TITLE: N-terminal Serine Phosphorylation Not Required For Statherin Enamel Demineralisation Inhibition

AUTHORS/INSTITUTIONS: P. Anderson, R. Hill, R. Lynch, R. TRIPATHI, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Statherin is a 43 residue salivary protein with cariostatic functionality which binds to enamel as part of the enamel pellicle. Statherin is also involved in preventing calcification within the oral environment, as saliva is supersaturated with respect to hydroxyapatite (HAP). The effective concentration of free calcium ions in saliva is reduced as statherin, which has a pSXE Ca^{2+}-binding motif at its N-terminal, binds to calcium ions. It is statherin's N-terminal region which binds to HAP.

Amelogenin (evolutionarily related to statherin) is also a Ca^{2+}-binding protein of approximately 170 residues, involved in amelogenesis. It too has a pSXE Ca^{2+}-binding domain also near its N-terminal. However, the HAP binding region of amelogenin is at its C-terminal. The amino acid sequence of the HAP binding C-terminal sequence of amelogenin is almost a mirror image of that of the HAP binding N-terminal sequence of statherin. Studies using knock-out mice where there is no post-translation phosphorylation of the serine residue demonstrate that serine phosphorylation is required for amelogenin function.

The aim was to investigate if phosphorylation of the N-terminal serines of statherin is needed for its cariostatic function.

Methods: Statherin containing either phosphorylated (pSXE) or un-phosphorylated (SXE) serine residues at the N-terminals were synthesised using FMOC chemistry. Enamel model system HAP discs were treated with either pSXE or SXE (20.0 µmol/L) statherin by immersion for 24h. Both were then demineralised at pH=4.0 at 37°C for periods of 1h and the rate of calcium release (used as a proxy for mineral loss) was monitored continually using calcium ion-selective electrodes.

Results: HAP discs with treated with pSXE and SXE statherin inhibited demineralisation by 31.0(±5.1)% and 49.1(±3.1)% respectively. SXE statherin-treated HAP demineralised slower than pSXE statherin-treated HAP.

Conclusions: Phosphorylation of N-terminal serine is not required for statherin's cariostatic function. This is because its calcium binding is associated with its supersaturation function rather than its demineralisation inhibition function.

CONTROL ID: 3906799

TITLE: Mechanical and Topographical Changes on Dentine Following Citric Acid Exposure

AUTHORS/INSTITUTIONS: B. Murchie, F. Mullan, Restorative, Newcastle School of Dental Sciences, Newcastle Upon Tyne, UNITED KINGDOM|P. Waterhouse, Paediatrics, Newcastle School of Dental Sciences, Newcastle Upon Tyne, UNITED KINGDOM|M. German, Dental Materials, Newcastle School of Dental Sciences, Newcastle Upon Tyne, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: 1. To determine the effects of short-term exposure of dentine to different concentrations and pH of citric acid;

2. To determine the stiffness and topographical changes associated with dentine erosion.

Methods: Bovine incisors were prepared into 20 dentine discs (5mm^3) and polished with 0.05µm Al_2O_3 paste. Erosion was measured in terms of topographical and stiffness changes using atomic force microscope (AFM, Nanowizard 3, JPK Instruments).

Specimens were exposed via the AFM liquid flow-cell to 1wt% or 6wt% citric acid, either unbuffered (pH 2.17 or 1.88, respectively) or buffered (pH 3.8) for repeated 20s cycles of citric acid up-to 120s. Baseline measured in PBS only. A representative sample was selected from each group for post-erosion scanning electron microscope (SEM) assessment.

Results: Table 1 outlines stiffness results and AFM topography images demonstrate all groups post-erosion. The 1% buffered group had the least measurable changes across all time intervals and the 6% unbuffered citric acid had the greatest overall impact on the surface. The 6% buffered acid was more erosive compared with the 1% unbuffered acid, in terms of both stiffness and topography changes, between 20s and 80s exposures. However, the 1% unbuffered group had similar erosive surface changes, as for the 6% buffered samples, with increasing exposure times at 100s onwards. SEM and AFM topography showed a similar loss of peri-tubular dentine with enlargement of the tubules. AFM also demonstrated increased surface height variations with increasing exposure times and similar erosive trends to mechanical stiffness changes.

Conclusions: The data shows that citric acid concentration is more critical to early erosive changes on dentine compared with a lower pH, demonstrated by stiffness elasticity reduction and structural changes. The 1% buffered group was the least erosive acid, compared with the 6% unbuffered solution which had the greatest surface changes. These AFM findings were supported by SEM data.

CONTROL ID: 3907286
TITLE: Dental Surgical Activity in Hospitals: a Nationwide Observational Cohort Study

AUTHORS/INSTITUTIONS: A. Booth, Dental Public Health and Primary Care, Barts & The London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|A. Booth, R. Witton, Peninsula Dental School, University of Plymouth, Plymouth, UNITED KINGDOM|A. Fowler, Y. Wan, R. Pearse, T. Abbott, Critical Care and Perioperative Medicine Research Group, William Harvey Research Institute, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The number of surgical extractions performing in hospitals in England remains unclear. This study reports the volume of surgical extractions conducted in hospitals and change in activity during the COVID-19 pandemic.

Methods: We conducted a nationwide observational cohort study using Hospital Episode Statistics (HES) in England for patients undergoing surgical removal of a tooth (defined using OPSC-4 code F09) between April 1st 2015 and December 31st 2020. Procedures were stratified by age, gender and urgency (elective or non-elective), reported using descriptive statistics, number and percentage. We conducted post-hoc modelling to predict surgical activity to January 2023. In addition, we contrast this with aggregate national data on simple dental extraction procedures and drainage of dental abscesses in hospital as well as dental activity in general practice.

Results: We identified a total of 569,938 episodes for the surgical removal of a tooth (Females 57%). Of these, 493,056/569,938 (87%) were for adults and 76,882/569,938 (13%) children ≤18 years. Surgical extractions were most frequent in adult females. Elective cases accounted for 96% (n=548,805/569,938) of procedures. The median number of procedures carried out per quarter was 27,256 dropping to 12,003 during the COVID-19 pandemic, representing a 56% reduction in activity. This amounted to around 61,058 cancelled procedures. Modelling predicts that this activity has not returned to pre-pandemic levels.

Conclusions: The number of surgical extractions taking place in hospital during the pandemic fell by 56%. The true impact of this reduction is unknown but delayed treatment increases the risk of complications including life-threatening infections.

CONTROL ID: 3929815
TITLE: Fate Decisions During Minipig Tooth Replacement

AUTHORS/INSTITUTIONS: J. Chan, J. Fons Romero, A. Tucker, Centre for Craniofacial and Regenerative Biology, Floor 27 Tower Wing, Guy's Hospital, King's College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Understanding fate decisions is an essential goal in developmental biology with important ramifications for tissue regeneration and repair and our understanding of disease. Every cell in a body receives and provides cues to its neighbours allowing initially similar cells to embark on unique pathways. Here we have investigated the decisions that determine whether a replacement tooth forms or not by a comparison of the development of the dental lamina in the minipig. The minipig like humans has two sets of teeth a deciduous and permanent set. The deep dental lamina, which forms a tooth, was compared to the interdental lamina which does not form a tooth.

Methods: The dental lamina from different parts of the jaw were dissected from embryonic minipig embryos and processed for bulk RNAseq. Bioinformatic techniques, such as DESeq2, were then used to compare gene expression patterns in the two laminas. The gene expressions of the output were validated using publicly available datasets on Eurexpress, Allen Brain and Genepaint with respect to mouse molar development. Work on minipig embryos was organised through a collaboration with researchers in the Czech Republic with ethical approval provided by Masaryk University.

Results: The results of the analysis showed a total of 10 differentially expressed genes including 2 undefined genes. One of the candidates, MTHFD2L, was expressed in the tip of the epithelium of the molar placode.

Conclusions: Molars are formed by serial addition whereby a single placode forms all three molars by budding of the dental lamina at the posterior of the jaw. This system of additional molar formation shares many characteristics with tooth replacement, highlighting this gene as a good candidate to focus on for future experiments.

TITLE: Socioeconomic Position and Dental Pain in 12-Year-Olds in Wales, UK

AUTHORS/INSTITUTIONS: E. Barnes, A.L. Cope, I.G. Chestnutt, Cardiff University, Cardiff, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To explore the association between area-level socioeconomic position and incidence of dental pain and pain-related school absence amongst a cohort of 12-year-old children in Wales, UK.

Methods: During the 2016/17 academic year, one in four children in year 7 (12-years-olds) in each state secondary school in Wales were randomly selected to undergo a clinical examination and to complete a short impact questionnaire which collected information about (1) dental pain or discomfort and (2) days off school due to pain or discomfort in the mouth in the last week. BASCD diagnostic criteria was used to calculate DMFT (decayed, missing, and filled teeth) and PUFA (pulpal involvement, ulceration, fistula, and abscess) scores were for each child. The child's home postcode was cross referenced with Welsh Impact of Multiple Deprivation 2014 (WIMD) to determine area-level socioeconomic ranking.

Results: Data were gathered from 5,775 children, with a mean age of 12.1 years. Mean DMFT was 0.58, with 1,654 (29%) participants having a DMFT >0 (mean score = 2). 102 participants (1.8%) displayed evidence of one or more of the PUFA conditions. 92.3% had visited a dentist within the last year. In the previous week, 11.6% of children reported experiencing dental pain, and 1.6% had missed school because of pain. DMFT >0, last dental visit, PUFA, and WIMD quartile were significantly associated with dental pain ($p<0.05$). Only recency of dental visit was significantly associated with days of school missed due to pain. Multi-level modelling will be used to further explore the interaction of these variables and the specific domains of deprivation in more detail.

Conclusions: Understanding the incidence and impact of oral health conditions across the socio-economic spectrum can help us with the planning of urgent dental care services.

CONTROL ID: 3931198

TITLE: Case-Finding Cardiovascular Risk in a Dental School with Integrated Care

AUTHORS/INSTITUTIONS: A.S. Doble, Z. Brookes, R. Witton, R. Bescos, R. Ayres, University of Plymouth, Plymouth, UNITED KINGDOM|S. Shivji, Office of the Chief Dental Officer, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: An estimated 4.8 million adults in the UK may have undiagnosed hypertension, presenting a higher risk of major cardiovascular events. The dental team could play a role in finding cases of undiagnosed hypertension and high cardiovascular risk, and thus the aim of this pilot study was to detect incidences of hypertension, hypercholesterolaemia, and hyperglycaemia and provide an integrated model of care by referring appropriately to the GP for management.

Methods: We have previously established and integrated a hypertension clinic at the University of Plymouth; therefore, the aim of this current study was to amplify recruitment and assess the incidence of cardiovascular risk factors in our specific population. Patients (n=139, >40 years/old) were recruited. Participants were invited to a 'health case finding' clinic, separate from dental treatment, Systolic (SBP) and diastolic (DBP) blood pressures, atrial fibrillation, BMI, cholesterol, glucose, and Qrisk were assessed and participants were referred to the GP, and provided with information for self-referral to local services, when high values of blood pressure (SBP >140mmHg; DPB >90mmHg), high cholesterol (>5mmol/L) and/or high glucose (>7mmol/L) were found.

Results: The return rate was 69.4%. All participants were screened for blood pressure, and we detected 25 (17.9%) with undiagnosed hypertension, 17 (12.2%) with uncontrolled hypertension, and 37 (26.6%) with a pre-hypertensive result. Of the undiagnosed hypertensive individuals, 4 were confirmed by their GP. Of the participants who underwent cholesterol assessment, 21 (29.6%) were referred to their GP for hypercholesterolaemia, and 1 was confirmed by their GP. Of the participants who underwent glucose assessment, 3 (13.6%) were referred to their GP for hyperglycaemia and 100% awaiting follow-up.

Conclusions: 17.1% of participants with undiagnosed hypertension exceeds previous UK estimates, and our pathway of integrated care was able to provide confirmed diagnosis and medical intervention. Peninsula Dental School was successful in detecting individuals with high cardiovascular risk.

TITLE: Type your abstract in the box below or copy-and-paste into the box from your word-processing program

AUTHORS/INSTITUTIONS: V. Ravaghi, School of Dentistry, University of Birmingham, Birmingham, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Please do not include title, authors, or references in the text you enter into the Abstract Body fields below. Abstracts should be 300 words or less and the program will inform you if you have exceeded the maximum space allotment.

Provide a clear description of the materials to be presented. Abstracts are required to have an Objective(s), Method(s), Result(s), and Conclusion(s) section.

Type your abstract in the box below or copy-and-paste into the box from your word-processing program. The text will wrap automatically to fit.

Methods: ABSTRACT TITLE:

Abstract titles are limited to 10 words or less. The title should be dynamic and conclusive, rather than descriptive, and should be entered in title case format, AP format. In general, you should capitalize the first letter of each word unless it is a preposition or article. Do italicize scientific names of organisms such as streptococci or candida. Titles should not be bold. (example: Using Capital Letters and Lowercase Letters in Titles

Results: ABSTRACT TITLE:

Abstract titles are limited to 10 words or less. The title should be dynamic and conclusive, rather than descriptive, and should be entered in title case format, AP format. In general, you should capitalize the first letter of each word unless it is a preposition or article. Do italicize scientific names of organisms such as streptococci or candida. Titles should not be bold. (example: Using Capital Letters and Lowercase Letters in Titles

Conclusions: Abstract titles are limited to 10 words or less. The title should be dynamic and conclusive, rather than descriptive, and should be entered in title case format, AP format. In general, you should capitalize the first letter of each word unless it is a preposition or article. Do italicize scientific names of organisms such as streptococci or candida. Titles should not be bold. (example: Using Capital Letters and Lowercase Letters in Titles

CONTROL ID: 3931738
TITLE: Single-cell atlas of the oral cavity reveals its scarless potential.

AUTHORS/INSTITUTIONS: D. Pereira, A. Mavros, I. Sequeira, Institute of Dentistry, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|K. Annusver, M. Kasper, Department of Cell and Molecular Biology, Karolinska Institutet, Stockholm, SWEDEN|T. Kirk, E. O'Toole, E. Rognoni, Centre for Cell Biology and Cutaneous Research, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Adult skin wounds are frequently accompanied by scarring and the development of more efficient skin wound treatments is an urgent need. A fascinating and unique property of oral mucosa is that it rarely scars in response to wound healing, yet the mechanisms of scarless healing and fibroblast heterogeneity are yet to be revealed. The current project aims to enhance skin wound healing by disclosing oral mucosal fibroblast regenerative potential.

Methods: Analysis of several timepoints of murine tongue wound healing by immunofluorescence using markers of inflammation, proliferation and tissue remodelling revealed oral wound healing dynamics. (2) Multimodal approach including single-cell RNA-sequencing (scRNA-seq), RNAScope, and in vitro assays to highlight the different fibroblast subpopulations of different regions of the oral mucosa compared to skin and investigate the mechanisms by which the oral mucosal wounds heal in an accelerated and scarless fashion.

Results: Mouse tongue wounds showed fast healing resolution. Our in vitro assays show a significant increase in oral fibroblast proliferation, migration and less contraction capacity compared to skin fibroblasts. Furthermore, analysis of scRNA-seq of oral neonatal and juvenile tissues revealed the heterogeneous distribution of fibroblast subpopulations between different oral tissues, and its developmental trajectory. Interestingly, integration of oral fibroblasts with skin fibroblasts gene expression datasets revealed that the oral tissues lack the most skin-like pro-fibrotic fibroblasts. Lastly, RNAscope technique allowed us to disclose the spatial distribution of oral fibroblast subpopulations, validating the scRNA-seq results.

Conclusions: Our study has characterised the heterogeneity of fibroblasts between the different tissues of the oral cavity and identified oral fibroblast subpopulations that hold higher regenerative capacity compared to skin fibroblasts.

CONTROL ID: 3931938
TITLE: Probing Antimicrobial Effects Through 3-Dimensional Tracking Of Bacteria Motility

AUTHORS/INSTITUTIONS: E. Ison, M. Alexander, School of Pharmacy, University of Nottingham, Nottingham, UNITED KINGDOM|E. Ison, P. Williams, School of Life Sciences, University of Nottingham, Nottingham, UNITED KINGDOM|R. Howlin, R. Hawkins, D. Bradshaw, Haleon, Weybridge, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Digital holographic microscopy (DHM) is a powerful tool allowing 3-dimensional probing of bacterial motility. Interrogation of motility may correlate with membrane perturbation by antimicrobial agents since the membrane is required for proton motive force, powering flagellar rotation. Chlorhexidine digluconate (CHX), a commonly used mouthwash antimicrobial, perturbs membrane integrity through binding to lipid bilayer head groups, leading to disruption of the cytoplasmic membrane and leakage of cellular components. Here we sought to understand the differential effects of CHX applied in solution or via surface adsorption on the motility of model organism, Pseudomonas aeruginosa, and to correlate these observations with membrane perturbation assays.

Methods: DHM imaging was used to probe bacterial trajectories using a 685nm laser taking 1000 frames at 56Hz (18 s observation), with surface adsorbed conditions being imaged intermittently over 1 hour, where chamber walls had been immersed in 0.02% (w/v) CHX for 2 min. For solution treated cells, 0.02% (w/v) was applied for 2 min prior to imaging for 18s. Confinement ratios were calculated from 3D reconstruction of tracks. For membrane integrity assays, P. aeruginosa made bioluminescent by tagging with lux genes was used. A plate reader allowed quantification of changes in bioluminescence upon the addition of a range of CHX concentrations.

Results: Tracks of CHX-treated cells showed visible sharp turns without any portions a straight trajectory which corresponded with a lower confinement ratio. The proportion of bacteria displaying paths that could be best described as oscillating increased over time with exposure to the CHX-treated surface. These findings can be correlated with membrane damage observed by the reduction in bioluminescence over time.

Conclusions: Therefore, we suggest CHX induced membrane damage impacts bacterial motility, likely contributing to its antibiofilm properties and clinical efficacy.

CONTROL ID: 3931956

TITLE: Impact of Tray Adhesive on Alginate Impression Accuracy

AUTHORS/INSTITUTIONS: E.E. Negm, M. Patel, Centre for Oral Bioengineering, Queen Mary University of London, London, UNITED KINGDOM|E.E. Negm, Prosthodontics Department, Tanta University, Tanta, EGYPT|P. Ryan, Centre for Oral Immunobiology and Regenerative Medicine, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To investigate the effect of tray adhesive on the dimensional accuracy of partially edentulous alginate impressions at different time points: A 3D-surface analysis.

Methods: Ten alginate (Hydrogum) impressions (Maxillary Kennedy class II) were undertaken using custom trays and randomly assigned into two groups; group I (no tray adhesive, n=5) and group II (with tray adhesive, n=5). Impressions were scanned at T0, immediately; T24, after 24 hours; T48, after 48 hours; T120, after 120 hours, and stored in sealed Zip-lock bags. Stereolithographic (STL) files of the impressions were superimposed on the reference cast STL using 3D-surface analysis software. Colour maps were used to quantify deviations from the reference cast in four areas. Two-way ANOVA with Tukey correction was used to compare mean deviations across all areas and time points.

Results:

Colour mapping demonstrated palatal expansion and shrinkage in edentulous areas in both groups as storage time increased. The lowest mean deviation value was observed in the total area at T0 in group II (15±4 µm). At all storage intervals, both groups displayed non-significant negative palatal deviations. Adhesive group had a higher mean palatal deviation than non-adhesive group (-57±16 µm). The free-end saddle showed significant deviations between the groups at T0 and T120. A significant deviation was observed at T0 in the bounded saddle (p<0.05).

Conclusions: Tray adhesive significantly affects dimensional accuracy, with the palatal area showing the greatest variation. All evaluated areas showed decreasing impression accuracy as storage time increased, with T0 having the highest accuracy.

CONTROL ID: 3932027
TITLE: Effects of Smoking on Oral Health and Oral Nitrate Reduction

AUTHORS/INSTITUTIONS: T.L. Nicholas, A.S. Doble, R. Witton, Z. Brookes, Peninsula Dental School, University of Plymouth, Plymouth, UNITED KINGDOM|R. Bescos, L. du Toit, School of Health Professions, University of Plymouth, Plymouth, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Oral nitrate-reducing bacteria can reduce salivary nitrate into nitrite; this pathway increases nitric oxide availability, which may have beneficial effects on oral and systemic health. Previous literature suggests that cigarette smoke creates an anaerobic oral environment, ideal for nitrate-reducing bacteria. Cigarette smoke has been shown to inhibit enzymatic activity in saliva, but it is unclear if this is translational to nitrate-reductase activity. This pilot study therefore, aimed to investigate the activity of nitrate-reducing bacteria in the oral cavity of smokers compared with non-smokers.

