide, health care systems should facilitate better integration and communication between dental and medical teams, especially in patients with multiple co-morbidities.

Fusobacterium nucleatum Subspecies Differ in Biofilm Forming Ability In Vitro

Maria Muchova, University of Birmingham

Objectives: This study aimed to evaluate mono-species biofilm formation in vitro using subspecies of Fusobacterium nucleatum, oral opportunistic pathogen associated with periodontitis. F. nucleatum acts as a bridging organism in complex subgingival biofilms. Five subspecies have been identified: animalis, fusiforme, nucleatum, polymorphum and vincentii. Differential subspecies-specific biofilm formation has been reported in multispecies biofilm models, however, formation of single-subspecies biofilms remains to be studied.

Methods: Single-subspecies biofilms were grown statically for three days on glass and plastic coverslips in multi-well plates. Coverslips were coated with agents known to promote cell attachment to culture surfaces: fibronectin, gelatin and poly-L-lysine. Additionally, untreated glass slides were modified by sandblasting (25µm grit size) to create roughened surfaces. Biomass formation was quantified using crystal violet staining. Coverslip coverage, as well as biofilm structure were analysed using fluorescence and scanning electron microscopy.

Results: Surface treatments had a differential effect on bacterial attachment and biofilm formation was determined by quantification by biofilm mass. Biofilm formation was at its lowest on sandblasted glass slides and highest with a poly- L-lysine coated surface. F. nucleatum ssp. polymorphum (ATCC 10953) consistently formed very low amounts of biofilm on all tested surfaces when compared to other subspecies.

Conclusions: Our results indicate that the ability of F. nucleatum to form single-subspecies biofilms in vitro is subspecies-specific, consistent with previous studies reporting differences in F. nucleatum integration into multispecies biofilms. Moreover, it is conceivable that not all subspecies are able to form stable single-subspecies biofilms. F. nucleatum ssp. polymorphum will be investigated further due to its limited ability to form biofilms. Understanding single-subspecies biofilm formation by F. nucleatum is important for future studies focusing on virulence and immunogenicity of biofilm-resident subspecies. This, in turn, may provide novel insights into prevention and treatment of periodontitis and associated F. nucleatum-related systemic diseases.

Synergistic Effects of Sodium Hypochlorite on SDF Treated Primary Dentine

Alexei Mogilevski, Queen Marey University of London

Objectives: To investigate the effects of a sodium hypochlorite pre-treatment on silver diamine fluoride treated primary dentine artificial lesions using Micro-CT analysis

Methods: An extracted primary tooth was mounted and cut to create an enamel and dentine block using a diamond blade. Occlusal enamel was removed to create a 2mm thick dentine disc and to expose the occlusal dentine tubules. The disc was cut again to make two smaller dentine blocks. These were covered in protective varnish exposing only a 2x2mm window of occlusal dentine. Each block was demineralised in 100 ml acetic acid (0.1M pH 4) for 24 hours at 37 degrees celsius. The control block was topically treated using SDF (Riva Star, Australia) and then remineralised for 5 days in 100ml of remineralisation solution (CaCl2, KH2PO4, NaCl, pH 7) at 37 degrees celsius. The test block was pre-treated using sodium hypochlorite (5%) for 1 minute followed by identical topical SDF application and remineralisation for 5 days. Micro-CT analysis was undertaken at baseline, after demineralisation, and after remineralisation for both blocks.

Results: Micro-CT analysis revealed significant differences in the characteristics of silver compound between the test pre-treated hypochlorite and control blocks. For the control block, a distinct deposition of silver was present at the base of the artificial lesion with significant penetration of silver throughout the whole thickness of the block. Whereas, for the test block, a considerably thicker surface layer of silver compounds. Furthermore, silver deposition up to 200 microns below the artificial lesion base was seen, but there was no further penetration of silver deeper into the block.