Methods: Participants were recruited from Peninsula Dental Social Enterprise (PDSE) and were grouped into smokers (n=9) and non-smokers (n=19), with exclusion criteria applied to remove major confounding factors. Saliva, nitrate rinse samples and oral health data were collected from each participant via primary care student dental clinics. Biochemical techniques were used to analyse salivary nitrate, nitrite, ammonia, lactate, glucose, buffering capacity and pH and nitrate-reducing activity in mouth rinses.

Results: Preliminary data demonstrated lower salivary pH in smokers compared with non-smokers (p=0.003) in addition to lower buffering capacity (p=0.019). Nitrite was higher in the saliva of non-smokers compared with smokers (p=0.039), but the oral nitrate-reducing capacity was higher in smokers (p=0.015). Salivary nitrite was also higher in those with a gingival bleeding score of less than 20% (p=0.038). Further, there were differences in the pH and nitrite levels between participants with periodontal disease, versus those without (p<0.05).

Conclusions: These analyses demonstrated that smoking decreases salivary pH and has a deleterious effect on salivary buffering capacity, in addition to lower salivary nitrite availability. Lower bleeding scores associated with higher salivary nitrite also supported literature proposing that nitrate reduction may be associated with oral health. Interestingly however, the oral nitrate reducing capacity, was found to be higher in smokers, which was not expected and therefore requires further research into the mechanism involved.

CONTROL ID: 3932228
TITLE: In-vitro Model for Investigating Oxidative-Stress Impact on Orthodontic Tooth Movement

AUTHORS/INSTITUTIONS: S. Hosseini, U. Baumert, A. Wichelhaus, M. Janjic Rankovic, Department of Orthodontics and Dentofacial Orthopedics, University Hospital, LMU Munich, Goethestrasse 70, 80336 Munich, Germany, Munich, GERMANY|

ABSTRACT BODY:

Objectives: In recent years, there is a growing number of adult orthodontic patients with periodontal disease, and its progression is well linked to oxidative stress as in many other inflammatory disorders. However, the impact of oxidative stress on orthodontic tooth movement (OTM) is not fully clarified. Therefore, the goal of this study was to introduce an oxidative-stress in-vitro model utilsing H_2O_2 to investigate molecular events on the compression and tension side during OTM. Herein, we focused on monitoring cell viability and proliferation to identify suitable experimental parameters.

Methods: Human periodontal cells (hPDLCs) were stimulated with H_2O_2 concentrations ranging from 20µM to 500µM; 50µM was identified as the lowest concentration showing a cytotoxic effect without affecting cell viability. To simulate the effect of OTM on oxidative-stress compromised cells, hPDLCs were cultured with or without 50µM H_2O_2 for 24h, followed by mechanical stimulation using either compression ($2g/cm^2$) or tension force (10%) for further 24h. Cells cultured for 48h without any stimulation but otherwise treated identical served as controls. Cell viability was determined using a Live/Dead Viability/Cytotoxicity kit. Cell proliferation and cytotoxicity was assessed using alamarBlue.

Results: We found that stimulation with H_2O_2, followed by mechanical stimulation with static or tensile strain did not affect cell viability. A slight decrease in cell proliferation was observed when comparing the cells subjected to compression force to the control group. This was independent to the pretreatment with H_2O_2. This is in line with observations from previous studies applying in vitro compressive force simulating OTM. This is explained as a proliferation stagnation due to contact inhibition induced by the weight that is placed above the cell monolayer.

Conclusions: The in-vitro model presented herein, does not impose potential destructive effects on the cells, making it suitable for investigating the effect of oxidative stress during OTM.

CONTROL ID: 3932802

TITLE:

Comparison Between the Enamel Surfaces During Multi-Factorial Erosive Tooth Wear

AUTHORS/INSTITUTIONS: L. Almejrad, D. Bartlett, Kings Coolage London, London, UNITED KINGDOM|R. Austin, King's College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To investigate erosion & attrition enamel wear according to location (buccal vs. occlusal)

Methods: Sixteen polished human enamel samples (8 occlusal/8 buccal). Three 1.5 mm areas per sample were subjected to erosion, attrition, and erosion/attrition. To simulate erosion, two exposed areas were immersed in 0.3%, pH 3.8 citric acid solution for 5 min, and one erosion area then underwent attrition. Erosion/attrition (and attrition-only) areas were then exposed to 200 cycles of 80 N attrition using ceramic antagonist (ElectroForce 3300 wear simulator). Lesions were measured using profilometry (step height enamel loss), digital microscopy (surface roughness), and Vickers microhardness at two loads (0.1 N for superficial (<5 µm) subsurface integrity and 0.5 N to assess deeper (>5 µm) enamel).

Results: Attrition-alone resulted in no differences for mean (SD) enamel loss in both buccal (26.3±1.2 µm) vs. occlusal surfaces (26.1±4.5 µm) similarly for Sa roughness. A similar picture resulted from erosion: buccal loss of 1.8±0.1 µm vs. 1.7±1.1µm for occlusal loss. Erosion/attrition resulted in an intermediate level of enamel damage and no statistical differences between groups. The 0.5 N microhardness testing of the three lesion types resulting in no differences buccal vs. occlusal (P>0.9999). Whilst the 0.5N hardness testing revealed a similar pattern to profilometry and roughness: attrition resulted in the greatest (64-65%) hardness reduction for both buccal vs.occlusal surfaces, whereas erosion caused the least (6.6%) hardness reduction and erosion/attrition resulting intermediate hardness reduction in both groups. However, the addition of 0.1 N microhardness testing revealed that in the superficial <5 µm enamel, there were statistically increased enamel hardness reductions in the occlusal enamel: (18% for erosion and 41% for erosion/attrition) vs. buccal (7% and 20% respectively) (P<0.001).

Conclusions:

The enamel sample location did not affect the enamel step height loss or roughness changes.

CONTROL ID: 3932949
TITLE: Ion-substituted glass phase of glass-ionomer cements with potential antibacterial properties

AUTHORS/INSTITUTIONS: J. Makanjuola, S. Deb, Centre for Oral, Clinical & Translational Sciences, Faculty of Dentistry, Oral & Craniofacial Sciences, King's College London, London, UNITED KINGDOM|S. Banerji, Unit of Distance Learning, Faculty of Dentistry, Oral & Craniofacial Sciences, King's College London, London, UNITED KINGDOM|R. Hill, Dental Physical Sciences, Centre for Oral Bioengineering, Dental Institute, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To develop a novel glass-ionomer cement (GIC) using a glass phase by ionically substituting strontium with a combination of magnesium and zinc to enhance the physical properties and confer potential antibacterial activity.

Methods: Strontium-based alumino-fluorosilicate glass (LG99Sr) was synthesized using glass precursors at molar ratios, $4.5SiO_2$-$3Al_2O_3$-$1.5P_2O_5$-$3SrF_2$-$2SrO$ by conventional melt-quench technique. An equivalent novel experimental glass powder, LG99Sr-Mg-Zn, with a composition $4.5SiO_2$-$3Al_2O_3$-$1.5P_2O_5$-$3SrF_2$-$0.5SrO$-$1MgO$-$0.5ZnO$, was synthesized and GICs prepared with these formulations using Fuji IX GP (GC Corporation, Tokyo, Japan) as control. The glasses were characterized using X-ray diffraction, Fourier Transform Infrared spectroscopy, scanning electron microscopy and energy dispersive X-ray spectroscopy. Fluoride release, compressive strength (CS), flexural strength (FS) and Vickers microhardness number (VHN) of the GICs were determined in accordance with ISO-specifications at 24 h,1 and 3 months stored in distilled water at 37°C. Results were analysed statistically using two-way ANOVA and Tukey's post-hoc tests at significance level of 0.05.

Results: CS, FS and VHN values of the different GIC groups tested at 24 h showed no significant differences (p>0.05), however, each group exhibited a significant increase in values post maturation. CS of Fuji IX was significantly higher than CS of LG99Sr (p=0.0042) while FS and VHN of Fuji IX and LG99Sr-Mg-Zn groups were significantly higher than that of LG99Sr after 1 month ageing (p<0.05). After 3 months ageing, the VHN of Fuji IX and LG99Sr-Mg-Zn groups remained significantly higher than that of LG99Sr (p<0.05) while CS and FS were similar in the 3 groups (p>0.05). All GIC groups had similar fluoride release patterns with LG99Sr-Mg-Zn displaying higher release during the first and second week of the test period.

Conclusions: Ionic substitution of strontium alumino-fluorosilicate glass with magnesium and zinc did not compromise mechanical properties and improved fluoride release. This new cement could serve as a potential restorative material after antibacterial activity is determined.

CONTROL ID: 3933269

TITLE: Remote Measurement of Trismus Using Mobile Phones – Reliability and Validity

AUTHORS/INSTITUTIONS: X. Li, A.T. Kroeger, T. Dietrich, Department of Oral Surgery, School of Dentistry, Institute of Clinical Sciences, College of Medical and Dental Sciences, University of Birmingham, Birmingham, UNITED KINGDOM|C. Kristunas, G. Landini, School of Dentistry, Institute of Clinical Sciences, College of Medical and Dental Sciences, University of Birmingham, Birmingham, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To evaluate the reliability and validity of a novel method for remotely measuring trismus.

Methods: We propose a novel method to remotely measure trismus in clinical studies. The reliability and validity of variations of this method were assessed using the Intraclass Correlation Coefficient (ICC) and the limits of agreement (LoA), respectively. We recruited 60 volunteers who took three types of photographs at a fixed restricted jaw position mimicking limited mouth opening, including one selfie and one portrait with or without a reference frame. Additionally, the interincisal distance and the width of the upper central incisors were measured with a ruler, as per common practice. Measurements of photographs were made using ImageJ software, using different calibration methods, including direct calibration using an ImageJ macro on photos with the reference frame (M1), calibration using incisor width from photographic or clinical measurements, using portrait photos (M2 and M3) or selfies (M4 and M5, respectively). STATA software was used to assess the reliability of the gold standard (M1) and to compare the 95% limits of agreement with 95% confidence interval between proposed methods.

Results: M1 showed extremely high reliability (ICC: 0.998, 95% CI: 0.997, 0.999). Compared to the gold standard, conventional ruler measurements were 1.7mm higher (mean difference: -1.7, 95% CI -2.1, -1.4, LoA: -5.32, 95% CI: -5.94, -4.70 to 1.87, 95% CI: 1.25, 2.49). Direct calibration of remotely taken portrait photos showed no systematic error and the narrowest LoA (Table). Measurements on selfies showed somewhat wider LoAs and calibration using clinical measurements of incisor width introduced a systematic error.

Conclusions: Remotely evaluating trismus can be reliably achieved using photographs provided by patients. Use of a reference frame and the use of portraits rather than selfies can maximise the accuracy of measurements.

CONTROL ID: 3933384
TITLE: High-pressure mercury intrusion for BSE-SEM and XMT histology.
AUTHORS/INSTITUTIONS: A. Boyde, D. Mills, DPSU, QMUL, London, UNITED KINGDOM|
ABSTRACT BODY:

Objectives: Mercury intrusion under very high pressures is used to study the distributions of dimensions of pores in permeable solids. We noted that archival calcified tissue samples which had been tested to 750 bar were permanently stained, had therefore retained mercury, and decided to investigate whether this could be a valuable morphological space stain for studies with backscattered electron imaging in scanning electron microscopy (BSE-SEM) and X-ray microtomography (XMT).

Methods: Samples included human and rat teeth, African elephant tusk, and freeze-dried developing bovine teeth. Porosimetry tested samples were embedded in poly-methyl-methacrylate. Blocks were cut and polished for imaging, uncoated, with 20kV BSE-SEM and 90kV XMT.

Results: Unmineralized space compartments were brought into great prominence in all tissues. In cementum, mercury filled non-mineralised cores of Sharpey fibres as well as cementocyte lacunae and canaliculi. Dentine tubules were extremely marked and often showed an astonishing number of fine side branches at a size just below the resolution limit of conventional optical microscopy: their continuity across the enamel dentine junction with enamel tubules and spindles was clearly shown. Interglobular dentine zones were heavily impregnated. Imaging the mercury revealed detailed information concerning the tubule curvature (odontoblast movement) patterns responsible for the wonderful chequer board arrangement in elephant ivory. In enamel, prism boundary discontinuities ('sheaths') were prominent in the known hypomineralisation tracts - tufts and lamellae - but also in developmental hypomaturation regions in MIH and 'white spot' caries. In rat incisor, defect non-mineralised zones were seen in innermost enamel.

Conclusions: Hg staining is a useful method. Because of the extreme high density and signal levels from mercury, both XMT and BSE-SEM demonstrate its presence at below their normal spatial resolution limits giving rise to apparently higher resolution.

CONTROL ID: 3933574

TITLE: The Oral Healthcare Teams Role in Early Identification of Diabetes

AUTHORS/INSTITUTIONS: Z. Yonel, I. Chapple, T. Dietrich, University of Birmingham, Birmingham, UNITED KINGDOM|L. Gray, University of Leicester, Leicester, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Diabetes represents a growing health and economic burden with 22-million undiagnosed cases in Europe. Oral Healthcare professionals (OHPs) access patients who have not attended GP services in the previous 12-months, providing an opportunity to identify undiagnosed cases, especially in periodontitis patients, a known risk-group for type-2 diabetes.

The objectives of this study were to:

Determine the proportion diabetes cases presenting within NHS dental settings.

Evaluate the performance of 2 validated diabetes detection tools in dental settings.

Understand the barriers/facilitators of utilising OHPs to identify diabetes.

Methods: 13 NHS general dental practices recruited patients >40 years-of-age without known diabetes diagnosis. 750 patients recruited across England answered two validated risk-questionnaires and underwent point-of-care HbA1c testing. Those at high-risk were given brief preventative advice and advised to attend their GP. Semi-structured interviews were undertaken with a purposive sample of patients. Focus groups with practice staff were undertaken using pre-determined topic guides, recorded, transcribed verbatim and thematic analysis used to identify codes, themes and interpret findings.

Results: Please see tables.

Conclusions: OHPs can identify patients at high-risk of diabetes and with undiagnosed diabetes. Patient support is positive and dental teams find it a valuable addition to their job role. Principal barriers are time and resources.

CONTROL ID: 3933923

TITLE: Development of protein-based matrices for enamel regeneration

AUTHORS/INSTITUTIONS: S. Gamea, E. Radvar, S. kundi, S. Horamee, S. Hadadi, S. Elsharkawy, Centre for Oral, Clinical, and Translational Sciences, Faculty of Dentistry, Oral & Craniofacial Sciences, King's College London, London, UNITED KINGDOM|S. Gamea, Department of Restorative Dentistry, Faculty of Dentistry, Tanta University, Tanta, EGYPT|D. Athanasiadou, Department of Physics, Chalmers University of Technology, Gothenburg, SWEDEN|D. Athanasiadou, K. Carneiro, Faculty of Dentistry, University of Toronto, Toronto, Ontario, CANADA|R. Lee Chan, K. Carneiro, Institute of Biomedical Engineering, University of Toronto, Toronto, Ontario, CANADA|K. Chan, Institute of Pharmaceutical Science, King's College London, London, UNITED KINGDOM|N. Pugno, Laboratory for Bioinspired, Bionic, Nano, Meta, Materials & Mechanics, Department of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, ITALY|N. Pugno, School of Engineering and Materials Science, Queen Mary University of London, London, UNITED KINGDOM|P. Sharpe, Centre for Craniofacial and Regenerative Biology, Faculty of Dentistry, King's College London, London, UNITED KINGDOM|S. Elsharkawy, Restorative Dentistry, Dental Directorate, Guy's and St Thomas' NHS Trust, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Intrinsically disordered proteins are generally considered one of the most promising methods for the prevention and repair of damaged biological hard tissues. They are known to play a role in mineralization as they contribute to the intermolecular interactions at the protein–mineral interface. Our aim is to develop biomimetic approaches utilizing keratin-based platforms and investigate their disorder-order interplay to create hierarchical functional systems of outstanding mechanical properties for hard tissue regeneration.

Methods: Keratin-based membranes were developed with and without crosslinking and their biomimetic potential were tested by exposing them to a supersaturated hydroxyapatite solution. The chemistry of the mineralized structures was studied with FTIR-imaging and MAS-NMR. The keratin supramolecular assembly was also investigated before and after mineralization using SEM, AFM, HR-TEM, and SAED. Moreover, the remineralization potential of these membranes on artificially induced enamel lesions were explored by analyzing the structural integrity of these lesions using grayscale analysis, SEM, and microhardness testing.

Results: In this study, we demonstrated that keratin can self-assemble into a network of micro/nano-fibrillar structures and organic birefringent spherulitic structures. These organic spherulites adopt ordered β-sheets that acted as templates to nucleate mineral ions, forming organized nanocrystals, which had crystallographic diffraction patterns of hydroxyapatite and fluorapatite. Upon investigating keratin-treated artificially induced enamel white spot lesions, not only enhancement in the structural integrity of the lesions could be detected, but also improvements in the microhardness have been reported and were comparable to natural enamel.

Conclusions: Our results show that keratin-based membranes acted as templates for biomimetic mineralization, were able to reverse enamel white spot lesions, and exhibited excellent recovery for the mechanical properties of the native tissues. We believe that this study represents a promising yet simple approach for developing novel protein-based matrices from a naturally abundant protein source, that can open accessible opportunities for hard-tissue regeneration.

CONTROL ID: 3934134
TITLE:
Characterisation of Hybrid P11-4/HA Coating on Ti Surface Implant

AUTHORS/INSTITUTIONS: D.G. Abdelfattah, R. El-Gendy, R.P. Davies, Division of Oral Biology,Faculty of Dentistry, University of Leeds, Leeds, UNITED KINGDOM|D.G. Abdelfattah, Dental Biomaterials, Faculty of Dentistry,Beni suef University, Beni suef, EGYPT|R. El-Gendy, Oral Pathology, Faculty of Dentistry, Suez Canal University, Ismailia, EGYPT|R.P. Davies, Bragg Centre for Materials Research, University of Leeds, Leeds, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Optimizing osteointegration of implant surfaces is a viable strategy to substantially improve efficacy of implants especially in challenging cases such as osteoporosis. Here a hybrid coating was developed for Ti implant surfaces, using self-assembling peptide (SAP) P11-4 in combination with hydroxyapatite (HA) to improve osseointegration around the implant surface under osteoporotic conditions.

Methods: Treated Ti disks were divided into; G1 control group, G2 Electrodeposited HA layer, G3 Dip coated P11-4, G4 coated with P11-4 (10mg/ml), G5 coated with P11-4 (30 mg/ml), and G6 P11-4(30mg/ml) sublimed on previously electrodeposited HA layer. The physicochemical properties of all groups were investigated via Fourier transform infrared spectroscopy (FTIR) and X-ray Diffraction (XRD). Scanning electron microscopy with energy dispersive X-ray spectrometer (SEM/EDX) was used to investigate surface morphology and Ca/P ratio of HA and hybrid P11-4/HA coatings.

Results: FTIR peaks found around 1625cm-1 and 1682cm-1 are indicative of β-sheet, indicating the SAP was rich in β-sheet in all coatings, the highest amount was found inG5 and G6., and the least in G3 and G4. XRD supported presence of β-sheet in all P11-4 coated samples. EDX revealed HA phase with Ca/P ratio 1.76 in hybrid and electrodeposited HA coatings. Under SEM, G2 showed a needle-like structure of HA, while in G6 showed a huge difference in the crystal morphology with shorter crystals and flatter edges. G4 and G5 displayed a characteristic lamination of SAP with uniformity in the latter. SEM images showed non-homogenous covering of the surface in G3.

Conclusions: P11-4 was deposited effectively, providing a templated heterogeneous nucleation site for HA. Incorporation of P11-4 onto electrodeposited HA maintains the correct peptide secondary structure. Our hypothesis is that the hierarchical structures β-sheet formed by P11-4 are intrinsically attracted to the Ca ions in the HA, increasing persistence of the fibrils.

CONTROL ID: 3934333

TITLE: Nitrate Affects Taste by Changing the Oral Metabolome

AUTHORS/INSTITUTIONS: S. ZHANG, F. Clasen, S. Shoaie, G. Carpenter, Centre for Host-Microbiome Interactions, Faculty of Dental, Oral & Craniofacial Sciences, King's College London, London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Measure the change of taste before, during and after nitrate supplementation.