Conclusions: There has been concern that SDF can penetrate through the entire thickness of dentine into the pulp of primary teeth. This study shows that a sodium hypochlorite pre-treatment could add safety factor to reduce the penetration of silver deeper towards the pulp. Furthermore, a thicker surface silver layer and an increased deposition of silver compounds in the sub-lesion zone may provide improved clinical cariostatic properties with less safety concerns.

Is Periodontitis a risk factor for Gestational Diabetes Mellitus? A Systematic Review and Meta-Analysis of Cross-sectional and Prospective Studies

Syed Hussain, University College London

Objectives: The nature of the association between periodontitis (PD) and gestational diabetes mellitus (GDM) is still unclear. The aim of this review was to systematically appraise the evidence linking PD and GDM.

Methods: Six databases (PubMed, Google Scholar, Embase, Cinhl, Scopus and CENTRAL) were searched up to February 2021. Observational (cross-sectional and prospective) studies including pregnant women without baseline GDM and diagnosis of periodontitis were included in the review. Risk of bias and publication bias was assessed through the Newcastle-Ottawa Scale. Our primary outcome was the likelihood of PD pregnant women to develop GDM. Secondly, we compared periodontal measures from GDM and non-GDM patients. Random effects meta- analysis of odds ratio (OR) and of ratio of means (ROM) were performed.

Results: Searches resulted in 12 studies and eight case-control and four prospective studies met our eligibility criteria. High degree of variability of case definitions of GDM and PD were reported in all studies. Analysis of 2344 pregnant women (including 1601 without GDM and 743 with GDM) confirmed that diagnosis of PD during the first trimester was associated with doubled odds of developing GDM during the last two trimesters (OR=2.41, 95% CI=0.95 to 3.03, p<0.001, I2=50%). Further GDM was associated with worse clinical periodontal parameters including periodontal probing pocket depth (ROM of 1.10, 95% CI 1.03-1.16), clinical attachment level (ROM 1.15, 95% CI 1.04-1.31), and bleeding on probing (ROM 1.24, 95% CI 1.08-1.42).

Conclusions: PD diagnosis during the first trimester of pregnancy increases the odds of development of GDM. Conversely GDM is associated with poor periodontal health status during pregnancy.

Effectiveness of a Bioactive glass with Strontium for acid-induced demineralization

Syeda Ambreen Zehra, Queen Marey University of London

Objectives Various novel materials and agents have been investigated in the in-vitro environment to evaluate their effectiveness prior to clinical evaluation. The aim of this in-vitro study was to evaluate the effectiveness of strontium Bioglass to inhibit acid induced demineralization through Immersion study and XRD analysis.

Methods: BG in the system (SiO –P O –CaO–SrO–Na O) were prepared using a melt–quench route. 100% of Ca 225 2 was replaced by strontium on a molar basis in order to maintain the structure of the silicate glass matrix. Tris buffer (pH 7.3) and Acetic acid (pH 4.5) were used for the immersion studies at different time points (1h, 2h, 4h, 6h, 8h, 24h, 1 wk) and analysed through pH study and XRD analysis.

Results: BG was immersed in 0.1M Acetic acid (pH 4.5) for specific time periods (1h, 2h, 4h, 6h, 8h, 24h, 1wk). A pronounced rise in the pH has been observed for one week which was 5.45 pH. A rise in the pH is an indicator of strontium and fluorapatite formation which was confirmed through XRD analysis.

Conclusions: The observed results revealed that Strontium Bioglass is effective to inhibit acid induced demineralization. Strontium can be used as a marker to differentiate between the apatite formation formed by the breakdown of the Bioactiveglass and the other factors in the process of remineralization of the tooth.

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Abstracts

Paediatric dentistry specialty training: oral medicine and the medically-compromised child

Philip Atkin, Cardiff University

Objectives: In adult dentistry, medically-compromised patients or those with orofacial disease are cared for by specialists in oral medicine (OM) and special care dentistry. Paediatric dentists care for these child patients and therefore need appropriate training described in the curricula from the UK General Dental Council and the Specialty Advisory Committee. Prevalence of congenital and chronic disease in children is increasing and future specialists therefore need an understanding of health, disease and OM. This study of paediatric dentist specialty trainees aimed to determine if current teaching and assessment was fulfilling these needs.

Methods: A survey was distributed to UK and Ireland specialty trainees to gain opinion on whether knowledge gained prior to entering training, and teaching & learning during training equipped them for management of medically- compromised children and those with OM conditions.

Results: There was a response rate of 51%. Most were aware of the curriculum elements for medically-compromised children and OM, and the linked teaching and assessments. The majority felt that knowledge and experience gained as undergraduates and early graduates was insufficient and recognised the need for these topics in speciality training. Teaching and learning included specialist-clinic attendance (e.g.: OM), lectures/seminars, and postgraduate degrees in paediatric dentistry. For medically-compromised children, 96% of trainees felt this learning was considered a good use of time, and 88% felt this topic should be given more attention. For OM 96% of trainees considered this learning a good use of time, and 69% felt this topic should be given more attention.

Conclusions: Trainees recognise that knowledge and experience of managing medically-compromised patients and those with OM conditions is an important part of their curricula, and these areas need greater emphasis, especially in light of changing demographics with congenital and acquired chronic disease, oral manifestations of systemic disease and the presentation of children with OM conditions.

Effectiveness of a Bioactive glass with Strontium for acid-induced demineralization

Fidaa Wazwaz, King's College London

Objectives: The aim of this study was to predict the activity of human salivary proteases during the alignment stage of orthodontic treatment with fixed appliances using naturally occurring peptides in the saliva of orthodontic patients.

Methods: Unstimulated whole saliva was collected from five orthodontic patients. Samples were collected before fixed appliance placement (T1), 1 hour (T2) and 1 week (T3) following appliance placement, and completion of alignment (T4). Naturally occurring peptides in the saliva were extracted using 10 kDa centrifugal filters. Peptides were identified by mass spectrometry. Protease prediction was carried out using Proteasix in silico with the identified peptides. Gelatin zymography and ELISA (enzyme-linked immunosorbent assay) were performed to assess proteolytic activity.

Results: An association between orthodontic treatment and the number of degraded peptides was observed. The number of peptides significantly increased at T2 and T3, then returned to baseline levels at T4. In total, 78 proteases revealed some predicted activity. A comparison of T1 to T2, T3 and T4 showed significant changes in predicted protease activity. More predicted protease activity of different matrix metalloproteinases, cathepsins and others was observed at T2 and T3 when compared to T1 and T4.

Conclusions: The results of this study suggest that orthodontic treatment causes changes in predicted proteases and proteolytic activity and hence these proteases may play a major role as potential biomarkers for fixed appliance orthodontic treatment. However, this should be further validated in studies with larger numbers of patients.

Compositional changes in organic matrix of dentin by post-sequential irrigation

Jukka Matinlinna, Hong Kong University

Objectives: Preparation of dentin prior to treatment involves irrigating the tissue with sequential use of proteolytic (sodium hypochlorite) and chelating agent (ethylenediaminetetraacetic acid). These chemicals affect the dentin matrix composed of organic collagen fibers and inorganic components, and alter the dentin ultrastructure and its properties. The aim is to analyze the compositional changes within dentin after treatment with saline, NaOCl, and EDTA, using FTIR, polarized light, and electron diffraction spectroscopies.

Methods: Dentin blocks (n = 24, 4mm x 3mm x 2mm) were obtained from freshly extracted third molars and divided into 4 groups based on irrigants used: saline (group 1), NaOCl (15min), group 2, NaOCl-EDTA (15-2-min), group ,3 and NaOCl-EDTA-NaOCl (15-2-2-min), group 4. Half of the specimen from each group were demineralized, stained with picrosirius, and observed under polarized light microscope (PLM). The mineralized samples were analyzed using FTIR and EDS spectroscopy. Atomic-weight-% of carbon and nitrogen obtained were statistically analyzed using one- way-ANOVA (P=0.05).