Methods: 13 healthy volunteers were assessed for taste using visual analogue scales (VAS) in response to 9 different tastants, before, during and after a 5-day dietary nitrate supplement. Saliva was collected each day for ammonia, nitrate and nitrite assays, NMR and shotgun analysis of oral microbiota. During treatment, saliva was collected 2-6 hours after the supplement intake to optimize the salivary entero route affecting the oral microbiome. Friedman, Two-way ANOVA, Paired-t, Wilcoxon, Correlation and PCA tests were used for analysis.

Results: During nitrate treatment, there was increased ($P<0.001$, 0.41 ± 0.61 to 3.47 ± 2.36 micromolar per minute) salivary nitrate but no change ($P=0.063$) in salivary nitrite. All subjects had increased Neisseria species compared to before treatment. Results from the sensory data divided the volunteers into two groups: responders (who taste changed, N=7, $P<0.05$) and non-responders (N=6, $P>0.05$). NMR and shotgun analysis of oral microbiota indicated that responders and non-responders had different characteristics. Decreased salivary propionate ($P<0.05$, 0.34 ± 0.11 to 0.14 ± 0.10 mM) and formate ($P<0.05$, 0.18 ± 0.21 to 0.040 ± 0.06 mM) only occurred in the responder group. Whereas the non-responders had increased Capnocytophaga gingivalis abundance ($P<0.05$) during the nitrate treatment. Correlation analysis suggests Capnocytophaga gingivalis had a strong positive relationship with Neisseria flavescens in the non-responders ($r= 0.76$, $P<0.01$). For nitrogen metabolism, urea had a negative relationship with ammonia in the responder group ($r=-0.70$, $P<0.01$) while non-responders did not show any tendency ($P=0.70$).

Conclusions: Nitrate supplements in the salivary entero cycle induced change in nitrate-reducing bacteria in all subjects, despite no change in nitrite. Half the participants showed a change in taste accompanied by decreased propionate and formate. And a subtle change between urea and ammonia, both nitrogenous compound equilibria. Capnocytophaga gingivalis may limit the conversion from ammonia to urea in non-responders and within responders an underlying mechanism may exist which limits the growth of Capnocytophaga gingivalis. In conclusion, nitrate alters the oral metabolome and thereby tastes.

CONTROL ID: 3934747

TITLE: Characterisation of Biomaterials for Enamel Remineralisation using X-ray Nanoprobe Techniques

AUTHORS/INSTITUTIONS: R. Gonnah, R.P. Davies, M. Al-Jawad, Oral Biology (School of Dentistry), University of Leeds, Leeds, UNITED KINGDOM|R. Gonnah, J. Parker, Diamond Light Source, Didcot, Oxfordshire, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: A self-assembling peptide (P11-4) has demonstrated efficacy in nucleating hydroxyapatite. Despite its successful translation into the clinic, its mechanism is yet to be elucidated. Here, synchrotron nanoprobe X-ray microscopy is used to study the nucleation on deposited fibrils of P11-4 at the micro- and nanoscale to elucidate the peptide's mechanistic role in dental enamel remineralisation.

Methods: Various methodologies were used to deposit P11-4 on silicon nitride (SiN) windows (n=3 per method). The conformation of P11-4 was probed by Fourier-transform infrared (FTIR) spectroscopy to determine which method deposited the highest proportion of beta-sheets by analysing the amide I region. The morphology of the deposited structures was determined by transmission electron microscopy. After peptide deposition, the SiN windows were immersed in mineralising solution at various time points. FTIR was used to confirm P11-4's presence on the windows after immersion in mineralising solution. The mineralised fibrils were mapped using nano X-ray fluorescence (n-XRF) and diffraction (n-XRD) at Beamline I14 (Diamond Light Source, UK). Elemental calcium and phosphorous maps (up to 50 nanometres resolution) were extracted.

Results: A robust protocol for the deposition of peptide materials on SiN windows (for subsequent characterisation) has been established. Insights on P11-4's ability to nucleate as a function of time were obtained by XRF. The distribution (figure 1) and quantity of calcium and phosphate deposited on the windows with and without P11-4 could be extracted from the data. The calcium and phosphorus content increased as a function of time in mineralising solution in the presence of P11-4.

Conclusions: X-ray nanoprobe techniques can be used to extract valuable information on the role of soft biomaterials on dental enamel remineralisation at different length scales with the aim of elucidating their mechanism and kinetics of action for optimisation and improved treatment strategies of dental caries. SiN windows can be used as a surface for material deposition to be characterised for dental applications.

CONTROL ID: 3934951
TITLE: Diversity And Expression Of Nitrate Reductase Genes In Oral Biofilms

AUTHORS/INSTITUTIONS: R. Hawkins, M. Curtis, W. Wade, King's College London, London, UNITED KINGDOM|R. Hawkins, D. Bradshaw, J. Pratten, Haleon, Weybridge, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Dietary supplementation with nitrate has been shown to increase the relative abundance of nitrate-reducing bacteria in saliva. The objective of this study was to explore the diversity of nitrate-reducing oral bacteria in an in-vitro oral biofilm model and to investigate the expression of nitrate reductase genes in response to nitrate supplementation.

Methods: Degenerate PCR primers were designed and validated for the nitrate reductase narG genes in bacteria from the phyla Pseudomonadota, Actinomycetota and Bacillota. The diversity of narG genes in oral biofilms generated using the Calgary Biofilm Device from saliva inocula was determined. Genus-specific qPCR primers were designed for narG genes in Neisseria, Rothia, Veillonella and Actinomyces. The effect of treatment with 10 mM sodium nitrate on expression of narG in biofilms was determined by qPCR.

Results: narG sequences were detected in the saliva inocula from a wide range of genera including Neisseria, Rothia, Actinomyces, Kingella and Lautropia, while the narG genes identified in the biofilms were Neisseria or Rothia. The expression of narG from Neisseria was significantly higher in biofilm samples pre-treated with 10 mM nitrate and then supplemented with nitrate compared to no pre-treatment (Wilcoxon rank sum test, $p < 0.001$). Rothia narG expression was significantly higher in nitrate pre-treated samples (Wilcoxon rank sum test, $p < 0.001$) but supplementation did not further stimulate expression. No differences in Veillonella or ActinomycesnarG expression were seen with nitrate supplementation with or without nitrate pre-treatment.

Conclusions: The results of this study confirmed that a wide range of oral bacteria possess the narG nitrate reductase gene. Prior exposure of biofilms to nitrate increased expression of narG in Neisseria and Rothia in biofilms and nitrate treatment further stimulated expression in Neisseria. Neisseria and Rothia have potential for use in the development of cardiovascular health-enhancing strategies based on oral nitrate reduction.

CONTROL ID: 3934989

TITLE: Biocompatibility and antimicrobial effect of demineralised dentin matrix hydrogel for dental pulp preservation

AUTHORS/INSTITUTIONS: J. Camilleri, B. Scheven, School of Dentistry, Oral Biology, College of Medical and Dental Sciences, University of Birmingham, Birmingham, UK, Birmingham, UNITED KINGDOM|N.S. Abd Elhamed, Department of Oral Biology, Faculty of Dentistry, Mansoura University, Egypt., Mansoura, EGYPT|

ABSTRACT BODY:

Objectives: Regenerating dentin and preserving pulp vitality are the two key targets for the vital pulp therapy. This study aimed to produce and evaluate a novel biomimic pulp capping agent with increased dentin regenerative activities.

Methods: Human extracted teeth were grinded and treated by using ethylene diamine tetra-acetic acid solution to produce demineralised dentin matrix (DDM) particles. Scanning electron microscopy (SEM) was used to define the particle size of DDM. Collagen-I (COL-I), bone morphogenic protein-2 (BMP-2) and vascular endothelial growth factor (VEGF) were analysed in DDM by enzyme linked immunosorbent assay (ELISAs). Prepared DDM particles were added to the sodium alginate then, was dripped into a 5% (w/v) calcium chloride solution to obtain DDM hydrogel (DDMH). The eluants of both DDMH and MTA was assessed by MTT to detect their cytotoxic effect on dental pulp stem cells (DPSC). COL-I gene expression was analysed on DPSC exposed to different dilutions of material eluants by real time quantitative polymerase chain reaction (RT-qPCR). Acridine orange staining was used to monitor the cell growth over the tested materials and agar diffusion assay was used to test the antimicrobial effect of the tested materials.

Results: Significant levels of COL-1, BMP-2 and VEGF were detected in DDM particles. MTT assay revealed that neat eluates of DDMH promoted DPSC viability, however neat eluates of MTA were cytotoxic on DPSC after 72h of culture. Moreover, DPSC were able to grow and attach to the surface of DDMH, while showed marked reduction in their number when cultured on surface of MTA as shown by acridine orange stain. COL-I gene expression was upregulated in DPSC cultured with DDMH eluates compared to those cultured with MTA eluates. DDMH had a significant antibacterial activity in comparison to MTA after 24 h incubation.

Conclusions: DDMH could be an alternative pulp capping agent for use in regenerative endodontics.

CONTROL ID: 3935032

TITLE: Characterization Of An Oral Model For Studying Immune Cell Transmigration

AUTHORS/INSTITUTIONS: A. Ho, N. Boukbir, E.K. Parkinson, L. Bergmeier, F. Flores-Borja, E. Hagi-Pavli, Queen Mary University of London, Londond, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Neutrophils are important innate immune cells in the oral cavity. To study neutrophil transepithelial migration and other immunological processes involved in chronic oral inflammation, we have developed a novel in vitro oral epithelial model (OEM) critical for identifying neutrophil-epithelial interactions and signalling during infection and inflammation.

Methods: Normal human oral keratinocytes, OKF6/TERT-1 were cultured on transwell filters to establish the OEM. Barrier properties were assessed by transepithelial electrical resistance (TEER), Lucifer Yellow (LY) permeability assay, confocal microscopy, and high throughput qPCR. To assess OEM biological functional properties, the model was exposed to relevant microbial stimulants followed by immunoassay analysis of supernatants. In preliminary transmigration assays, neutrophil-like HL-60 cells were incorporated into the OEM to mimic neutrophils activities including proteolytical processing of pro-inflammatory IL-36 cytokines.

Results: The OEM has a tight functional barrier characterised by high TEER and low permeability properties. Confocal microscopy confirmed tight junction protein expression across the OEM and based on qPCR analysis, similarexpression to normal human oral epithelium of cytokeratins, tight junction, adherens junction and desmosome proteins in addition to matrix metalloproteinases was shown. In response to P. gingivalis LPS treatment, cytokines known to favour neutrophil recruitment including IL-8, TNF-a, GM-CSF, MCP-1 and MIP-1a were released into supernatants. Furthermore, there was also upregulated gene expression of IL-36α, IL-36β and IL-36γ in the OEM. IL-36g levels were also increased in the presence of HL-60 cells, suggesting HL-60 derived proteases as the possible source that cleave and generate active IL-36g during oral epithelial migration.

Conclusions: We have established a novel in vitro model suitable for studying neutrophil trafficking across the oral epithelium. This will help to identify critical innate immune mechanisms of cell migration and activation associated with epithelial cell damage in oral inflammatory diseases.

CONTROL ID: 3935249
TITLE: Symmetry in Tooth Formation Within and Between Jaws

AUTHORS/INSTITUTIONS: G. Haghi Ashtiani, H. Liversidge, J. Davies, Institute of Dentistry, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Most dental age reference data are based on mandibular teeth while limited data exists for maxillary teeth. Most methods of assessing dental maturity use left side teeth and symmetry of dental development is assumed. The objective of this study was to assess symmetry of developmental stage of permanent teeth between the left and right side of the jaw, as well as between the maxilla and the mandible.

Methods: A sample of 150 panoramic radiographs of individuals aged 6 to 20 years (69 males, 81 females) were selected from an open-access radiographic collection (Maxwell Museum of Anthropology's orthodontic collection, Albuquerque, USA). All developing immature permanent teeth (n=489) were scored by the first author using Moorrees (MFH) and Demirjian (DGT) tooth stages. Symmetry of developing teeth was assessed between the left and right sides of the jaw, as well as between the maxilla and the mandible using McNemar test with $p<0.05$ considered significant.

Results: No significant differences were found comparing left and right sides within the maxilla (n=489), (McNemar, p=0.759 MFH, p =0.736 DGT), or within the mandible (McNemar, p =0.262 MFH, p=0.707 DGT) using either tooth scoring method. Percentage agreement for individual teeth between left and right sides was least for third molars. Significant differences were observed comparing maxillary and mandibular teeth for both tooth scoring methods (n=978), (McNemar, p=0.00 MFH, $p<0.001$ DGT). Percentage agreement for individual teeth between the maxilla and mandible was least for incisors.

Conclusions: In our sample, differences in tooth formation were not significantly different in left and right side of the jaw while a significant difference was observed between maxilla and mandible, however this should be confirmed using a larger sample and wider age range.

CONTROL ID: 3935372

TITLE: A cohort study and matched pair analysis evaluating the effects of the COVID-19 Pandemic on access to dental care for people with Inherited Bleeding Disorders

AUTHORS/INSTITUTIONS: T. Cavell, A. Booth, T. Gill, L. Nanayakkara, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|A. Booth, T. Gill, D. Hart, L. Nanayakkara, Royal London Dental Hospital, Barts Health NHS Trust, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Patients with inherited bleeding disorders (IBDs) can experience challenges in accessing dental care. The COVID-19 pandemic saw the cessation of routine dentistry in England. This study aims to highlight whether access to dental care for patients with IBDs was impacted by the pandemic, and whether the severity of their IBD impacts patients experience of dental care.

Methods: Patients over the age of 18 with Haemophillia A and B, Von Willibrands (VWD), Bernard-Soulier syndrome (BSS) and Glanzmann's disease (GD) were recruited. 178 patients were called and invited to complete a questionnaire. Full cohort and matched pair analysis was performed.

Results: 70 participants completed the questionnaire (62 males, mean age 39.9), 26 had a mild IBD and 44 severe. Mild and severe patients were matched on IBD, gender, deprivation index and age. 31% of patients tried to seek dental advice during the pandemic. 81% of mild patients saw a dentist routinely prior to the pandemic, compared to 58% of severe patients. Doctors were more likely to discuss the importance of dental prevention with patients with severe IBDs (p = 0.0042).

Conclusions: Fewer patients with severe IBDs accessed regular dental care compared to their matched pair counterparts prior to the pandemic. This could indicate that access to care is more difficult for those with severe IBDs. Patients felt that oral health is relevant to their IBD. While doctors were more likely to discuss the importance of preventing dental disease with patients who have severe IBDs, the profession needs to ensure this translates into routine engagement.

CONTROL ID: 3935673

TITLE: X-ray microtomography investigation of the fit of minimally invasive CAD/CAM occlusal veneers

AUTHORS/INSTITUTIONS: A. Songwatcharaporn, S.K. Sidhu, Centre for Oral Bioengineering, Queen Mary University of London, London, UNITED KINGDOM|K.E. Tanner, School of Engineering and Materials Science, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To compare the fit of occlusal veneers made from four commercial CAD/CAM ceramic and ceramic-like materials using x-ray microtomography (XMT) by comparing the absolute marginal discrepancy (AMD), marginal gap (MG), and internal gap (IG) values.

Methods: Four master dies were made of high-strength PMMA from a typodont mandibular first molar prepared for an occlusal veneer with 1 mm occlusal reduction and obtuse-angled margins. The dies were digitally scanned (E4 lab scanner, 3Shape A/S, Denmark) to produce 1 mm occlusal veneers from 4 materials (n=15 for each material): a lithium disilicate [IPS e.max®CAD (Ivoclar Vivadent, Liechtenstein)]; two different zirconia-reinforced lithium disilicates [Celtra®Duo (Dentsply Sirona, USA) and VITA Suprinity®PC (VITA Zahnfabrik, Germany)]; and a resin nanoceramic [Lava™ Ultimate (3M ESPE, USA)]. Each veneer was placed on one of the master dies and scanned using XMT (XT H 225, Nikon Metrology Inc, Japan); the scanned XMT files were transferred for reconstruction using special software for assessment in three orthogonal planes and determination of AMD, MG and IG values. For each veneer, 220 measurements were made at 1 mm intervals in mesiodistal and buccolingual sections. Statistical differences in the median AMD, MG, and IG values within the same and across materials were assessed using Friedman's two-way analysis of variance by ranks and the Kruskal-Wallis H-test, followed by Dunn's test.

Results: Lava™ Ultimate had the smallest AMD and MG values ($p<0.05$). No significant difference was found between the IG values of the materials. MG values were significantly lower than AMD and IG values for all materials ($p<0.05$). Minor chippings were observed at the edges of all materials except the resin nanoceramic.

Conclusions: Milled occlusal veneers made from a resin nanoceramic had smaller marginal discrepancies than those made from lithium disilicate-based materials.

TITLE: Mechanical properties of plasma-treated AR-glass fibres in experimental fibre-reinforced composites with three silanes

AUTHORS/INSTITUTIONS: M. Yon, Centre for Oral Clinical Research, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|J. Matinlinna, Division of Dentistry, Faculty of Biology, Medicine and Health, The University of Manchester, Manchester, UNITED KINGDOM|J. Tsoi, Applied Oral Sciences & Community Dental Care, Faculty of Dentistry, University of Hong Kong, Hong Kong, HONG KONG|P. Vallittu, L. Lassila, Turku Clinical Biomaterials Centre, Institute of Dentistry, University of Turku, Turku, FINLAND|P. Vallittu, Wellbeing Services County of South-West Finland, Turku, FINLAND|

ABSTRACT BODY:

Objectives: To compare and contrast mechanical properties of experimental alkali-resistant (AR) glass fibre-reinforced composites (FRCs) silanised with one of three silanes: 3-methacryloxypropyltrimethoxysilane (3-MPS), 8-methacryloxypropyltrimethoxysilane (8-MOS) and 3-acryloxypropyltrimethoxysilane (3-APS). The effect of plasma pre-treatment of fibres in AR-FRCs were compared.

Methods: Continuous unidirectional AR-glass fibres (ARcoteX® 5326 2400tex, Owen Corning) were cleaned ultrasonically, treated either with or without cold plasma (Piezobrush® PZ2, Relyon Plasma, Germany), then silanised by immersion for 10 min in activated, hydrolysed silane solution containing either 3-MPS, 8-MOS or 3-APS. The fibre bundles were next air-dried (24h), and dried in vacuum oven (80°C, 5kPa, 2h), producing 6 types of silanised AR-glass fibres.

After laminating with a resin matrix (bis-GMA:TEGDMA 60:40wt%, CQ 0.7wt% and DMAEMA 0.7wt%) for 10 min, silanised AR-glass fibres rovings were used to prepare AR-FRC beams (n=16) in stainless steel moulds (2mm × 2mm × 25mm) that were light-cured from the top and bottom directions for 60s (Elipar S10, 3M ESPE). Half of the samples (n=8) underwent accelerated artificial ageing by immersion in boiling water (100°C, 16h). Finally, 12 experimental AR-FRC groups were produced.

All specimens were subjected to the three-point bending test (NEXYGEN Plus, Lloyd, Ametek, USA) before inspection under scanning electron microscopy (SU1510, Hitachi, Tokyo, Japan).

Statistical analysis was performed with three-way ANOVA and the Tukey post hoc test at $\alpha = 0.05$.

Results: The flexural modulus, flexural strength and fracture work of the materials were significantly affected by silane type ($p < 0.05$) and artificial ageing ($p < 0.001$). Plasma treatment on AR-glass fibres significantly reduces flexural modulus of FRC ($p < 0.001$) and slows the plasticising effect of artificial ageing on FRC.

Conclusions: Long chain silanes impart higher flexural strength and lower flexural modulus to AR-FRCs. While artificial ageing halves flexural strength and plasticises them, plasma surface pre-treatment of AR-glass fibres before silanisation reduces the plasticising effect.

TITLE: "All for one and a "One" for all".
AUTHORS/INSTITUTIONS: K. Hurry, C. Chang, J. Davies, Paediatric Dental Department, Institute of Dentistry, Faculty of Medicine and Dentistry, Barts Health NHS Trust, London, UNITED KINGDOM|H. Bolooki, P. Jauhar, Orthodontic Department, Institute of Dentistry, Faculty of Medicine and Dentistry, Barts Health NHS Trust, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Maxillary central incisors are the third most impacted teeth. Timely multidisciplinary management of unerupted maxillary central incisors (UMCI) is key to preventing prolonged functional and appearance-based anguish. Our objectives were to assess referral appropriateness of children with UMCI for joint paediatric-orthodontic management in a teaching hospital and orthodontic treatment burden pre- and post-lockdown.