Results: Under PLM, the network of organized collagen fibers is seen (group 1). There is a change in organization of these fibers in groups 2 and 3. Group 3 shows thinning of fibers. The intensity of the pixels was higher in group 1 and 4 with presence of red, blue, and green channels. Groups 2 and 3 had lower peak levels, with diminished blue channel in group 3, suggesting loss of components. This was confirmed using FTIR, where group 2 and 4, have no amide III peak. Group 2 had significantly lesser C and N percentage compared with group 1.

Conclusions: Different changes take place in the organic matrix of the dentin with the sequential use of saline, NaOCl, and EDTA.

How do Ti Based Nanoparticles Alter Chemoattractant Properties of Chemokines?

Joanna Batt, University of Birmingham

Objectives: This study aimed to determine the effects of Ti based nanoparticles on known chemoattractant chemokines. It is known that implanted Ti devices produce wear particles within tissues of varying sizes and compositions, from nanoscale upwards. When present in tissues adjacent to implanted Ti devices, such as dental implants, these particles may affect immune or inflammatory responses occurring in response to the presence of bacterial biofilms or other inflammatory stimuli. The hypothesis is that the presence of Ti species within tissues can affect the inflammatory response within tissues by binding to and inactivating key chemokines in the inflammatory and immune response.

Methods: Freshly isolated neutrophils from healthy volunteers were exposed to a panel of chemoattractant chemokines (e.g. CXCL8) in the presence and absence of a variety of Ti (e.g. anatsase, rutile, mixed) based nanoparticles at differing concentrations. The chemotaxis velocity and directionality of neutrophils was measured.

Results: The chemoattractant properties of CXCL8 are negatively affected in a dose dependent manner by the presence of TiO_2 nanoparticles in anatase form. The parameters measured were speed, velocity and chemotactic index.

Conclusions: The presence of Ti species within tissues has the potential to adversely affect the chemoattractant properties of important chemokines. Further research to characterise the nature of these interactions is required and other potential Ti product – chemokine interactions, as the potential impact on the progression of inflammatory conditions such as peri-implantitis may be clinically important.

2D Texture Mapping of Dental Enamel Effected by MMP-20 Mutation

Asmaa Harfoush, University of Leeds

Objectives: To map enamel ultrastructure including crystallographic texture and orientation, and density of a tooth affected by hypomature Amelogenesis Imperfecta (AI) with known MMP-20 mutation. Our aim is to correlate the quality and quantity of enamel tissue to the mode of inheritance of AI to better inform diagnosis and bespoke treatment regimens.

Methods: An MMP20-affected permanent canine tooth and its corresponding control were scanned intact by a high resolution micro computed tomography (μ-CT) for quantification of mineral density and identification of regions within the tooth where the mutation has most affected enamel structure. Teeth were then cut to obtain 360 μm buccolingual sections to be scanned by synchrotron X-ray diffraction (SXRD) at XMaS beamline at the European Synchrotron Radiation Facility. 2D diffraction images were azimuthally integrated along the 002 plane; subsequently peak fitting was performed, and contour maps for texture analysis for the whole crown were generated via Mofit software. Quantification of enamel mineral density was carried out within specified region of interests using Fiji.

Results: MMP20-affected enamel presented lower mineral density of 1.66 g/cm3 compared to 2.31 g/cm3 in healthy control tooth. Contour texture maps revealed two population of crystallites in both specimens, with angular separation ∘of 35 . SXRD analysis of enamel texture showed that population 1 had the predominant contribution with a clear difference in texture magnitude between the AI affected tooth and healthy enamel, where MMP-20 affected enamel showed generalized lower texture across enamel thickness with the most affected regions being at the buccal part of the cusp and the cervical region. Whereas population 2 showed higher texture comparable to healthy enamel.

Conclusions: MMP-20 is a critical protein for proper crystallite organization across the bulk of the enamel. Its mutation leads to significant decrease in mineral density that can be correlated to decreased crystallite texture.