Methods: A retrospective analysis was completed of consecutive patients (aged 6-to-16-years-old) who required surgical management under general anaesthetic for their UMCI between 2018-2021. Nine-years-old was selected as a proxy measure of age-appropriate referral. Liversidge and Molleson's stage of root development was also recorded and inter-examiner reliability tested.

Results: Fifty-two children with 62 UMCI were identified; 69.3% were male. Mean age of referral was 8.8 years-old; 60.1% were referred age-appropriately. Most (53.2%) roots were at least half development (R½) at time of assessment. Supernumerary teeth were diagnosed in 82.7% of UMCI cases; both tuberculate (n=29/43) and conical (n=21/43). Almost all children had pre-surgery plain-film radiographs (90.4%) with 42.3% requiring CBCT; 77.3% of which had supernumeraries (n=17/22).

Mean age at surgery was 10.4 years-old. Prior to March 2020, mean time between listing and surgery was 4.3-months but, due to lockdown, this increased to 15.2-months. Most children required removal of supernumerary and exposure and bond of UMCI (54.7%).

The orthodontic burden of care was higher for patients who were referred above 9-years-old. Root development also impacted orthodontic treatment burden: 83.3% at level ≥R¾ required orthodontic treatment, compared to only 36.4% at ≤R¼. Mean time from surgery to tooth eruption was 2.2-years.

Conclusions: Our results show that conical supernumeraries can obstruct incisor eruption and should be removed; CBCT can aid surgical planning. COVID-19 has undoubtedly delayed care for these patients, the long-term treatment burden is currently unknown. Our findings suggest that primary care referrers should consider stage of root development not patient age alone.

CONTROL ID: 3936204

TITLE: A Novel Porphyromonas gingivalis Human Challenge Model

AUTHORS/INSTITUTIONS: R.A. Irwandi, F. D'Aiuto, Periodontology Unit, UCL Eastman Dental Institute, London, UNITED KINGDOM|J. Glanville, G. Collins, D. Gilroy, Department of Experimental & Translational Medicine, UCL Division of Medicine, London, UNITED KINGDOM|J. Santini, Institute of Structural and Molecular Biology, UCL Division of Biosciences, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Animal experimental evidence suggests P.gingivalis as a keystone pathogen in the development of periodontitis and its links with systemic diseases. Limited or no evidence exists in humans. The aim of this research was to develop a novel experimental model of P.gingivalis challenge in humans.

Methods: Ten healthy volunteers received two intradermal UV-killed P.gingivalis injections on the forearms followed by the formation of artificial blister. Serial increasing doses of P.gingivalis were evaluated by blood perfusion, skin temperature, and cellular analyses of the blister exudate were conducted using polychromatic flow cytometric analysis. The host response to the challenge was monitored by forehead temperature, full blood count, and serum C-Reactive Protein (CRP) levels.

Results: P.gingivalis challenge demonstrated a visible forearm response with increased blood flow peaking at 24 hours ($p<0.001$) and fading at 48 hours, whilst the local site's temperature remained unchanged. The local cellular response (4 hours post-injection) was characterized by neutrophil influx ($p<0.001$) and late T lymphocyte accumulation (48 hours). Consistent alterations of blister fluid-derived myeloid (monocyte subsets and dendritic cells) and lymphoid cells (CD4, CD8, B lymphocytes, and NK cells) were observed between 4 and 48 hours post-injection. No substantial alteration in forehead temperature and serum CRP level were noted whilst increased white blood cell and neutrophil counts ($p<0.01$ for both) that were observed at the onset of inflammation returned to baseline at 48 hours.

Conclusions: A novel human-challenge model of UV-killed P.gingivalis injection was developed to induce localized and transient inflammatory responses. A self-contained innate immune response reaction was safely reproduced. The model holds promise in evaluating host-pathogens interaction in periodontitis and systemic health in humans.

CONTROL ID: 3936230

TITLE: Early soft tissue contour changes around implants with or without soft tissue augmentation

AUTHORS/INSTITUTIONS: M. Yon, E. Calciolari, N. Mardas, N. Donos, Centre for Oral Clinical Research, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To describe the early healing after implant placement with or without soft tissue augmentation (STA) in terms of soft tissue surface profilometric changes.

Methods: In an ongoing randomised pilot study, eleven patients have received STA with either a porcine, volume-stable cross-linked collagen matrix (n=3), connective tissue graft (n=3) or no STA (control, n=5), performed simultaneously with implant placement. The surgical area was scanned (TRIOS, 3shape) at baseline, immediately post-implant placement and at days 1, 3, 7, 14 and 30. Horizontal linear differences at the buccal peri-implant mucosa up to 2 mm were obtained by comparing post-operative to baseline STL images with a dedicated software (smop, Swissmeda).

Self-reported pain was assessed on days 1, 3, 7, 14 and 30 with a visual assessment scale. Descriptive statistics and an exploratory mixed model linear regression analysis were performed to assess the impact of the type of graft on the assessed parameters.

Results: There was an initial increase in contour post-operatively followed by a reduction up to 30 days in all treatment groups. Patients receiving STA had at least 1.5mm increase in contour by 30 days while in the control group, the buccal contour was similar at 30 days compared with pre-operative scans.

Self-reported pain level was highest in the first 3 days post-implant surgery which gradually subsided by 30 days post-op in all groups.

Mixed model linear regression revealed significant effect of the type of soft tissue graft on contour changes (p<0.001) but not with self-reported pain level (p=0.178).

Conclusions: Soft tissue contour changes exhibited similar patterns following implant placement regardless of graft usage. STA significantly increased buccal soft tissue contour in the first 30 days post-surgery, while all patients experienced similar post-operative pain. Future follow-up of patients would reveal long term trends in buccal contour change.

CONTROL ID: 3936249
TITLE: Functionalization of Nanophase in Dental Resin Composites with Antibacterial Behaviours

AUTHORS/INSTITUTIONS: Y. Guo, S. Sirovica, Centre for Oral Bioengineering, Barts and The London School of Medicine and Dentistry, Queen Mary, University of London, London, UNITED KINGDOM|Y. Guo, G. Koller, O. Addison, Faculty of Dentistry, Oral & Craniofacial Sciences, King's College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To functionalize nanophase cellulose nanocrystals (CNCs) with chlorhexidine (CHX) in experimental resin-based composites (RBC) to confer antibacterial properties on the resultant material.

Methods: Photo-polymerizable experimental resins were formulated by combining BisGMA and TEGDMA monomers (60:40 wt.% ratio) with 1 wt.% Lucirin-TPO photo-initiator system. Composites were prepared by incorporating 5 wt.% CNCs and 1 wt.% of CHX into monomer blends, by mechanical mixing (MM) or solvent exchange (SE) processes. Disc-shaped RBC specimens (diameter=9 mm, thickness=1 mm) were fabricated by photo-polymerization for 60s at an irradiance of 1200 mW/cm^2 (Bluephase Style 20i). The antibacterial activities of RBC samples against Pseudomonas aeruginosa PAO1 (PAO1) and Staphylococcus aureus (USA300) were investigated directly using an agar-based disc-diffusion assay; or indirectly by monitoring CHX release using UV-vis spectroscopy. Three-point bend flexural strength and modulus testing was performed according to ISO 4049 (n=5). Differences between results were analysed using one-way ANOVA and post-hoc Tukey tests ($p < 0.05$).

Results: The introduction of CHX into RBC systems inhibited growth against PAO1 and USA300, while no inhibition effects were observed for non-functionalized RBCs for both strains. Samples functionalized with CHX exhibited a minor but non-significant increase in flexural strength and Young's modulus, compared with non-functionalized counterparts. CHX functionalized RBC samples prepared by SE demonstrated significantly greater flexural strength than MM counterparts.

Conclusions: CNC filled RBCs were successfully functionalized with antibacterial reagent CHX, which conferred promising antibacterial behaviour, with direct and indirect evidence of bacterial growth inhibition effects against two representative Gram-positive and Gram-negative strains. The resultant material showed no deleterious effect on the mechanical properties compared with the non-functionalized control group and suggests that solvent exchange is a more effective route towards CHX incorporation.

CONTROL ID: 3936272

TITLE: Artificial Intelligence in Oral Diseases: Clinical-Histopathological correlation (every day practice)

AUTHORS/INSTITUTIONS: S.O. Zayed, oral maxillofacial pathology, Cairo University, Giza, October 6th, EGYPT| S.O. Zayed, oral maxillofacial pathology and surgery, Misr University for science & Technology, Giza, October 6th, EGYPT|Y.S. Abdelhamid, Computer science, media minors, New York University, Giza, October 6th, EGYPT|R.M. Yasser, oral maxillofacial pathology and surgery, Misr University for Science and, Giza, October 6th, EGYPT|

ABSTRACT BODY:

Objectives: <div>Developing a software with all needed input data downloaded in the computer device to act as machine learning program to diagnose variety of oral diseases with accuracy and proposal of treatment plan especially for life threatening conditions. So our research question was: Can we develop a Computer-Aided Software (CAS) for accurate diagnosis for oral diseases based on clinical and histopathological data inputs?.</div><div> </div><div> </div><div> </div>

Methods:

10 cases for each disease were enrolled in the study. The study sample included clinical images, patient symptoms, radiographs & histopathology texts for the oral diseases of interest in the current study (premalignant lesions, oral cancer, salivary gland diseases, immune-mediated oral mucosal lesions)

Results: The diagnostic performance of CAS was comparable to experienced oral pathologist and significantly superior to inexperienced clinicians. CAS provided faster differential diagnostic list and reliable recommendations for further investigatory tests in challenging cases.<div> </div>

Conclusions: <div>CAS has a potential to be used as diagnostic guidance tool for clinicians as well as could be used for accurate confirmation of diagnosis, test and treatment plan.</div><div> </div>

CONTROL ID: 3936388

TITLE: Analyses of experimental injectable bioactive glass as an endodontic sealer

AUTHORS/INSTITUTIONS: A.S. Khan, A. Alqasim, R. Bousaleh, M. Almehrij, College of Dentistry, Imam Abdulrahman Bin Faisal University, Dammam, SAUDI ARABIA|N. Irshad, Department of Dental Materials, Sharif Medical City, Lahore, PAKISTAN|N. Jahanzeb, A. Shah, Interdisciplinary Research Centre in Biomedical Materials, COMSATS University Islamabad, Lahore Campus, Lahore, PAKISTAN|

ABSTRACT BODY:

Objectives: This study aimed to synthesize fluoride-doped bioactive glass (F-BG) based thermo-responsive injectable hydrogel for endodontic applications.

Methods: The cold preparation method was used with F-BG, copolymer, and hydroxyl propyl methylcellulose. The structural and phase analyses were done with Fourier Transform Infrared Spectroscopy and X-ray Diffraction, respectively. The setting time of the prepared injectable was investigated at 21°C (in the presence and absence of an ultrasonic scalar) and at 37°C. Flowability was tested according to ISO-6876:2012 specifications, whereby injectability was checked by extrusion method using 21-, 22-, and 23-gauge needles. The in vitro bio-adhesion and push-out bond strength were studied on days 7 and 90 and compared with the commercially available TotalFill®. The ion release profile was analyzed for up to 30 days with inductively coupled plasma optical emission spectroscopy. Statistical analyses were performed using SPSS version 22 with one-way ANOVA post hoc tukey's test.

Results: The structural and phase analyses confirmed the presence of bioactive glass. The final setting time at 21°C, 21°C+ultrasonic scalar, and 37°C were 38.66±3.21, 29.12±1.23, and 32±3.46 min, respectively. The flowability was 25±3.94 mm, and the injectability coefficient was ≥70.3 for 22, 21, and 57% in a 23-gauge needle. A significant difference in bond strength was found between days 7 and 90, where the strength was increased, and a new apatite layer was formed on the tooth surface. Calcium, phosphate, and silicon were released more initially; however, continuous release was found for up to 30 days.

Conclusions: The prepared F-BG injectable hydrogel has shown promising results and has the potential to be used as an endodontic sealer.

CONTROL ID: 3936397

TITLE: Characterization of a New Bioactive Glass Containing Fluoride Varnish.

AUTHORS/INSTITUTIONS: E. Thambi, R. Hill, S. Shahid, Institute of Dentistry, FMD Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To characterise a new fluoride varnish containing BioMinF bioactive glass and NaF (developed by VOCO GmbH).

Methods: In the first part, the active solid ingredients were separated from the four varnishes and characterised by ATR-FTIR, X-ray powder diffraction and solid-state NMR spectroscopy for 31P and 19F.

The BiominF+NaF varnish was compared with 3M Clin Pro White, GC Tooth Mousse and VOCO Profluorid varnish. Each varnish was coated onto a glass coverslip (20 x 25mm). These coated coverslips are immersed in 10ml of three media:Tris buffer pH 7.3, 0.1M Acetic acid pH 4.0 and Artificial Saliva pH 7.0. These are stored at 37C and at timepoints 2, 4, 6, 24 and 72 the coverslip was removed and placed in fresh media. The media was analysed for Ca, Na, Si and P concentrations using ICP- OES. Ion Selective Electrode and a pH electrode were used to measure changes in F and pH respectively. Active solid ingredients were separated from the four varnishes and characterised by ATR-FTIR, XRD and solid-state NMR spectroscopy for ^{31}P and ^{19}F.

Results: All the varnishes released fluoride and all released P and Ca with the exception of the Profluorid varnish. Only the BioMinF varnish increased the pH. The XRD and ^{19}F NMR detected presence of NaF in all varnishes. ^{31}P NMR detected TCP in Clin Pro White whereas calcium orthophosphate was detected in GC Tooth Mousse. The BioMinF varnish exhibited a peak in the ^{31}P spectrum which matched the reference spectra for the BioMinF glass, with an additional peak corresponding to that of brushite suggesting a small amount of degradation of the glass had occurred.

Conclusions: VOCO BioMinF varnish could potentially promote remineralization by increasing the pH and providing a sustained release of therapeutic ions that needed for the formation of fluorapatite.

CONTROL ID: 3936428
TITLE: Key Interaction of Pea Proteins and Saliva to Charged Surfaces

AUTHORS/INSTITUTIONS: M. Kawashita, G. Carpenter, Centre for Host-Microbiome Interactions, King's College London, London, UNITED KINGDOM|T. Reddyhoff, Tribology Group, Department of Mechanical Engineering, Imperial College London, London, UNITED KINGDOM|S. Vladescu, Department of Engineering, King's College London, London, UNITED KINGDOM|R. Nicholson, Motif FoodWorks, Inc, Boston, Massachusetts, UNITED STATES|

ABSTRACT BODY:

Objectives: The plant-based proteins are important as they provide all the necessary nutrients but pea proteins are known to cause astringency by interacting with salivary proteins, but the mechanism behind this interaction remains unclear. A previous study showed that pea protein, PURIS^{TM} P870, caused delubrication of a salivary film whereas VITESSENCE^{TM} Pulse 1803 (P1803) did not. One potential mechanism of astringency could be displacing mucins by pea proteins and this interaction can involve both salivary proteins bound to the surface (i.e., the pellicle surface) and in the bulk of the fluid.

Therefore, the aim of this study was to investigate if pea proteins affect mucin binding to charged particles (positively/negatively charged, and hydrophobic particles), and if sodium ions may play a role in the binding mechanism.

Methods: Saliva, P870/P1803, and saliva-pea protein mixtures (1:1) were bound to the charged particles in water or PBS. SDS-PAGE was performed to identify how much salivary protein (Muc5B, Muc7, Amylase) and a unique pea protein (P38) are bound to each particle.

Results: The study showed that the saliva-P870 mixture provided a significant increase in Muc5B binding to positively charged particles (132 % increase, $p < 0.05$) and P38 binding to hydrophobic particles (174 % increase, $p < 0.05$), and a significant decrease in Amylase binding to hydrophobic and negatively charged particles (76 % and 100 % decrease respectively, $p < 0.05$). However, the saliva-P1803 mixture did not show a significant difference. Furthermore, sodium ions did not affect the protein binding.

Conclusions: Delubrication is not caused by the displacement of salivary mucins from the surface, but a significant increase in P38 binding might be a possible mechanism of astringency.

CONTROL ID: 3936539
TITLE: Healthy Lifestyles as Protective Indicators for Periodontal Diseases. Results from Two Large-Scale Surveys.

AUTHORS/INSTITUTIONS: C. Marruganti, S. Luthra, H. Syed, J. Suvan, F. D'Aiuto, Periodontology Unit, University College London, London, UNITED KINGDOM|C. Marruganti, University of Siena, Siena, ITALY|

ABSTRACT BODY:

Objectives: To ascertain whether healthy lifestyles are associated with periodontal diseases in two large-scale surveys (National Health and Nutrition Examination Survey–NHANES in the US and UK Biobank-UKB).

Methods: Data from 9,854 adults were retrieved from the NHANES 2009-2014 waves, whilst data from 111,679 adults were retrieved from the UKB database. A healthy lifestyle score, ranging between 0 and 5, was constructed based on the reported number of healthy behaviours, including never smoking, no heavy alcohol consumption, top third of leisure-time physical activity, higher dietary quality, and ideal sleep duration. In the NHANES, periodontal status was assessed through a full-mouth periodontal examination, while in the UKB only self-reported periodontal status was available. Simple and multiple regression models were designed to explore the association between the healthy lifestyles score and periodontal diseases and combined with mediation analyses.

Results: Multiple regression analyses confirmed that the presence of at least 2-3 healthy behaviours (vs. 0-1) was associated with lower odds of overall and severe periodontitis case definitions (ORs 0.5; 95% CI: 0.4-0.6; p<0.001 and 0.5; 95% CI: 0.3-0.8; p=0.003 respectively) in the NHANES, and of bleeding gums (OR=0.9; 95% CI: 0.8-1.0; p=0.092) and loose teeth (OR=0.6; 95% CI:0.5-0.7; p<0.001) in UKB. This beneficial association increased when considering prevalence of 4-5 healthy behaviours (vs. 0-1) in both the NHANES (periodontitis: OR=0.3; 95% CI:0.2-0.4; p<0.001; severe periodontitis: OR= 0.1; 95% CI:0.01-0.2;p<0.001) and the UKB (bleeding gums: OR=0.8; 95% CI:0.7-0.9; p<0.001; loose teeth: OR=0.5; 95% CI:0.4-0.6;p<0.001). Mediation analyses revealed how these protective associations were partially mediated (1-14%) by markers of systemic inflammation.

Conclusions: Healthy lifestyle behaviours are protective indicators for the prevalence of periodontal diseases in the population, in a dose-response relationship and are partially mediated by systemic inflammation. Further studies should investigate the effects of promoting healthy lifestyles to improve both oral and general health.

CONTROL ID: 3937572
TITLE: Adhesion strength testing in dentistry – an improved approach
AUTHORS/INSTITUTIONS: H. Mohammed Elnadif, W. palin, M. Abdul Hadis, B. Darvell, University of Birmingham, Birmingham, UNITED KINGDOM|
ABSTRACT BODY:

Objectives: Background: Generally, the bonding of one material to another is important for function, and especially with so-called 'adhesive dentistry'. A reliable test with good discriminatory power that mimics the clinical failure mode has not emerged.

Objective: Develop and validate a test protocol based on 4-point bending that may be used to examine the bonding of various dental materials to a range of substrates. The bonding of an RBC to dentine is taken as an example.

Methods: Slices of dentine ($2.0 \times 5.0 \times 2.0$ mm^3), from extracted molars were prepared using a diamond saw under running water. Pairs of RBC bars ($24.0 \times 5.0 \times 2.0$ mm^3) (Z250) were bonded symmetrically either side of a dentine slice using all combinations of the following treatments: E: acid-etched (Scotchbond Universal Etchant), P: primer (Adper Scotchbond Multipurpose Adhesive); A: adhesive (Adper Scotchbond Multipurpose Primer) (all 3M) as well as NT: no treatment. At 24 h (100% RH, 37 °C), test pieces were subject to 4-point bending at 23 °C, cross-head speed 0.5 mm/min, until fracture. 3-way Analysis of Variance on log(bend strength) was applied. Scanning electron microscopy (SEM) was used to examine fracture surfaces and identify failure origins.

Results: Fracture strengths in MPa: NT: 1.38 ± 0.56; P: 9.82 ± 0.89; A: 5.12 ± 0.73; E: 9.39 ± 1.78; E+P: 21.03 ± 2.63; E+A: 12.80 ± 1.53; P+A: 17.16 ± 3.03; E+P+A: 20.84 ± 3.93. The main effects of the treatments ($p < 10^{-12}$) were not additive, there being significant two-way ($p < 10^{-5}$) and three-way ($p = 0.037$) interactions. There was no significant difference between E+P+A and E+P ($p = 0.86$).