In Vivo Evaluation of Cotton-Wool-Like Bioactive Glasses for Bone Regeneration

Soher Jayash, University of Birmingham

Objectives: Histomorphometric and microCT investigation of the effect of cotton-wool-like bioactive glasses (Biowool) on bone healing in rat tibial defects.

Methods: Biowool was synthesised using a combination of sol-gel process with electro-spinning technique. In this investigation, 27 rats were used and randomly distributed into 3 groups: Biowool group (Group I), Bioglass® group (Group II) and control group (Group III, bone defect without treatment). Three animals from each group was euthanized at 2, 6 and 12 weeks post-surgery. Bone healing was evaluated histologically using H and E staining and radiographically using micro-CT and scanning electron microscopy (SEM).

Results: At 2 weeks, new trabecular bone was present in groups I and II in histological and radiographical images and some areas presented a loosely arranged connective tissue with inter-fibre spaces in histological images. At 6th week, histological and micro-CT results showed more bone formation with linear cortical bone but still some remaining large medullary spaces in groups I and II, however, histological images of group I showed remarkable presence of blood vessels in the central area of the bone morrow. At 12th week, histological and radiographical results revealed complete cortical bone formation in groups I and II but with large medullar spaces in particular for group II. The amount of bone formed in the group III in histological and micro-CT images was similar to those observed in groups I and II.

Conclusions: The cotton-wool-like bioactive glass induced bone formation similar to Bioglass®, with evidence for mature blood vessel formation. Thus, the cotton-wool-like bioactive glasses could promote tissue repair when used as bone graft in tooth extraction sockets.

The Impact of Intensive Exercise on Saliva – A Systematic Review and Meta-Analysis

Hesham Matabdin, University College London

Objectives: The mechanisms that explain dental erosion in athletes remain unclear. We assessed effects of physical training on salivary parameters as a potential mechanism of dental erosion.

Methods: The systematic review was performed following the PRISMA guidelines. A systematic search was conducted in the following databases: Medline (Ovid) Scopus, Web of Science, Sportsdiscus and grey literature using MeSH terms up to January 2021. One researcher individually selected the studies according to the eligibility criteria (athletes, physical activity, salivary parameters) and performed data extraction and methodological evaluation. Secondary screening was performed by two additional researchers to assess included studies. A random effects model was adopted in the meta-analysis. Certainty of the evidence was assessed using the GRADE approach. The outcomes assessed were the salivary parameters: saliva flow rate, salivary IgA concentration, saliva total protein (STP) content, salivary α-amylase and salivary mucins in individuals after periods of intense exercise.

Results: The inter examiner agreement at full-text screening was excellent (kappa score = 0.72). Thirty-one studies were included in the systematic review of which fifteen studies were included in the meta-analyses. Eight studies were considered as low risk of bias, seventeen moderate risk and two studies were at high risk of bias. The results of the meta-analysis indicated that there was no statistically significant effect of intense physical activity on saliva flow rate (effect size: -0.01) (p=0.88), salivary IgA (effect size: -12.93) (p=0.14), STP (effect size: -596.81) (p=0.30), salivary α- amylase (effect size: 12.68) (p=0.12) and salivary mucins (effect size: 0.73) (0.44) with extremely high heterogeneity (>70%). However, the certainty of the evidence obtained by GRADE for all outcomes was very low.

Conclusions: Intense exercise was not related to alterations in the salivary parameters which were hypothesised to cause dental erosion in athletes. However, we observed high heterogeneity and substantial risk of bias

Use of Stabilization Splints by Croatian Dental Practitioners

Samir Cimic, Croatia

Objectives: There are few treatment options for treating symptoms of temporomandibular disorders and also for bruxism. Occlusal stabilization splints are most frequently used. The purpose of present study was to determine Croatian dental practitioners' knowledge and attitudes about stabilization splint therapy.

Methods: An online questionnaire was sent (using e-mail) to a Croatian dentists' database. Questionnaire had 22 questions that aimed to specify Croatian dentists' knowledge, attitudes and practice with occlusal and stabilization splints therapy.

Results: A total of 296 dentists filled out the questionnaire. The two most common indications for occlusal splint therapy were bruxism (79.5%) and pain or disfunction of the temporomandibular joint (41%). Most of participants (49.4%) are using both soft and hard (acrylic) splints, 29.6% are using onlyacrylic splints, 15.8% are using only soft splints, while 5.3% is not certain about used occlusal splint material. Over 65% of participants responded that they do not know what is stabilization splint or that are not sufficiently informed about it. Still, 89.3% of participants recommend stabilization splints to their patients.

Conclusions: Most frequent indication for occlusal splint therapy among Croatian dentist was bruxism. As most participants considered that they are insufficiently informed about stabilization splits there is a need for motivation and additional education about occlusal splint indications and therapy.

Mathematical model for polymerising bisGMA/TEGDMA resins with different initiators

Madeline Jun-Yu Yon, Hong/Kong Birmingham

Objectives: To seek a mathematical model that can fit experimental data of degree of conversion (DC) bisGMA/TEGDMA resins with various photoinitiators and concentrations undergoing photopolymerisation.

Methods: Six bisGMA/TEGDMA resins at equal weight ratios were prepared with camphorquinone (CQ)/(dimethylamino)ethyl methacrylate (DMAEMA) photoinitiator system at a constant 1:4 weight ratio. CQ content was 0.1, 0.2, 0.4 and 0.8wt% in four of the groups; the fifth group contained 0.2wt% CQ and additionally 0.51wt% of diphenyliodonium hexafluorophosphate (DPI) as a co-initiator; the last group was a negative control (no photoinitiator). Samples were prepared (n=3) for each group in moulds (Ø6mm×3mm), irradiated for 20 seconds with an LED light source (Elipar S10, 3M ESPE) and analysed real time by Attenuated Total Reflectance-Fourier Transform near Infra- Red spectroscopy (ATR-FTIR). DC was calculated from spectral data. Data were fitted using two sigmoidal mathematical models (logistic function and Hill sigmoid equations) and goodness of fit was analysed by comparing $R2$ (Python 3.8; MATLAB R2021a, MathWorks, Inc., Natick, Massachusetts, United States). Results were displayed graphically.

Results: Resins with increasing photoinitiator content showed a gradual pattern in DC during the course of photopolymerisation. When DPI was incorporated, DC increased at nearly ten-folds the rate in the initial 3 seconds and reached a higher DC of over 80% compared with other resins. Regarding mathematical modelling, Hill sigmoid equation can fit DC data better at $R2 > 0.995$ regardless of photoinitiator type and content, whereas logistic function can only fit DC data containing CQ/DMAEMA only.

Conclusions: A narrow range of photoinitiator content optimises resin photopolymerisation in terms of polymerisation rate and DC. When a suitable co-initiator was present, the reaction follows a different trajectory with greatly accelerated conversion and higher DC within the duration of irradiation. Hill sigmoid model seems suitable in fitting various DC of bisGMA/TEGDMA with different initiator systems.

Studying the Effect of Curing Time on the Properties of 3D Printed Denture Base Material

Ahmed Altarazi, University of Manchester

Objectives: This study aims to evaluate the effect of post-curing time on the mechanical and physical properties of 3D printed denture base specimens.

Methods: 45 samples were printed using NextDent resin material in a Formlabs printer and divided into 3 groups with either 20 min, 30 min, or 50 min post-curing times. Flexural strength, and surface hardness, of the printed specimens were characterised.