Conclusions: With good reproducibility, high discriminatory power, economy with regard to substrates, and a straightforward robust process, the method is adaptable to many systems.

CONTROL ID: 3937581

TITLE: Biomarkers for Diagnosis of Stage III, Grade C with Molar Incisor Pattern Periodontitis in Children and Young Adults: A Systematic Review and Meta-Analysis

AUTHORS/INSTITUTIONS: M.M. ALAMRI, G. Proctor, L. Nibali, Centre for Host Microbiome Interactions, Faculty of Dentistry, Oral and Craniofacial Sciences, King's College London, London, UNITED KINGDOM|M.M. ALAMRI, Dental Heath Department, King Saud University, Riyadh, SAUDI ARABIA|G.N. Antonoglou, Centre for Dental Education, Faculty of Dentistry, Oral and Craniofacial Sciences, King's College London, London, UNITED KINGDOM|C. Balsa-Castro, I. Tomás, Oral Sciences Research Group, Department of Surgery and Medical Surgical Specialties, School of Medicine and Dentistry, Health Research Institute Foundation of Santiago (FIDIS), Universidade de Santiago de Compostela, Santiago de Compostela, SPAIN|

ABSTRACT BODY:

Objectives: Aim: To explore the existing salivary, gingival crevicular fluid (GCF), blood, and serum biomarkers associated with grade C molar-incisor pattern (C/MIP) periodontitis in systemically healthy children and young adults.

Methods: Materials and Methods: Cross-sectional, case-control, and cohort studies on stage III grade C periodontitis or former equivalent diagnosis with analysis of molecular biomarkers in saliva, GCF, blood, or serum were retrieved from six databases and screened based on the eligibility criteria. The risk of bias in included studies was evaluated. Meta-analysis was planned for biomarkers assessed using the same detection methods and sample type in at least two papers.

Results: Results: Out of 5621 studies identified at initial screening, 28 papers were included in the qualitative analysis of which 2 were eligible for meta-analysis for IgG in serum samples. Eighty-seven biomarkers were assessed with the majority being higher in cases than in controls. Only the meta-analysis of total serum IgG with low heterogeneity value revealed a significant increase in its levels in C/MIPs compared to controls (standardized mean difference: 1.08; 95% CI: 0.76, 1.40).

Conclusions: Conclusion: There is a paucity of data on biomarkers associated with molar-incisor pattern periodontitis. Although serum IgG levels are raised, other more specific biomarkers in saliva, GCF, and blood/serum may be promising but require further investigation

TITLE: Upstream Interventions to Promote Oral Health and Reduce Inequalities

AUTHORS/INSTITUTIONS: M. Stennett, E. Dawson, M. Hijryana, R. Watt, Dental Public Health, UCL, London, England, UNITED KINGDOM|P. Cannon, University of Glasgow, Glasgow, UNITED KINGDOM|B. Daly, Trinity College Dublin, Dublin, IRELAND|

ABSTRACT BODY:

Objectives: This scoping review aimed to identify, and review published literature on upstream interventions which may promote oral health and/or reduce socioeconomic oral health inequalities.

Methods: Databases (ASSIA, CINAHL, PsycINFO, Medline, Embase, Cochrane Database of Systematic Reviews, Scopus) and grey literature sources (OpenGrey, WorldCat, NICE Evidence search, EThOS, Trip, and NTIS: Technical Reports) were searched, alongside websites of relevant public health organisations. Searches included available data published prior to October 2021. The review included articles examining upstream population-wide polices or upstream interventions targeted at certain population groups. Articles published in languages other than English were translated and included. Two independent reviewers screened and extracted data from all eligible articles for review.

Results: A total of 84 articles were identified, including 21 systematic reviews. A very limited number of the upstream interventions identified specifically focused on promoting oral health and/or reducing socioeconomic oral health inequalities. Legislative and regulatory measures (e.g., advertising control), fiscal measures (e.g., sugar sweetened beverage/tobacco taxation) and specific oral health interventions such as water fluoridation, were identified as having a positive effect in promoting oral health.

Regarding socioeconomic heath inequality reduction, the following interventions demonstrated some positive impacts: fiscal measures (e.g., tobacco taxation), food subsidies targeted at low-income groups, improvements to housing/work environments . However, the evidence concerning the effects of water fluoridation was mixed. Some interventions may have generated inequalities; these included mass media interventions, educational programmes, and regulatory measures to reduce alcohol taxation.

Conclusions: The evidence base for effective upstream interventions for oral health is limited, but interventions linked to wider social health determinants and those targeted at non-communicable diseases with shared risk factors for oral health proved positive. Further high-quality research and evaluation is needed to increase our understanding regarding the most effective upstream interventions for oral health

CONTROL ID: 3937816

TITLE: Deciphering the Genetic & Spatial Intratumour Heterogeneity of Oral Squamous Cell Carcinoma

AUTHORS/INSTITUTIONS: R.A. Ibrahim, Faculty of Dentistry, Mansoura University, Mansoura, EGYPT|E. Bailey, J. Wang, Barts Cancer Institute, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|R.A. Ibrahim, R. Kumar, I. Sequeira, Institute of Dentistry, Barts Centre for Squamous Cancer, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|H. Cottom, Barts Health NHS Trust, London, UNITED KINGDOM|B. Ben Cheikh, O. Braubach, Akoya Biosciences, Menlo Park, California, UNITED STATES|

ABSTRACT BODY:

Objectives: This study aims to enhance our comprehension of the evolutionary dynamics of oral squamous cell carcinoma (OSCC) and the impact of subclonal mutations on the arrangement of cells within the tumour microenvironment (TME).

We investigated the molecular and cellular heterogeneity of metastatic vs. non metastatic OSCC.

Methods: (1) We performed whole-exome sequencing from multifocal OSCC tumour regions and matched metastasis, and used computational methods to investigate the tumour subclonal organisation and assessed the genetic diversity of the different tumour regions and metastasis.

(2) We performed Single cell Phenotype profiling using CODEX multiplexed imaging (CO-Detection by indEXing) with a panel of 34 antibodies comprising epithelial, immune, endothelial, and stromal markers to map the interaction of tumour cells with the surrounding TME.

Results: We observed certain genetic mutations that were unique to certain tumour regions. Additionally, we constructed individual phylogenetic trees for each tumour and annotated each branch with the corresponding GO/ KEGG pathway information.

Next, we utilized the CODEX platform to perform single-cell spatial proteomics on the same tumour regions. All cells were segmented and clustered using the Leiden algorithm. t-SNE plots and spatial plots depicted the spatial arrangement of tumour clusters, along with pie charts that illustrated the proportion of each cell type among the segmented cells. We also conducted cellular neighbouring analysis and calculated the 10 nearest neighbours at the tumour invasive front and adjacent stroma.

Conclusions: This multi-modal integrated spatial genomics and proteomics analysis of the tumour ecosystem highlights the importance of spatial cellular organisation and provides a foundation for exploring cancer evolution, heterogeneity, and progression.

TITLE: Development of Novel Bioinspired Adhesives for Dental Applications

AUTHORS/INSTITUTIONS: E. Dzinovic, S. Elsharkawy, O. Addison, S. Niazi, S. Gamea, N. Keyhani, L. Clark, Centre for Oral, Clinical and Translational Sciences, King's College London, London, UNITED KINGDOM|N. Pugno, Department of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, ITALY|Z.J. Zhang, Y. Liu, N. Rosik, School of Chemical Engineering, University of Birmingham, Birmingham, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Although removable complete dentures are a widely used and affordable solution for treating edentulism, they often have inadequate retention which can be a significant problem and a source of dissatisfaction for patients. Towards improving the retention of complete dentures, we aim to apply adhesive strategies from nature and to answer the following questions: (1) can bioinspired topographies increase physical retention? (2) can certain proteins, such as keratin, enhance chemical retention?

Methods: Octopus vulgaris was a source of inspiration for two types of topographies utilized in this study: (1) a simplified design – octopus holes (OH), and (2) a complex design with the protuberance – octopus suckers (OS). Topographies were replicated using PMMA. Two sets of PMMA blocks were used: one set had the topographies alone, while the other set contained topographies and a keratin coating at a concentration of 5wt%. The surface properties of PMMA blocks were assessed by measuring contact angles (CA) at different time points. Dry adhesion was conducted with Instron (5569A series) (n=20 repeats per sample, 4 preloads) on sheep's oral mucosa. We assessed maximum detachment forces and area under the curve and compared them with the Fixodent® and flat (non-patterned) surface.

Results: Topographies alone increased the CA values, while the presence of keratin coating reduced CA size for all groups, irrespective of the topographies' dimensions. In the setup without keratin coating, OH groups showed higher maximum detachment forces than OS and flat surface. Conversely, the presence of keratin significantly improved the detachment forces for OS and flat surface, including the area under the curve. Regardless of the presence of keratin, the performance of OS was slightly superior to the flat surface when larger preloads were applied.

Conclusions: The results showed that when larger preloads were applied in dry conditions, topographies exhibited slightly better retention compared to the flat surface. Preload dependency was noticed for all samples except for the flat surface meaning that topographies might require external preload to achieve the adhesion. Keratin positively affected maximum detachment forces and area under the curve, especially for the octopus sucker.

CONTROL ID: 3937849

TITLE: Novel calcium carbonate-poly(vinyl alcohol) scaffolds for bone tissue engineering

AUTHORS/INSTITUTIONS: J. Xue, N. Gurav, S. Elsharkawy, S. Deb, Faculty of dentistry, oral & craniofacial sciences, King's College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The management of large bone defects in oral and maxillofacial region remains clinically challenging due to varied rate of degradation, limited osteogenesis and insufficient vascularisation of the graft material to effect successful bone healing. In this study, we report novel calcium carbonate-poly(vinyl alcohol) scaffold using vaterite particles with high bioactivity, osteoconductivity and biocompatibility to offer viable alternatives to address these challenges in oral and maxillofacial surgery.

Methods: A series of scaffolds were fabricated using poly(vinyl alcohol) (PVA) as matrix and vaterite particles in calcium carbonate phase as filler, using freeze thawing (FT) with and without gelatin as a porogen. Several parameters during the fabrication were varied and evaluated for their physicochemical and mechanical properties, morphology, degradation and mineralization behaviour. In vitro cytocompatibility was conducted using Human osteoblast-like cell line (HOS TE85).

Results: The systematic study showed that vaterite particles acted not only as fillers but also as porogens due to its high solubility, which resulted in a more porous structure and higher water uptake compared to our previously reported PVA-calcium phosphate composites. Higher vaterite concentration (60%(w/v) led to superior mechanical properties and thermal stability due to improved crosslinking of PVA matrix. However, inclusion of gelatin as a porogen resulted in inferior mechanical properties, since the high porosity compromised structural integrity. All scaffolds showed good mineralization with fast apatite formation and good cell attachment both on the surface and within the pores, indicating a 3D cell-material interaction.

Conclusions: PVA-Vaterite composites without gelatin simplified the fabrication process and yielded scaffolds resembling spongy bone with a well-defined porous structure due to high resorbability of vaterite particles and freeze-thawing of PVA, enabling transport of nutrients across the construct with an enhanced cell attachment in the 3D network that could be easily shaped with surgical tools to fit complex anatomical bone defects.

CONTROL ID: 3937853
TITLE: Adsorption of salivary and serum proteins on hydroxyapatite powder and pellets

AUTHORS/INSTITUTIONS: J. Kosoric, School of Medicine and Dentistry, Queen Mary, London, UNITED KINGDOM|M. Gonzalez, Faculty of Dentistry, Santiago, CHILE|L. Cleaver, E. Priest, G. Proctor, Kings College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Caries and periodontal diseases are biofilm-induced diseases. The formation of the biofilm is initiated by adsorption of salivary proteins on hard dental surfaces and near gingivae, the pellicle can contain serum-derived and other proteins from gingival crevicular fluid (GCF). The aim of this study was to investigate adsorption of salivary and serum protein on hydroxyapatite as an in vitro model of pellicle formation on cervical tooth surfaces.

Methods: Whole mouth unstimulated saliva collected from 10 healthy volunteers and serum (Sigma-Aldrich, USA) were used to assess adsorption of salivary and serum proteins on hydroxyapatite (Hap) powder (Sigma-Aldrich, USA) and pellets (Himed, USA) as in vitro models. Hap powder and pellets were exposed to saliva and serum for 0-60 minutes and adsorbed proteins were identified and quantified using SDS PAGE (NuPage, Invitrogen) and the BCA assay (Thermo-Fisher scientific USA). Observation of competitive adsorption of salivary and serum proteins labelled with CyDyes (Cyanine 5.5 and 7.5 NHS esters, Lumiprobe, USA) mixed in ratios 1:9; 1:1 and 9:1 respectively was performed using near-infrared fluorescence detection system (Odyssey FC, Lumiprobe, USA).

Results: Both salivary and serum proteins showed selectivity in their binding onto hydroxyapatite powder and pellets, with as the most prominent being proline-rich proteins and albumin from saliva and serum respectively. Adsorption of both salivary and serum proteins increased with time (Fig 1) and in similar quantities relative to their initial concentration, although serum proteins appear to be more loosely bound as compared to salivary proteins. The quantity of serum proteins (1.29-1.36 mg/ml) eluted from Hap was four times larger compared to salivary proteins (0.22-0.39 mg/ml). Competitive binding of salivary and serum proteins indicates the potential for dynamic changes over time (Fig 2).

Conclusions: In conclusion, salivary and serum proteins show selective and time-dependent binding to Hap. This protocol can be used as a reproducible in vitro model to simulate salivary and serum protein adsorption onto tooth surfaces.

CONTROL ID: 3937876

TITLE: Integrated Modelling for Periodontal Risk Assessment: the MAMPs-Microbiota Interplay

AUTHORS/INSTITUTIONS: A. Dong, Y. Jin, G. Proctor, S. Zaric, King's College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The role of Microbe-Associated Molecular Patterns (MAMPs) in the pathogenesis of periodontal diseases and their use for periodontal risk assessment remain unclear. The objective of this study was to forecast the subgingival ecosystem functions using the subgingival taxonomic profiles and predictive modelling, and to correlate these functions with the actual subgingival endotoxin activity and lipoteichoic acid (LTA) concentrations.

Methods: Endotoxin activity and LTA levels in subgingival plaque samples, from 296 healthy, gingivitis, and periodontitis patients, were analysed using the recombinant Factor C assay and ELISA, respectively. The microbial composition of the samples was assessed using the 16S rRNA gene sequencing and the functional profiles were predicted using the Picrust2 algorithm. The correlations between the subgingival MAMPs, predicted functional profiles and periodontal diagnoses were assessed using the Spearman two-side test and the Kruskal Wallis test, respectively. A machine learning model could be used to determine the periodontal risk index on the basis of the 16S rRNA gene amplicon sequencing and predicted functional profiles.

Results: Endotoxin activity in diseased samples was significantly higher than in healthy individuals while the LTA levels were not. 16S rRNA gene analysis revealed higher microbial diversity in diseased plaque samples. The increased predicted pathways in diseased samples included energy metabolism, LPS biosynthesis, motility proteins, flagellar assembly, and bacterial motility, while ion channels pathways and non-ribosomal peptide synthesis were decreased. The actual subgingival endotoxin levels showed high positive and negative correlations with the listed functions and demonstrated good accuracy in assessing the periodontal disease risk.

Conclusions: This study is the first to combine subgingival MAMP activity, 16S rRNA gene sequencing and Picrust2 predictive functional modelling to assess periodontal risk. Our findings indicate that endotoxin activity levels are strongly correlated with subgingival predictive functional profiles. Additionally, our predictive model provides a useful tool to evaluate periodontal status and assess the periodontal risk for personalised periodontal care.

CONTROL ID: 3937885
TITLE: Creating a Bio-tooth: Designing a Microenvironment to Generate Tooth Organoids

AUTHORS/INSTITUTIONS: X. Zhang, A. Angelova Volponi, P. Sharpe, Centre for Craniofacial and Regenerative Biology, Faculty of Dentistry, King's College London, London, UNITED KINGDOM|N. Contessi Negrini, A.D. Celiz, Department of Bioengineering, Imperial College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Using the understanding of tooth development processes, and recreating these in laboratory conditions, enables us to bioengineer teeth in vitro, that could replace dental implants in the future. A proof of concept for mouse and human teeth has been demonstrated when one of the two necessary populations of cells (mesenchyme or epithelium) is derived from fresh embryonic tooth primordia.

The general objective of this study is to create tooth organoids in bioorthogonal click gelatin hydrogels so that this material is used as a microenvironment mimicking natural extracellular matrix (ECM), needed to direct cellular behavior and enable organogenesis in vitro models.

Methods: As part of the fabrication of the hydrogel matrix material, gelatin was modified either with tetrazine (Tz) or norbornene (Nb); hydrogel precursors were prepared at 8% w/v and mixed to obtain hydrogels via bioorthogonal click chemistry. Mesenchymal and epithelial cells were sourced from E14.5 GFP and CD1 mouse embryo tooth germs, respectively and used in the experiments, where cells were easy to track and identify, showing in vitro bioengineered tooth organoids. Confocal microscope was used for imaging in this study. Staining methods of the tooth organoid were carried out by using H&E staining and immunofluorescence staining.

Results: The hydrogel scaffold provided a microenvironment for the cells to interact and form bio-tooth organoids. Mesenchymal and epithelial cells from different mouse strains successfully established cell communication and induced tooth organogenesis. Upon histological analysis of the reconstituted tooth organoids, it was found that they exhibited a consistent morphology with native tooth germs. In addition, immunofluorescence staining was used to demonstrate the involvement of GFP mesenchymal cells and CD1 epithelial cells in the development of the reconstituted tooth organoids.

Conclusions: Bioorthogonal click gelatin hydrogels are a promising biomaterial for replicating in vitro tooth development microenvironment. As a result of the hydrogel providing a suitable substrate for cellular recombination, tooth organoids can be formed in vitro. Thus, it can be viewed as a potential alternative material for the development of tooth regeneration strategies in the field of bio-tooth engineering.

CONTROL ID: 3938089
TITLE: Understanding Dental Defects and Odontomas: Insights from Evc Mouse Mutants

AUTHORS/INSTITUTIONS: T. Qiu, A. Tucker, King's College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The Vestibular lamina (VL) initially forms as a transient epithelial structure that later develops into the oral vestibule, forming the furrows of the upper and lower lips and cheeks. The VL shares a common developmental origin with the dental lamina (DL), and is situated on the buccal/labial aspect of the DL. Under certain pathological conditions, the VL has the potential to develop tooth-like structures. Defects in the VL and DL are key phenotypic characteristics of several ciliopathies, such as Ellis-van Creveld (EvC) syndrome and are vital for the initial diagnosis. EvC patients have multiple frenula and adherence of the lips to the gums, in addition to dental defects. EVC, the major causative gene, is a crucial constituent of the primary cilium and is indispensable for the transduction of hedgehog signaling. In this analysis we have investigated the underlying developmental mechanisms that lead to the defects in EvC.

Methods: To investigate the mechanisms underlying the phenotype we have investigated Evc mouse model using microCT imaging, histology, Immunofluorescence, DIG insitu hybridization, and RNAscope from embryonic stages to weaning.

Results: Evc mutants display a variety of oral abnormalities, including supernumerary teeth arising from the VL, talon cusps, microdontia, taurodontism, malocclusion, fused teeth, multiple VL, and shallow oral vestibular, which closely mirror the clinical manifestations observed in patients with EvC syndrome. Defects were driven by alterations in proliferation and defects in the Shh signalling pathway leading to a shortened and often branched VL, which could give rise to supernumerary teeth. Interestingly, the underlying pathological mechanism differed from that observed in our earlier study on another Shh mouse model (Gas1).

Conclusions: Our study enhances our understanding of the formation of frenulum defects and tooth-like odontomas, and provides novel insights into the etiology of EvC syndrome and other ciliopathies.

CONTROL ID: 3938118

TITLE: Investigation of Bioactive Coatings to Promote Gingival Attachment to Subgingival Dental Restorations

AUTHORS/INSTITUTIONS: D. Abduallah, R.M. Shelton, M.R. Milward, J. Camilleri, School of Dentistry, Institute of Clinical Sciences, University of Birmingham, Birmingham, UNITED KINGDOM|D. Abduallah, Faculty of Dentistry, Alexandria University, Alexandria, EGYPT|

ABSTRACT BODY:

Objectives: Restoring subgingival defects is challenging due to the potential toxicity of restorative materials as well as the material surface properties which all together can lead to soft tissue attachment loss. The present study investigated bioactive coatings to promote epithelial attachment and exert an antimicrobial effect.

Methods: Resin modified glass ionomer (RMGI) is a commonly used material to restore subgingival defects. RMGI surfaces were tested unmodified (NC) or after coating with resin (RC) or varnish (V) impregnated with strontium substituted bioglass (SrC and SrV, respectively). Surface elemental analysis, wettability, roughness, surface charge and crystallinity were assessed using scanning electron microscopy coupled with energy dispersive spectroscopy (SEM-EDS), contact angle measurements, profilometry, surface zeta potential measurements and X-ray diffraction (XRD), respectively. Viable H400 cell attachment was determined using the trypan blue dye exclusion assay after 48 hours. Culture media pH changes after exposure to the different surfaces were also determined. Attachment of Streptococcus oralis was investigated using a direct contact test.

Results: Strontium substituted bioglass coatings significantly increased surface roughness and changed the surface of the RMGI as SEM-EDS demonstrated decreased Al^{3+}, a higher C-O ratio and the absence of fluoride on the modified surfaces. Poorly crystalline $SrCO_3$ formed on SrC after 48 h immersion in culture media. Strontium modified surfaces did not cause the acidity induced by NC in the culture media. Significantly more cells were attached to strontium modified surfaces than to NC (P<0.0001). A statistical reduction in bacterial counts was observed in RC and SrC compared with NC (P=0.0002).

Conclusions: The present study showed the potential of strontium substituted bioglass coatings to modify RGMI surfaces that promoted epithelial attachment and offers a mechanism to prevent gingival recession and at the same time exert an antimicrobial effect.

CONTROL ID: 3938412

TITLE: Factors Influencing the Provision of Oral Healthcare for Patients with Periodontal Diseases in Seychelles: a Cross-Sectional Survey

AUTHORS/INSTITUTIONS: S. Servina, M. Al-ezzi, N. Seoudi, College of Medicine and Dentistry, Birmingham, UNITED KINGDOM|M. Al-ezzi, N. Seoudi, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The behaviours of dental practitioners can impact the quality of oral healthcare provision for patients with periodontal diseases. This study aims to investigate the critical determinants of clinician behaviour regarding periodontal care, which can help develop interventions to improve periodontal management and enhance oral health outcomes of patients in Seychelles.

Methods: This cross-sectional survey received ethical approval to screen primary dental care practices using a validated, self-administered questionnaire. The study targeted public-sector general dentists, therapists, and hygienists registered with the Seychelles Medical and Dental Council or Health Professional Council Seychelles. The questionnaire gathered information about their capabilities, opportunities, and motivations concerning periodontal management.

Results: Of the 50 forms distributed, 39 were returned, yielding a response rate of 78%. The study results revealed that while 72% of participants claimed to possess current knowledge of periodontal diseases, and 95% were aware of the risk factors for periodontitis, 77% did not perform periodontal screenings, and only 28% screened recall patients. Regarding periodontitis diagnosis, 82% of dentists relied on radiographs, and 25% prescribed antibiotics for patients' periodontal management. Moreover, 51% of participants routinely provided oral hygiene instructions, and 36% offered smoking cessation advice. The study found that 72% of participants felt the need for additional training to improve their management of patients with periodontitis.

Conclusions: Dental practitioners' periodontal management of patients is influenced by their capabilities, opportunities, and motivations. To achieve positive clinician behaviour patterns, it is necessary to provide regular continuing education courses and better resources. In Seychelles, based on the outcome of the survey, clinician education should prioritise periodontal screening protocols and antimicrobial stewardship training. It is essential to adopt a systematic approach to behaviour modification interventions for clinicians to improve oral healthcare standards for patients with periodontal diseases and ensure positive patient-centred outcomes.

CONTROL ID: 3938414

TITLE: Comparison Between Chlorhexidine and Green Tea Mouthwashes in Preventing Periodontal Diseases- A Systematic Review.

AUTHORS/INSTITUTIONS: S. Alkasti, N. Seoudi, College of Medicine and Dentistry, Birmingham branch, UNITED KINGDOM|N. Seoudi, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: It is estimated that half of the UK adults have irreversible periodontitis and around 10% (8.2%-11.4%) of the world's population has severe disease. Therefore, there is a need for an efficient prevention strategy. Multiple different interventions are available including oral hygiene along with regular periodontal check-ups and hygienist appointments. Many dentists tend to prescribe chlorhexidine mouthwash (CHX-MW) as part of the oral hygiene regimen. However, it has multiple side effects including hypersensitivity reaction, tooth staining and altered taste sensation. Herbal mouthwash such as green tea, if proven effective, could replace the use of traditional antiseptic mouthwashes. This study aims to review the efficacy of green tea mouthwash (GT-MW) compared to chlorhexidine mouthwash in preventing periodontal disease.

Methods: This systematic review was conducted using predetermined keywords on three scientific servers (PubMed, google scholar, and ScienceDirect). The included randomised controlled trials (RCTs) were critically appraised using the CASP tool, Cochrane risk of bias and Jadad scale.

Results: The literature search identified 415 studies which were screened on three levels to identify relevant RCTs that directly compared the effect of CHX-MW to GT-MW in reducing plaque accumulation. According to the inclusion and exclusion criteria, 409 studies were excluded leaving six relevant RCTs to be included in this review. Five studies showed that GT-MW and CHX-MW have equal effect. On the other hand, one study reported that GT-MW was more effective in preventing plaque accumulation and periodontal diseases. Three studies highlighted the need for long-term evaluation of GT-MW side effects.

Conclusions: Both GT-MW and CHX-MW have similar efficacy in preventing periodontal disease. However, long-term longitudinal studies are required to monitor the side effect of GT-MW before it is considered a safe replacement to CHX-MW.

TITLE: Microbiological Approaches to the Storage of Bottled Beverages

AUTHORS/INSTITUTIONS: M. Kawachi, A. Wakui, N. Kaku, N. Takahashi, M. Miyazawa, T. Abe, A. Sato, M. Imai, H. Sato, Y. Kato, R. Okabe, Y. Naruse, N. Sato, T. Sato, Division of Clinical Chemistry, Niigata University Graduate School of Health Sciences, Niigata, JAPAN|A. Wakui, Medical Technology, Niigata University of Health and Welfare, Niigata, JAPAN|J. Washio, Division of Oral Ecology and Biochemistry, Tohoku University Graduate School of Dentistry, Sendai, JAPAN|

ABSTRACT BODY:

Objectives: Oral bacteria can possibly be transferred to drinks in plastic bottles after direct drinking. We have characterized the bacteria in the remaining barley tea (non-catechin), finding that the bacterial levels increased a hundredfold to the 10^6 level (Wakui et al 2021), and that the bacteria were scarcely detected in sports drink and orange juice due to their lower pH even after incubation at 37°C for 24h (Kawachi et al 2022). In this study, resting saliva was collected and inoculated into the plastic bottles of green tea (catechin; 0.4 or 0.8mg/mL); and then the survival of oral bacteria in the green tea, containing higher concentrations of the catechins, were examined after storage at 37°C for 24 h.

Methods: Resting saliva was collected from 13 healthy subjects (19-24 years), and then inoculated as $1.8×10^3$ CFU/mL into the plastic bottles of green tea (catechin; 0.4 or 0.8 mg/mL). After 1-day, the samples in the bottles were inoculated onto the blood agar plates, and incubated anaerobically at 37°C for 7 days. Genomic DNA was extracted from individual colonies, and bacterial species were identified by 16S-rRNA gene-sequencing.

Results: From the green tea (catechins; 0.4 mg/mL) in the 5 cases, the mean amounts of bacteria were $(2.2±3.8)×10^5$, while in the 7 cases, those were $(1.5±2.5)×10^3$. Limosilactobacillus (54.7%) were predominant in the 5 cases, while Streptococcus (42.7%) and Veillonella (6.1%) were predominant in the 7 cases. In contrast, from the green tea (catechins; 0.8 mg/mL) in the 4 cases, the mean amounts of bacteria were $(5.0±5.3)×10^4$, while in the 9 cases, those were $(2.7±2.7)×10^2$. Limosilactobacillus (94.4%) were predominant in the 4 cases, while Streptococcus (43.3%), Limosilactobacillus (18.3%), Schaalia (9.6%) and Actinomyces (1.0%) were predominant in the 9 cases.

Conclusions: The bacterial levels of the green tea were quite distinct from those of the barley tea (non-catechin), suggesting that the catechin may suppress the growth of bacteria in the remaining drinks of the plastic bottles, and that the green tea, especially including a high concentration of catechin, may possibly be preserved for a longer period than non-catechin tea drinks from the view point of bacterial levels.

CONTROL ID: 3938503

TITLE: Special Care Dentistry General Anaesthesia: Are We Complying with Guidelines?

AUTHORS/INSTITUTIONS: H. Barrow, F. Alsayer, University College London Hospitals NHS Foundation Trust, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: General anaesthesia (GA) is utilised by Special Care Dentistry (SCD) services to facilitate dental treatment delivery to those who are unable to receive it by alternative means, commonly patients with severe learning disabilities. In 2022 new guidance was published by the British Society of Disability and Oral Health (BSDH) on the use of GA in SCD.

This project aimed to compare the SCD GA service at University College London Hospitals NHS Foundation Trust (UCLH) to the guidance and evaluate the service provided.

Methods: A retrospective audit and service evaluation was conducted on the 78 SCD patients who had undergone GA at UCLH between 01 January 2022–31 December 2022. Data was collected on domains from the new guidance, as well as on service users, multi-disciplinary team involvement and processes followed.

Results: -100% compliance on completion of anaesthetic pre-assessment, taking of radiographs and presence of suitably trained staff.

-91% documented rationale for GA, with 78% due to sedation not being possible.

-95% of service users had learning disabilities.

-97% documented post-operative instructions and completion of a venous thromboembolism risk assessment.

-Only 51% of records documented providing a pre-procedural leaflet.

-Pre-medication was used in 78% of cases and 50% had gas induction.

-Service users ranged from 16-66yrs. Nearly 50% were 18-29yrs.

-Examples seen of holistic care under GA, with different specialty involvement as co-morbidities required, such as Gynaecology.

Conclusions: GA in SCD supports delivery of dental care for patients who are unable to accept treatment by other means, such as those with severe learning disabilities. UCLH delivers a largely compliant service that utilises a multi-disciplinary team approach. Further development will enable the service to continue to meet the demands of the population, with more research needed nationally and internationally on SCD GA for patients with additional needs.

CONTROL ID: 3938627
TITLE: First fluoride releasing/rechargeable material for removable partial denture clasps.

AUTHORS/INSTITUTIONS: M. Sulaiman, M. Patel, N. Karpukhina, A. Agha, Oral Bioengineering, Barts and the London School of Medicine and Dentistry, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|M. Sulaiman, School of Dental Sciences, Health campus, Universiti Sains Malaysia, Kota Bharu, MALAYSIA|

ABSTRACT BODY:

Objectives: New caries tends to develop around the abutment teeth that are in contact with the denture clasps, with incidence of new caries of 60% for abutments after 2 years compared to 14% of non-abutment teeth. This study investigated the incorporation of 2:1 ZnAl and 2:1 MgAl Layered Double Hydroxide (LDH) in acetal resins to render them as fluoride rechargeable materials, to be used for the fabrication of denture clasps.

Methods: 10% weight of 2:1 ZnAl and 2:1 MgAl LDH were incorporated into acetal resin, respectively. Acetal resin pellets were injection moulded with the LDHs to produce the samples. 3 samples of each LDH-acetal resin measuring ~10x10x1mm were charged with 15ml of 0.1M sodium fluoride (NaF) solution for 48h and transferred to deionized water (DW). Fluoride release/re-release was measured every 24h for 1 week using ion-selective electrodes. DW was replaced daily and samples were recharged with 15ml of 0.05M NaF solution for 6h on day 3 and day 5. Samples were characterised using X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FTIR) before and after 3 absorption-release cycles.

Results: Both LDH acetal resins were able to absorb and release fluoride. The mean fluoride release in 7 days from 2:1 MgAl-acetal resins (0.497 ± 0.814ppm) was greater than 2:1 ZnAl-acetal resin (0.126 ± 0.186ppm). The LDH structure within the newly incorporated materials remained throughout the various stages of fluoride absorption and release cycles, as confirmed by findings from XRD and FTIR.

Conclusions: LDH-acetal resins have the potential to absorb and release fluoride repeatedly. These findings with novel LDH-acetal resins can lead to the development of this material as denture clasps, to minimize the risk of dental caries around abutment teeth.

CONTROL ID: 3938631

TITLE: Potassium Iodide Remineralisation with Silver Diammine Fluoride Characterised using 19F-NMR

AUTHORS/INSTITUTIONS: M. Kaur, F. Wong, P. Anderson, S. Shahid, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The application of Potassium Iodide (KI) following silver diamine fluoride (SDF) decreases the black staining of silver metal. The aim of this in vitro study was to compare and characterise chemical modifications of previously demineralised hydroxyapatite (HAp) treated with either SDF, or, SDF and KI, after remineralisation at clinically relevant time points using ^{19}F-MAS-NMR

Methods: 2g HAp powder (Plasma Biotal) was immersed in 10ml 0.1M acetic acid solution pH 4.0 and placed in a shaking-incubator at 37C for 2h. The demineralised HAp was washed, then dried for 24h at 37C. Demineralised HAp powder was divided into 4 parts 0.5g each. Two parts were mixed with 0.5ml 38% SDF (Riva Star, silver bottle, SDI, Australia) for 1 min and then air dried for 3 min. The other two parts were mixed with SDF then 0.5ml KI ((Riva Star, green bottle, SDI, Australia) for 1 min and then air dried for 3 min. All parts were then immersed in 10ml remineralisation solution (0.222g $CaCl_2$, 0.163g KH_2PO_4, 8.7g NaCl, pH7.0) separately and placed in a shaking-incubator at 37C. The samples were collected and dried for 19F-MAS-NMR analysis after 30min. and after 1h.

Results: 19F-MAS-NMR Spectra showed for SDF only peak positions indicating similar formation of calcium fluoride at both 30 min. and 1 h remineralisation, but no fluoride substituted hydroxyapatite (FSHA). For SDF+KI HAp showed formation of FSHA at both 30 min. and 1 h, but no calcium fluoride.

Conclusions: Treatment with SDF and KI not only helps to decrease the staining of the carious lesions but also promotes the formation of FSHA compared to SDF alone.

CONTROL ID: 3938833

TITLE: Developing and Validating an Antimicrobial Stewardship Educational Pack Based on Audit Outcome

AUTHORS/INSTITUTIONS: N. Seoudi, Senior Clinical Lecturer in Oral Microbiology, Centre for Oral Immunobiology and Regenerative Medicine, Queen Mary University of London, London, UNITED KINGDOM|K. Alakkam, Department of Oral Medicine, Institute of Dentistry, Queen Mary University of London, London, --None--, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The risk of antimicrobial resistance (AMR) has escalated, and there are fears that we will soon live in a post-antimicrobial world if no immediate action is taken. It is estimated that the death due to AMR may reach 10M annually by 2050, which is higher than the total fatality caused by the COVID-19 pandemic (Dec 2019-May, 2023: 6.9M). Overall, general dental practitioners contribute to about 10% of all antimicrobial prescribing in the NHS and all its consequences. Therefore, adhering to best prescribing practices is essential to reduce patient and public deleterious effects. Aim: To develop and validate an evidence-based educational antimicrobial stewardship pack guided by the learning points identified from two audit cycles.

Methods: The data from two audit cycles (2018 and 2020) were retrospectively analysed to identify learning points. An educational pack was developed with pre- and post-assessment surveys addressing the identified main prescribing faults. This pack was developed in two variants: classroom and online tools. The classroom tool was trialled with year 4 and 5 dental undergraduate students to identify its efficacy in improving their knowledge.

Results: Eight learning points were identified from the audit on the appropriate use of antibiotics to treat different types of oral infections and to prevent surgical site infections. The educational pack significantly improved the knowledge of students, especially concerning the timing of prophylaxis antibiotics when required (from 36% to 98%), the importance of microbiology sampling (from 10% to 93%), and the importance of review protocol (from 10% to 100%).

Conclusions: This project presented an example of utilising an audit's learning outcomes to develop an evidence-based targeted education tool to improve the knowledge and attitude on the best antibiotic prescribing practice.

CONTROL ID: 3938997
TITLE: Discovery of a Human scFv against OMVs of Porphyromonas gingivalis.

AUTHORS/INSTITUTIONS: R. Chance, A. Mirza, A. Kang, Faculty of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|J. Aduse-Opoku, M. Curtis, Faculty of Dentistry, Kings College London, London, UNITED KINGDOM|L. James, Centre for Immunobiology, Queen Mary University of London, London, UNITED KINGDOM|A. Hashim, College of Dentistry, King Faisal University, Al-Ahsa, SAUDI ARABIA|

ABSTRACT BODY:

Objectives: Porphyromonas gingivalis (P. gingivalis), a highly virulent microorganism residing in subgingival tissues, exerts a significant influence on the pathogenesis of periodontitis. Its outer membrane vesicles contribute to the pathophysiology of this disease, which once established, remains irreversible. There is potential for leveraging biologic therapy involving antibodies as an adjunct to current treatment modalities, offering the dual benefits of enhancing management outcomes and mitigating associated systemic complications. Monoclonal antibodies represent a prominent class of drugs in the biopharmaceutical industry, with a significant number of them being generated using technologies such as hybridoma and phage display. These methods rely on cells or bacteriophages to facilitate the efficient production and selection of antibodies. Here we utilize ribosome display to demonstrate a cell-free and virus-free alternative for the in vitro selection of fully human therapeutic antibodies against periodontitis.

Methods: Our study harnessed the specificity and diversity of the human antibody response against the outer membrane vesicles (OMVs) of P. gingivalis to construct an immunoglobulin single-chain variable fragment (scFv) library for selection using a eukaryotic ribosome display system. The scFv library was assembled with a T7 promoter to allow a T7 polymerase complex drive the synthesis of mRNA transcripts for translation within a rabbit reticulocyte lysate. Post-transcriptional-translational complexes, consisting of coupled mRNA transcripts and nascent polypeptides of linked antibody variable domains, were selected for binding to OMVs.

Results: Over 590 post-selection IgG/lambda and IgG/kappa series were generated from a single round of ribosome display. These were purified on a small scale, characterised experimentally by in vitro assays, and complemented with computational analysis. The investigations led to the identification of a lead scFv candidate with in vitro activity against OMV virulence.

Conclusions: At low concentrations, the lead scFv candidate bound selectively to OMVs. This specific binding could potentially provide a clinical advantage by disrupting P. gingivalis pathology without altering the microbiome.

CONTROL ID: 3939091
TITLE: Time-Dependent Angiogenic Response to 45kHz Ultrasound

AUTHORS/INSTITUTIONS: L. Shriane, B. Scheven, R.M. Shelton, A. Walmsley, University of Birmingham, Birmingham, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Angiogenesis involves the differentiation, migration and proliferation of endothelial cells to develop new blood vessels which could aid in hard and soft tissue repair. The present study aimed to explore the effect of kHz ultrasound (US) on endothelial cell behaviour. The findings focus on the cells' ability to form tube-like structures in an in vitro Matrigel assay and changes in gene expression. Cellular response was analysed at different time points post treatment to establish if there was a time dependent effect.

Methods: Human umbilical vein endothelial cells (HUVECs, Promocell, Germany) were seeded in a 35mm dish. A DuoSon US therapy device (SRA Developments Ltd, Ashburton, UK) treated cells with 45kHz continuous wave US for 5 mins at varying intensities (10, 25 & 75mW/cm^2). Effects on tube formation ability were analysed by seeding 6.6×10^4 cells onto Matrigel-coated wells 72h post US. Images were captured 6h post seeding and analysed using the Angiogenesis Analyser in Fiji. Reverse transcription-quantitative polymerase chain reaction (RT-qPCR) identified expression changes of angiogenesis-related genes 24h and 72h post treatment.

Results: The tube-formation effect of US treated cells was determined as the percentage difference in number of nodes, complete tubes and total tube length of untreated cells (100%). No significant difference was seen between untreated and treated cells 72h post US. However low frequency 45kHz continuous wave US increased gene expression of angiogenesis-related genes. The expression of angiogenesis-related genes was higher in all treated groups compared with untreated cells although no significant dose-dependent effect was identified. The highest increase in gene expression was in PECAM-1 and VEGFA which were 2-fold higher in all treated groups compared with untreated cells.