Results: The mean values of flexural strength (± SD) were recorded as 48.24 ± 4.99 MPa, 56.62 ±3.87, and 56.79 ± 3.88 MPa for 20 min, 30 min, and 50 min curing time respectively. On the other hand, the mean values of surface hardness (± SD) were measured as 10.74 ± 0.88 Kg/mm2, 12.99 ± 1.13 Kg/mm2, and 12.83 ± 1.04 Kg/mm2 for 20 min, 30 min, and 50 min respectively. The results indicated that after 30 mins of curing time, the hardness and flexural strength of the specimens did not change significantly. However, a significant improvement in the flexural strength and a slight improvement in the surface hardness were found when the curing time was increased from 20 min to 30 min. The water sorption results will be added once the experiment is finished.

Conclusions: It can be concluded that 30 min post-curing should be considered as the minimum time needed to fully cure the specimens and any further curing would be irrelevant. This was in line with the recommendations from the material manufacturer.

Analysing Early Wear Lesions On Curved Surfaces Using Novel Methods

Sagar Jadeja, King's College London

Objectives: This study aimed to use novel surface registration methods to detect wear ranging from 1-8 microns on a curved natural enamel surface

Methods: Human buccal enamel samples (n=60) were embedded in acrylic resin and randomly assigned to being polished or natural curved surfaces (n=30). Baseline scans of both surfaces were captured with a non-contact laser profilometer and then they were exposed to 0.3% citric acid (pH 2.7), abrasion (30 linear strokes with 290-295g load) or a combination of erosion and abrasion. Sequential scans were superimposed followed by surface subtraction and residual data used to create step heights.

Results: For the polished samples the mean step heights (SD) after 4 cycles of erosion was 3.08(0.4)µm, 0.26(0.29)µm for abrasion and 4.08(0.37) for the combination. On the natural surface 1.52(0.22)µm, 0.14(0.04)µm and 3.62(0.39)µm respectively. There were significant differences between the groups for erosion at each time point (p<0.001) and after cycle 4 of erosion and abrasion (p=0.016).

Conclusions: Combining superimposition with subtraction analysis measured step height on natural curved surfaces in the order of a few microns.

Regeneration of Palatal Cleft-Like Surgical Defects in Rabbits Using Poly (glycerol sebacate) Elastomer Scaffold

Ayat Abdullah , Egypt

Objectives: To evaluate the bone regenerative capacity of a load-transducing elastomeric scaffold-Poly (glycerol sebacate) (PGS) - in surgically created cleft-like palatal defects in New Zealand white rabbits.

Methods: In phase Iof the study,three different defect dimensions were evaluatedradiographically and histologically immediate post-operatively and after two weeks(n=7). The optimal defect dimensions of 5x2.5x4mm3 with intact nasal mucosa were maintained in phase II, to compare between the sham (n=5) and PGS (n=6) groups after 4 and 8 weeks usingCBCT, histological and histomorphometric analyses.

Results: At 8 weeks,both CBCT and histomorphometric assessmentsshowed that the remaining defect dimensions in PGS group significantly decreased than the sham group. This indicated bone resorption in the sham defects opposite to longer term remodeling and bone regeneration in the PGS group. The PGS group showed significantly higher bone density (and mean bone fill% (than the sham group ((these values increasedin PGS defects from 4 to 8 weeks,they decreased for the sham group demonstratingprogressive bone resorption. Histologically, PGS defectsshowed almost closure of the defect and preservation of the external contourat 8 weeks withhigher recruitment of mesenchymal progenitorcellsand significantly higher number of blood vessels. The PGS group also showed more tissue organization of the suture area.

Conclusions: 5x2.5x4mm3surgically created palatal defects in rabbitspreserved vital structures and maintained a reliable defect size that did not heal after two weeks. To our knowledge, this is the first study to incorporate PGS –an elastomer and load-transducing scaffold- in the maxillofacial region where development, growth and remodelingare highly influenced by occlusal forces and the load on the craniofacial bones. .Being similar in stiffness to developmental osteoid tissue, PGS could trigger the recruitment of osteoprogenitor cells and direct their commitment stimulating osteogenesis. PGS also preserved external contour and sutures which are all critical keys in cleft palate management.