Conclusions: The exposure of endothelial cells to low frequency ultrasound may have influenced angiogenesis in a delayed response up to 72h after exposure through gene expression changes. Consequently 45kHz US may affect the healing of hard and soft tissue up to 72h post treatment.

CONTROL ID: 3939570

TITLE: Force Measurement during Drilling Procedures for Operator Skills Assessment and Materials Characterisation

AUTHORS/INSTITUTIONS: A. Parr, W. palin, P. Tomson, G. Poologasundarampillai, M. Abdul Hadis, School of Dentistry, University of Birmingham, Birmingham, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Development of a method to measure force applied during drilling using an electric handpiece to assess material characteristics and clinical skills.

Methods: Cylinders (diameter 3mm, height 8mm) of Zinc Oxide (Kalzinol, Dentsply Sirona, US), Composite (Filtek-Supreme XTE, 3M, US), Flowable Composite (Filtek-Supreme XT, 3M, US), Amalgam (GS-80, SDI, Australia), Resin (BisGMA/TEGDMA, 60:40) were prepared (n=10). Extracted permanent molars were selected following ethical approval (BCHCDent048.2024) and divided into two groups: no preparation and sectioned to expose dentine (n=10). Typodont groups included Frasaco (Frasaco GmbH, Germany) and Bilkim (Bilkim, Turkey) (n=10).

Specimens were mounted onto a static load cell (Instron +/- 100N 45804) connected to a Universal Testing Machine (Instron 5544, Works US). An NSK Ti-Max Z95L handpiece (NSK, Japan) was run at 200000rpm using a NSK Surgic XT Plus motor (NSK, Japan). Operators included dentists (n=3) and non-clinicians (n=3) with instructions but no experience of dental drilling. A 3mm vertical cut was made using a diamond 3mm fissure bur (Henry Schein, US). Specimens were painted black and randomised. The force (N) applied during drilling was recorded in real time. Area under and gradient of the time/force curve in the loading phase was analysed. Multivariate analysis of variance (ANOVA) and post hoc Tukey comparisons ($p<0.5$) was used to assess the interactions between operators and materials.

Results: Two-way ANOVA confirmed differences in material characteristics and operator experience ($p<0.05$). Statistically significant difference was apparent in the amount of force required between specimens, with zinc oxide requiring the least (1.11N +/- 0.32) and extracted unprepared tooth requiring the most (3.80N +/- 0.42).

Conclusions: The development of a reliable method could be useful to assess clinical skills and for the characterisation and development of materials with more realistic feedback to natural tissues. Further work is required to increase sample size and to determine the sensitivity of the method.

CONTROL ID: 3939695

TITLE: Trigeminal Nerve Injury: Review of Cases in Somerset NHS Trust

AUTHORS/INSTITUTIONS: S. Mann, A. Bawor-Omatseye, M. Pino-Dos-Santos-Cabral, G. Merrick, Oral and Maxillofacial Surgery, Musgrove Park Hospital, Taunton, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To review Trigeminal Nerve Injury (TNI) incidence following lower third molar extractions in the Oral and Maxillofacial Department at Musgrove Park Hospital and to assess compliance with the local TNI management protocol.

Methods: Data was collected from June 2021 to December 2022 of TNI recorded in the Morbidity and Mortality reporting system. All lower wisdom teeth extractions carried out at Musgrove Park Hospital and Yeovil District Hospital under local anaesthetic and general anaesthetic, were included.

Results: A total of 252 lower wisdom teeth were extracted during this period. Twelve cases of TNI were reported; five were lingual nerve injury (two of which involved both sides), three involved the inferior alveolar nerve (IAN) and four involved both the IAN and lingual nerves. In addition to paraesthesia, one patient had loss of taste and three experienced intermittent pain.Treatment involved bone removal and tooth sectioning and two cases involved simple elevation. There was no documentation of lingual nerve protection in eight cases.

At 4-months post-operatively, symptoms had completely resolved in 16.7% of patients. One patient showed no improvement, requiring microscopic decompression of the lingual and IAN with steroid injection and now having significant recovery in sensation 5-months post decompression. The remaining patients had paraesthesia localised to a small area of the lip or chin.

There was good compliance with the protocol for TNI and pharmacological management, involving treatment with steroids, NSAIDs, Vitamin B complex and omeprazole.

Conclusions: Our incidence for TNI was 4.76%. A proforma to standardise the assessment and record keeping of TNI has been developed and compliance will be audited. Consent forms will be standardised amongst clinicians so that patients are informed about all the potential risks involving oral surgery procedures.

CONTROL ID: 3939733

TITLE: Establishing a scientific evidenced-base for paradigm shifts in root canal therapy.

AUTHORS/INSTITUTIONS: S.S. Bhandari, J. Camilleri, Endodontics and Applied Materials, University Of Birmingham, Birmingham, UNITED KINGDOM|S. Kuehne, Oral Microbiology, University Of Birmingham, Birmingham, UNITED KINGDOM|W. palin, Biomedical Materials Science, University of Birmingham, Birmingham, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Irrigating solutions are used during root canal therapy to reduce the bacterial burden and get the dentin ready for the sealer interaction. The aim of this research was to choose the most effective irrigation technique which provides an ideal dentine substrate for hydraulic cement sealer (HCS) interaction at dentine sealer interface during obturation. In addition, the effects of irrigation on the antibacterial characteristics of dentine and HCS sealers and the tooth to sealer interaction at the interface was also investigated.

Methods: AH Plus, BioRoot RCS, BioRoot Flow and TotalFill sealers were investigated after irrigating with 1) NaOCl–EDTA 2) NaOCl+HEDP 3) Distilled water. Alterations at dentine sealer interface was assessed by scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS) and Fourier transform infrared (FT-IR).Changes in antimicrobial properties of dentine and sealer was assessed by direct contact test

Results: Hydraulic cements reduced the intensity of the phosphate peak compared to sound dentine at the transition area of the sealer-dentine interface, while the intensities of the calcium silicate hydrate peak were reduced gradually towards dentin. The different irrigation protocols resulted in changes to the Si and Zr at the interface and this varied with sealer type. Overall calcium content increased while progressing from material to dentine. AH Plus did not show much difference at the interface with any irrigant groups. AH Plus demonstrated the least antibacterial activity ($p < 0.05$) for all types of irrigation regimes. Compared to other irrigation groups, the sealers with NaOCl-EDTA irrigation showed the greatest amount of bactericidal action.

Conclusions: For optimal material adaptation to dentin at the sealer-dentin interface, the HCS sealers, unlike the AH Plus, did not rely on chelator irrigating solutions. All of the sealers showed a reduction in their antimicrobial effect in contact with irrigated dentine.

CONTROL ID: 3939920
TITLE: Digital Analysis of Oral Dysplasia to aid Early Cancer Detection

AUTHORS/INSTITUTIONS: H. Mahmood, Academic Unit of Oral & Maxillofacial Surgery, School of Clinical Dentistry, University of Sheffield, Sheffield, UNITED KINGDOM|N. Rajpoot, Department of Computer Science, University of Warwick, Coventry, UNITED KINGDOM|A. Khurram, Department of Oral & Maxillofacial Pathology, School of Clinical Dentistry, University of Sheffield, Sheffield, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Oral epithelial dysplasia (OED) carries an increased risk of malignant transformation to squamous cell carcinoma, which is amongst the leading cancers worldwide. Histopathological diagnosis and grading of OED is challenging with unreliable behaviour and progression prediction. We investigate whether Artificial Intelligence (AI) and digital quantitative analyses can improve OED diagnostic accuracy and reveal novel predictors of transformation.

Methods: A retrospective sample (2008-2013) of OED, non-dysplastic and cancerous tissue was digitised, and five-year follow-up data collected. Individual architectural and cytological histological features were assessed and correlated to clinical information to develop cancer-risk scoring models (n=109). Novel morphological features pertaining to cells, nuclei and cytoplasm in OED were quantitatively analysed, and a multivariable model predictive of malignant transformation developed (n=100). AI algorithms were developed for automatic detection and analysis of OED (n=150-250). Algorithm performance was evaluated and externally validated, and feature-specific prognostic associations determined. Ongoing work exploring spatial biomarkers in OED is currently being conducted.

Results: Several conventional histological features were significant for transformation ($p < 0.036$) and recurrence ($p < 0.015$). Novel feature exploration demonstrated grade-based differences for cytoplasmic eosin, nuclear eccentricity and circularity in basal epithelial cells of OED ($p < 0.05$). Nucleus circularity was associated with OED recurrence ($p = 0.018$) and epithelial perimeter associated with malignant transformation ($p = 0.03$). The developed multivariable model demonstrated superior predictive potential for malignant transformation and recurrence (AUROC 0.77, 0.74, respectively) compared to conventional OED grading (AUROC 0.68, 0.71, respectively) supported by external validation. The developed AI models demonstrated promising ability for automated dysplasia detection (accuracy 0.80).

Conclusions: This research reveals new insights into OED progression to malignancy, with correlations between individual OED histological features and prognosis for the first time on a multicentre cohort.

CONTROL ID: 3940181

TITLE: Evaluating Buccal and Occlusal Polished Enamel Surfaces Following Erosion and Abrasion

AUTHORS/INSTITUTIONS: A. Almansour, D. Bartlett, O. Addison, king's college london, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: This study aimed to compare step height change from polished buccal and occlusal surfaces following erosion/abrasion to investigate if surfaces respond differently to erosive tooth wear.

Methods: Human enamel teeth (n=20) were cut from the coronal aspect of previously extracted molars and covered by existing ethical agreements. The samples were randomly divided into two groups, buccal and occlusal (n=10). Both groups were treated with 0.3% citric acid at pH 2.7, fully immersed and stirred at 62 rpm for 10, 20, 40, and 60 minutes. 240 strokes abrasion was carried out after each erosion cycle using non-fluoridated toothpaste with a reciprocating toothbrushing machine. The mean step height was measured using confocal non-contact white light laser profilometry using ISO standards.

Results: The mean step height increased progressively with time. The mean (SD) from the occlusal surface was 3.7 μm (0.6), and from the buccal surface, 3.5 μm (0.4), and this difference was not statistically significant at 10 min. This increased to 10.1 μm (1.2) and 9.7 μm (0.7) at 20 min, 21.8 μm (1.6) and 20.9 μm (1.3) at 40 min, with no statistically significant difference between the data. However, at 60 min, the occlusal surfaces exhibited a significantly higher mean step height compared to the buccal surfaces of 32.9 μm (2.8) and 31.1 μm (1.8), respectively (p = 0.02).

Conclusions: The occlusal surfaces showed a significantly higher mean step height at 60 minutes compared to the buccal surfaces. These findings emphasize the importance of considering both buccal and occlusal surfaces when evaluating tooth wear in in-vitro studies of erosion and may provide evidence that these surfaces have different erosive/abrasive behaviour.

CONTROL ID: 3940202
TITLE: The Remineralisation Properties of a Fluoride Bioactive Glass Containing Composite

AUTHORS/INSTITUTIONS: M. Tiskaya, S. Shahid, R. Hill, Oral Bioengineering, Queen Mary, University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Secondary caries due to polymerisation shrinkage and marginal gap formation is the most common cause of failure for resin-based composites. The aim of this study was to investigate the remineralisation properties of a novel fluoride bioactive glass-containing composite to prevent secondary caries.

Methods: Composite discs containing 75 wt% BAG fillers (BGC) were prepared (10mm x 1.2mm) and immersed into artificial saliva at pH7.0 (AS7) and pH4.0 (AS4) for up to 12 months. An inert composite (TP;Tetric Powerfill, Ivoclar Vivadent) was used as a control. At each time point, discs were removed from the media, dried, and characterised using ATR-FTIR, XRD and SEM. The respective supernatant solutions were characterised using ICP-OES, ISE and a pH meter to quantify the ion release and pH changes. The remineralisation was also assessed on extracted molars with an artificial caries lesion using X-ray microtomography (XMT) upon immersion for up to six months.

Results: ATR-FTIR and XRD detected the formation apatite upon immersion for BGC, which increased over time. There was a greater release of therapeutic ions (F^-, Ca^{2+} and PO_4^{3-}) and increase in pH in AS4 compared to AS7 and the oscillations in the ion release profiles suggest release and consumption to form fluorapatite. SEM indicated apatite precipitation on the cross section upon immersion as well as glass degradation close to the surface of the disc. XMT line profiles suggested an increase in mineral density at the carious lesion, suggesting remineralisation. TP did not show any evidence of remineralisation.

Conclusions: BGC presented the ability to release beneficial ions and neutralise the acidic pH to prevent acidophilic bacteria penetration. The apatite layer formed could potentially remineralise hard carious lesions, making BGC attractive for atraumatic restorative treatment as well as providing protection against secondary caries.

CONTROL ID: 3940612

TITLE: Synergistic Influence of Poly-Gamma-Glutamate and Fluoride on Hydroxyapatite Demineralisation

AUTHORS/INSTITUTIONS: F. Mai, R. Hill, M. Tiskaya, F. Wong, Institute of Dentistry, Queen Mary, University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Polygamma glutamate (PgGA) and fluoride are thought to be synergistic in preventing caries. This study explores the synergistic effect on hydroxyapatite (HA) discs with a dose ranging study. Furthermore, exploring its suitability in a sustainable PgGA toothpaste tablet.

Methods: PgGA was obtained from Natto Biosciences and used to create toothpaste tablet formulations with 1450 ppm F^- sodium fluoride (NaF): 0% PgGA (control), 1% PgGA, 1% PgGA + NaF, and NaF only. HA discs (20% porosity) were immersed in deionised water for 30 minutes. Each toothpaste tablet formulation was then immersed in 20 mL deionised water until dissolved. Discs were then treated with the mixtures for 2 minutes and shaken to stimulate toothbrushing action. The discs were then transferred and exposed to 0.1 M acetic acid (pH 4.0) for three hours. Real-Time Ion selective electrodes (RTISEs) were used to measure the calcium ion release (demineralisation) every 60s. The rate of demineralisation was then determined. The discs after treatment were analysed by Fourier Transform Infrared Spectroscopy (FTIR).

Results: PgGA combined with NaF showed synergistic properties towards inhibiting demineralisation. RTISEs showed that the rate of demineralisation of HA, measured by calcium ion release, was reduced for group 1% PgGA + NaF from 0.02 m/mol to 0.0009m/mol (by a factor of 20) compared with the NaF only group. The PgGA only group was only half as effective as 1% PgGA + NaF group. Theory suggests that PgGA works similarly to salivary statherin which forms a protective coating on the enamel surface, thereby inhibiting decay. This is supported by our FTIR data that shows binding PgGA to the hydroxyapatite.

Conclusions: PgGA in combination with fluoride is an effective inhibitor of HA demineralisation, thereby preventing caries. Thus, incorporating fluoride in PgGA toothpaste tablets will have the potential to be a sustainable and cost-effective mode of delivering preventive care.

CONTROL ID: 3940668

TITLE: Repurposing Approved Chemotherapeutics For Counteracting Chemoresistance In HNSCC

AUTHORS/INSTITUTIONS: M. Teh, Centre for Oral Immunobiology and Regenerative Medicine, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|K. Alkurdi, A.R. Tappuni, Department of Oral Medicine, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Due to its high prevalence and mortality rates, head and neck squamous cell carcinoma (HNSCC) remains a serious health problem worldwide, with drug resistance accounting for 40% of treatment failures. The capacity of tumours to acquire resistance to treatment therapies is one of their key traits. FOXM1, a transcription factor, is a gene that has been shown to be involved in human oncogenesis since 2002. This project investigated a chemical library consisting of synthetic and naturally occurring compounds in HNSCC cell lines in the aim to identify the most effective anticancer drugs that could counteract chemoresistance by antagonising FOXM1 expression

Methods: A total of 537 drugs were obtained from the Developmental Therapeutics Program at the National Cancer Institute, USA. Of these, 16 drugs were shortlisted prior to commencing the current study based on their proven effectiveness against cancer. Dose-response assay was performed to investigate their potency using crystal violet cell viability assay in 11 human cell lines consisting of normal, premalignant and HNSCC cell lines. The most potent drugs with the least toxicity towards normal control cells were selected to investigate their effect on FOXM1 gene expression using reverse transcription quantitative PCR.

Results: Vincristine, lanatoside A and topotecan were found to be the three most potent and anti- proliferative drugs on HNSCC cell lines with the least toxicity on normal cells. Lanatoside A was the most effective drug for a paclitaxel resistant cell line. All three drugs significantly suppressed FOXM1 gene expression levels in all HNSCC cell lines.

Conclusions: Our results showed that the level of FOXM1 expression before and after drug exposure, may potentially be an independent prognostic marker for chemoresistance in HNSCC. This study also provided evidence for Vincristine as an anti-cancer drug for HNSCC and Lanatoside A for counteracting chemoresistance, therefore providing a treatment option for recalcitrant cancer cases.

CONTROL ID: 3940779
TITLE: Interactions Between Oral Nitrate-Reducing and Sulphur-Metabolising Bacteria

AUTHORS/INSTITUTIONS: A.F. Alshammari, Department of Oral Medicine, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|A.F. Alshammari, Department of Basic Dental and Medical Science, University of Hail, Kindgom of Saudi Arabia, Hail, SAUDI ARABIA|A.S. Stephen, R. Allaker, Centre for Oral Immunobiology and Regenerative Medicine, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|N. Seoudi, Senior Clinical Lecturer in Oral Microbiology, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The oral microbiota plays a key role in the aetiopathogenesis of periodontitis. Whereby, nitrate-reducing bacteria (NRB) are associated with oral health, whereas sulphur metabolising bacteria (SMB) are associated with periodontitis. While the interplay between NRB and SMB within the oral cavity is recognised, the impact of higher order interactions between these on oral health remains to be characterised.

Methods: All possible combinations of Porphyromonas gingivalis, Veillonella dispar, Actinomyces naeslundii and Streptococcus mutans at identical initial cell densities were cultured anaerobically with L-cysteine or potassium nitrate supplemented Brain Hearth Infusion broth. Nitrate-reductase and cysteine-desuflhydrase activities were assessed through colorimetric assays, and nitrate reductase gene expression (narG and narH) in A. naeslundii and V. dispar was measured using RT-qPCR.

Results: Synergistic but not additive interactions were observed in the H_2S production by co-cultures of P. gingivalis, A. naeslundii and V. dispar, with inhibition by S. mutans except with V. dispar. Synergistic and multiplicative interactions were observed in the nitrate reductase activity of A. naeslundii and V. dispar under nitrate supplementation. P. gingivalis or S. mutans in co-cultures with the NRB significantly enhanced or inhibited this activity respectively, while combining P. gingivalis and S. mutans together with both NRB species, restored the nitrate reductase activity. Gene expression data indicated that narG and narH expression were elevated in co-cultures compared to monocultures, however the expression was comparable across different combinations including with S. mutans.

Conclusions: These data suggest that nitrate supplementation can enhance expression of nitrate reductases in NRB, however nitrate reduction may depend on other biotic or abiotic factors in the oral cavity. Strategies to increase nitrate reduction in the oral cavity to maintain or improve oral health should therefore consider ecological interactions prevalent in the oral niches.

CONTROL ID: 3940819

TITLE: A Single Cell and Spatially-resolved Atlas of the Mouse and Human Oral Cavity

AUTHORS/INSTITUTIONS: B. Matuck, Q. Easter, K. Byrd, Lab of Oral & Craniofacial Innovation, Department of Innovation & Technology Research, ADA Science & Research Institute, Gaithersburg, Maryland, UNITED STATES|D. Pereira, R.A. Ibrahim, A. Caetano, I. Sequeira, Institute of Dentistry, Queen Mary University London, London, UNITED KINGDOM|K. Tyc, Department of Biostatistics, Virginia Commonwealth University, Richmond, Virginia, UNITED STATES|M. Kasper, Karolinska Institutet, Stockholm, SWEDEN|A. Predeus, S. Teichmann, Sanger Institute, Cambridge, UNITED KINGDOM|B. Warner, Salivary Disorders Unit, National Institute of Dental and Craniofacial Research, National Institutes of Health, Bethesda, Maryland, UNITED STATES|H. Oral & Craniofacial Bionetwork, Human Cell Atlas, Cambridge, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The oral cavity acts as the gateway to the respiratory and digestive tract, and is in continuity with the skin, sharing several of its features and structure. The oral cavity consists of various specialised niches, such as the labial and buccal mucosae, salivary glands, periodontium, palate, tongue, with different functions. However, our understanding of the cell subpopulations heterogeneity, communication and spatial pattering across distinct niches is currently limited.

We aim to create the first Oral Cell Atlas and define the cellular and spatial heterogeneity across the different niches of the oral cavity for both mouse and human (part of the Human Cell Atlas).

Methods: We use state-of-the-art multi-omics technologies to create a reference atlas across several niches of oral cavity. Using computational tools, we: (1) generated new single-cell RNA sequencing datasets from mouse neonatal and adult oral niches; (2) integrated available and newly generated single-cell RNA sequencing datasets from 10 niches of the human adult healthy oral cavity; (3) inferred cell-cell communication by receptor-ligand analysis, and (4) established geographical locations using RNAscope, multiplex immunofluorescence and single-cell in situ transcriptomic multiplex imaging.

Results: Each distinct niche (i.e., buccal mucosa, tongue, gingiva, palate, gland) contained >20,000 cells, allowing for rare cell type discovery as well as harmonised cell annotation and cell type marker establishment. Comparison across niches and with other epithelia such as skin, identified shared and unique cell subpopulations and suggested niche-specific immune residency. Furthermore, we have uncovered a unique subpopulation of fibroblasts that may hold cues for the scarless behaviour of the buccal mucosa, when compared to skin.

Conclusions: This spatial single-cell compendium of the mouse and human adult oral cavity illustrates with unprecedented detail the heterogeneity of the oral tissues in health providing a comprehensive reference map of cells that will be a transformative resource for the research and clinical communities.

CONTROL ID: 3941305

TITLE: Association of Oral Health Impact with Psychosocial and Dentist-Patient Factors

AUTHORS/INSTITUTIONS: Y. Song, School of Dentistry, Seoul National University, Seoul, KOREA (THE REPUBLIC OF)|Y. Song, ARCPOH, University of Adelaide, Adelaide, South Australia, AUSTRALIA|

ABSTRACT BODY:

Objectives: Oral health is an essential component of overall health and well-being. In the biopsychosocial model of oral health, psychosocial factors and dentist-patient relationships (DPR) play a significant role in shaping oral health outcomes. This study aimed to examine the relationships between psychosocial factors, DPR, and oral health-related quality of life (OHRQoL) using a distal-to-proximal framework.

Methods: A random sample of 12,245 adults aged 18 years and above living in South Australia participated in the study. Data were collected through self-administered questionnaires in 2015-2016. Explanatory variables were categorized into psychosocial and DPR domains. The psychosocial domain consisted of well-being, social support, and health self-efficacy. The DPR domain comprised trust in dentists, satisfaction with dental care, and dental fear. The outcome variable was oral health impact, which measured OHRQoL.

Results: Data were analysed from 3,767 participants after screening and preparing responses (adjusted valid response rate 37.4%). Confirmatory factor analyses produced acceptable model fits and validity/reliability of each domain and full measurement model (GFI=0.95, CFI=0.98, RMSEA=0.04). The structural model in path analysis indicated trust was mediated by satisfaction (β=–0.14) and fear (β=0.19) for oral health impact. Well-being and self-efficacy had direct effects to the outcome with β=–0.12 and –0.07, respectively along with intermediate effects on DPR variables. The invariance of the final model was confirmed through cross-validation and multi-group analyses on participants' diverse characteristics except for the time since the last dental visit.

Conclusions: This study found the direct and indirect effects of psychosocial factors and DPR variables on OHRQoL in the conceptual framework. Psychosocial determinants are warranted for the promotion of health beyond clinical behaviour changes in the biomedical model.

CONTROL ID: 3942429

TITLE: A novel bioactive resin infiltrant for early enamel carious lesions

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ABSTRACT BODY:

Objectives: Resin infiltration is an effective microinvasive treatment for early non-cavitated enamel carious lesions. The current commercial material depends on complete infiltration and sealing of the lesion. As the material is non-bioactive, any leakage will lead to secondary caries formation. The aim of the present project was to develop a bioactive resin infiltrant with the potential of remineralization.

Methods: A fluoridated bioactive glass (FBAG), composed of silicon dioxide (SiO_2, 35.25 mol%), phosphorus pentoxide (P_2O_5, 5.75 mol%), calcium carbonate ($CaCO_3$, 43 mol%), sodium carbonate (Na_2CO_3, 6 mol%), and calcium fluoride (CaF_2, 10 mol%)), was prepared using a melt quench technique and milled to produce glass particles of 35μm. FBAG was mixed with an experimental infiltrant (EI, 80% triethylene-glycol dimethacrylate and 20% urethane dimethacrylate) at a weight% ration of 30:70 respectively. Ten human permanent teeth with artificial carious lesions on their proximal surfaces were infiltrated with this infiltrant. Five teeth were immersed in pH=4 while the other in pH=7 solutions. Calcium and fluoride ion release in both media were measured using an ion selective electrode and the pH was monitored using a pH meter. Readings were recorded over 12 weeks.

Results: Both calcium and fluoride release were higher in the acidic solution over the entire period than in the neutral solution. While the calcium concentration increased with time in both solutions, the fluoride ions decreased as pH increased in the acidic solution, indicating formation of calcium fluoride or fluorapatite.

Conclusions: The bioactive infiltrant has the potential to release beneficial ions to neutralize acidic challenge to return an environment that is suitable for remineralization.

CONTROL ID: 3942571

TITLE: 'Toothbrushing is out of the Game': Toothbrushing in Zaatari Camp

AUTHORS/INSTITUTIONS: D. Almegbil, B. Gibson, Oral Health, Dentistry and Society, University of Sheffield, Sheffield, South Yorkshire, UNITED KINGDOM|L. Mayblin, Department of Sociological Studies, University of Sheffield, Sheffield, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The aim of this study is to explore toothbrushing as a social practice in refugee camps.

Methods: This is a qualitative ethnographic study. Fourteen participants were recruited from Zaatari refugee camp in Jordan. The first stage of the study was conducted online using
WhatsApp through chatting and visual methods. The fieldwork stage included participant observation, interviews and shadowing. Data were then analysed using social practice theory.

Results: This study found significant 'discordance' between health-promoting and health-damaging environmental conditions for oral health in the camp. On the one hand, the 'activity-space' where toothbrushing is performed was challenging. The practice happened in different spaces (bathrooms or kitchens) within the shelter which conjure changes in bodily movement to accomplish the practice. Water politics, leading to its insufficiency, meant that water is a precious resource and toothbrushing competed with other water-consuming practices such as cooking and general cleaning. In addition, different school shifts for boys and girls in the camp created different daily routines for the two genders, including sleep time routines, making it harder for parents to incorporate toothbrushing as a daily habit. Finally, people have to buy oral hygiene products with scarce income that needs to cover other basic necessities including food.

Conclusions: Daily activities in Zaatari are shaped by the political context that has significant socio-material consequences. Toothbrushing aggregates with other practices in the camp such as cooking and general cleaning. This forms a nexus where changes in any of the elements of one practice, water for example, may affect the way toothbrushing is performed. This results in more people choosing to withdraw from the practice of toothbrushing. The study concludes that toothbrushing should be considered in the context of other daily practices in the camp to promote effective oral health programmes.

CONTROL ID: 3943791
TITLE: Multispecies Biofilm Model Associated with Noma Disease

AUTHORS/INSTITUTIONS: I.J. UZOCHUKWU, D. Moyes, J. Aduse-Opoku, G. Proctor, M. Ide, King's College London, London, Greater London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Noma is an acute necrotising periodontal disease with up to 90% mortality in children from developing countries. Malnutrition, poor oral hygiene, and immunocompromising conditions are common risk factors for Noma disease. Although studies show some uniqueness in the oral microbiome of Noma patients, the mechanism by which Noma progresses is not well understood. We previously highlighted microorganisms which are key to the pathogenesis; T. Denticola, P. Intermedia, and F. Nucleatum. A Noma-associated biofilm can be useful in studying the effects of risk factors on the disease progression. This work aims to assess a biofilm model using Noma-associated pathogenic bacteria.

Methods: T. Denticola, P. Intermedia, and F. Nucleatum were used to compare the mono-species, dual-species and poly-bacterial biofilm biomass and metabolic activity using Crystal violet staining and tetrazolium salt reduction assays. Ten variables of mono species, dual species, and poly-bacterial biofilms were tested to establish if a poly-bacterial Noma-associated biofilm model presents enhanced virulence.

Oral epithelial cell lines were infected with the biofilm models. Tissue damage and metabolic activity were measured by lactate dehydrogenase and ATP luciferin-luciferase assays. The infection was performed with all ten variables.

Results: Synergy in biofilm formation increased over the ten variables such that the highest formation and metabolic activity was observed in the poly-bacterial biofilms. The multispecies biofilm model increased Oral epithelial cells damage. Tissue damage was significantly lower when infection was carried out with single or dual species biofilms.

Conclusions: The Noma-associated biofilm can be used to study the microbial contributions and cellular mechanisms leading to Noma disease.

CONTROL ID: 3944224
TITLE: Molecular regulation of endothelial cell migration during tooth development

AUTHORS/INSTITUTIONS: H. asrar, center for craniofacial and Regenerative Dentistry, kings College London, London, --None--, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Background: During odontogenesis endothelial cells migrate to specific sites in the forming tooth to create the vasculature. Molecular regulation of this process is unclear, limiting the ability to create effective vascularised bio-engineered teeth, or to encourage revasculatisation of damaged dental tissues. We, therefore, analysed the mechanisms that control vascularisation during odontogenesis.

Methods: ethods: Blood vessel migration was mapped at pre-postnatal stages during mouse/human molar development using expression of CD31 as a label of endothelial cells. Conditional knock out mice were used to investigate the role of specific signalling pathways in migration.

Results:

Results: In both mouse and human, CD31+ve cells surrounded the dental follicle at the early cap stage but the central region of the dental mesenchyme was devoid of vasculature. By the bell stage endothelial cells had invaded the dental papilla, migrating towards the epithelial secondary enamel knots, surrounding the outer enamel epithelium and future cervical loops. During early differentiation, CD31+ve cells pushed through the basement membrane and populated the stellate reticulum (SR), eventually residing close to the newly differentiated ameloblast layer. Migration of endothelial cells was controlled by Vascular endothelial growth factor (VEGF), with VEGF expression localised to the enamel knots and SR. K14cresmoothened mutant, where hedgehog signalling is disrupted in the epithelium, blocked migration of CD31+ve cells into the SR. In this mouse, VEGF signalling was maintained but the outer enamel epithelium failed to remodel tight junctions, thereby preventing invasion of the vasculature.

Conclusions: Conclusion: Endothelial cells are able to penetrate the epithelium of the tooth to reach the ameloblast layer and so do not require a collapse of the stellate reticulum as previously reported. VEGF is an important signal attracting the vasculature into the tooth and controlling migration. Hedgehog signalling is important for breakdown of the outer enamel epithelium to allow endothelial cells to each the forming ameloblasts.

CONTROL ID: 3945337

TITLE: 'It's like being in a tunnel': Conceptualising the patient journey from tooth loss to living with removable dentures.

AUTHORS/INSTITUTIONS: B. Gibson, T. Broomhead, S.R. Baker, N. Martin, B. El-Dhuwaib, School of Clinical Dentistry, University of Sheffield, Sheffield, South Yorkshire, UNITED KINGDOM|G. McKenna, School of Medicine, Dentistry and Biomedical Sciences, Queen's University, Belfast, UNITED KINGDOM|A. Alavi, Global Medical Affairs, Oral Health, Haleon, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: There are few studies on the patient journey from tooth loss to rehabilitation with removable partial dentures (RPDs). The aim of this study was to conceptualise this journey to inform our understanding of patient-centred care.

Methods: Two partially dentate patient cohorts were included: (i) Denture wearers - Participants who had a RPD fitted within the last five years, and; (ii) Treatment journey - Participants going through clinical treatment for the provision of RPDs who were studied through a combination of direct clinical observations of the denture fitting process, debriefing interviews with patients and a follow-up focus group exploring the patient journey. Data were analysed drawing on grounded theory techniques with a specific focus on how successful adaptation to the new denture was achieved.

Results: Narrative interviews were completed with 20 participants of the denture-wearing cohort (11 males and 9 females, age range 22 to 86 years). Thirteen participants were included in the treatment journey cohort in two primary care settings: a general dental practice and student teaching clinics of a dental school (6 males and 7 females, aged 55 to 101). Data analysis revealed that tooth loss and recovery was described as being in an 'emotional tunnel' resulting from 'bodyphonic processes' associated with tooth loss. 'Bodyphonia' subsequently became the context for 'taking control' and 'managing disclosure' when living with a removable denture. Central to a successful trajectory is achieving a good fit. Different trajectories through this process can be readily observed with a range of processes influencing patient outcomes (i.e. previous experience, working knowledge, a good fit, the treatment alliance, negotiated compromises and bounded responsibility).

Conclusions: This study proposes an 'integrating framework' through which the examination of the patient journey into living with dentures can be achieved. The proposed framework integrates previous findings around tooth loss and recovery to develop an explicit pathway for future treatment.

CONTROL ID: 3945406

TITLE: Vickers hardness, flexural strength and modulus of 45S5 containing resin composites after short term water storage

AUTHORS/INSTITUTIONS: H. Zhao, X. Chen, Division of Dentistry, The University of Manchester, Manchester, UNITED KINGDOM|O. Tsigkou, Department of Materials, The University of Manchester, Manchester, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The aim of this project was to investigate the impact of 45S5 particle size and filler loading on the vickers hardness, flexural strength, and modulus of 45S5-containing resin composites after short term water storage.

Methods: Twenty-five experimental resin composites based on 35 vol% organic resin matrix and 65 vol% glass fillers (either 45S5 and/or inert glass) were prepared. Organic resin matrix contained 59.4 wt% UDMA, 39.6 wt% TEGDMA, 0.2% camphoroquinone and 0.8 wt% DMAEMA. Each groups contained 45S5 (0, 5, 10, 15, 20, 25 and 30 vol%) in 4 different particle sizes. The post cure vickers hardness, flexural strength and modulus of resin composites immediately, 1d, 2d, 4d and 1w in dry and water were measured using a microhardness tester (Future-Tech FM-700) and a universal testing machine (Zwick/Roell-2020, 500 N load cell) based on ISO 4049-2019, respectively (n=3). Difference between the results was analysed using one way ANOVA ($p < 0.05$) followed by Tukey's post hoc test.

Results: With the increasedparticle size or decreased loading of 45S5, the Vickers hardness of resin composites increased. The flexural strength decreased with increasing particle size or filler loading of 45S5. The flexural modulus increased with increasing filler size or/and decreasing filler loading of 45S5. The Vickers hardness of all resin composites increased during 1w post cure. However, the resin composites immersed in water exhibited lower Vickers hardness than these kept dry. No significant differences in flexural strength and modulus were observed on resin composites with immerision in water or dry.

Conclusions: Considerable differences in the Vickers hardness, flexural strength and modulus depend on different filler loading and/or particle size of 45S5 were found. The 45S5 containing resin composites immersed in water possessed lower Vickers hardness.

CONTROL ID: 3945775
TITLE: An in vitro co-culture model system for investigating host-pathogen interactions

AUTHORS/INSTITUTIONS: J.L. Brown, S. Alqahtani, M. Alshehri, Glasgow Dental School, University of Glasgow, Glasgow, UNITED KINGDOM|U. McDonnell, B. Moghaddam, D. Bradshaw, Oral Healthcare, Haleon, Weybridge, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The aim of this study was to investigate the effects of disease-state biofilm models on host cells following therapeutic interventions using in vitro organotypic co-culture systems.

Methods: A complex multi-species model representative of gingival inflammation (e.g., gingivitis) was used for the biofilm studies. Once mature, these biofilms were treated bi-daily with toothpaste alongside mechanical brushing, to mimic our recommended oral healthcare regimes. Following treatment, biofilm cells were exposed to oral keratinocyte cell lines and levels of inflammation were assessed using gene and protein expression profiling with qPCR and ELISAs, respectively. Host cells were also imaged with immunofluorescence.

Results: Bi-daily toothpaste treatment with mechanical debridement of the biofilm model systems reduced bioburden and cellular viability of the microbial consortia, compared to untreated controls. Consequently, biofilm treatment influenced the host response: repeat interventions had greater impact on reducing levels of inflammation in the oral keratinocytes, at a transcriptional and protein level. Gene expression and protein release of interleukin-8, a pro-inflammatory biomarker of the oral cavity, was increased following exposure of the cells to untreated biofilm cells. Such an inflammatory effect was alleviated with appropriate treatment regimes.

Conclusions: The use of in vitro models for investigating host-pathogen interactions are essential for testing of novel and conventional therapeutics in oral healthcare. Here we have demonstrated the use of a co-culture organotypic system for simulating bi-daily toothpaste and brushing interventions on a complex biofilm model.

CONTROL ID: 3945784

TITLE: Optimization of OCT Imaging for Dental Diagnosis

AUTHORS/INSTITUTIONS: N. Kazemigazestane, D. Mills, S. Rawlinson, Dental Physical Science, QMUL, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: This study will quantify the demineralization and remineralization processes by developing image analysis methodologies for use with X-Ray Microtomography (XMT) and Optical Coherence Tomography (OCT) outputs. This study will explore whether the OCT technique sufficiently sensitive, robust and accurate to generate clinically relevant data for assessing enamel erosion.

Methods: A spectral domain OCT (SD-OCT) system using a rapid scanning enabled high speed imaging of extracted teeth. Data denoising and augmentation was performed to obtain a large amount of less noisy training data in order to effectively learn. Different optimization methods were utilized to improve the accuracy of a convolutional neural network (CNN) classifier for diagnosing dental caries. Using high-definition high contrast time delay integration XMT as a gold standard for structural and mineralization measurements. This study highlights the performance of different optimization methods such Adadelta, AdaGrad, Adam and etc for deep CNN models with OCT images to detect dental caries.

Results: The attached images show three cracks on buccal view of a molar tooth that were detected via SD-OCT.

Conclusions: OCT shows the ability to visualize tooth abnormalities at early stage without the use of ionizing radiation. Apart from that, OCT provides 3D images and depth information, with the help of deep learning OCT may also demonstrate the morphological and optical changes in both sound and demineralized teeth almost similar to other advanced technologies, such as Micro-CT .

CONTROL ID: 3945871

TITLE: In Vitro Study on Citric Acid Erosive Lesions in Enamel

AUTHORS/INSTITUTIONS: H. Wong, T. Dyke, R. Cook, Mechanical Engineering, University of Southampton, Hampshire, Southampton, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: An in vitro study is carried out to examine and characterise enamel erosive lesions under citric acid treatments of varying concentrations, using surface morphology and nanomechanics. The study employed the use of profilometry, nanoindentation and SEM imagery, including not commonly used parameters, and intends to use this to inform the argument for citric acid treatment standards.

Methods: 15 bovine enamel samples were prepared and treated with citric acids of 1, 3, 10, 20 and 40 g/L. Each sample surface was divided into 5 strips, with each strip being treated for exactly 0, 1.5, 3.0, 4.5 and 6.0 minutes. Profilometry is used to extract the surface parameters of Ra, Rq, Rz, Rt, Rv, Rku and Rsk, as well as step height variation for each time strip. Subsequently, nanoindentation is done to evaluate the hardness and reduced modulus of each time strip, followed by SEM imaging to visually examine the surface roughening.

Results: While no significant etch patterns and surface roughening were observed, there is a strong relationship between citric acid concentrations with surface roughness and nanomechanics. Results showed that an increase in concentration and treatment time resulted in an increase in overall roughness and tissue loss, followed by reduction in hardness and modulus, which is directly linked to lesion growth.

Conclusions: While profilometric surface parameters excel in evaluating enamel tissue loss and surface roughness post acid treatment, it is not suitable for the characterisation of erosive lesion depths due to the presence of subsurface enamel lesions. Despite that, there is a strong relationship between nanomechanics and subsurface lesions. Hence, nanomechanical measurements are shown to be more useful in characterising erosive lesion.

CONTROL ID: 3945919

TITLE: Evaluation of Advance Dental Restorations with Conservative Endodontic Therapy

AUTHORS/INSTITUTIONS: H. Al-Omer, restorative, prince abdulrahman advanced dental institute, Riyadh, Riyadh, SAUDI ARABIA|

ABSTRACT BODY:

Objectives: Currently Bioceramics materials successfully support the vital pulp therapy on deep carious lesions. Therefore the superiority of available pulp preservation material has dramatically changed the prognosis of this procedure with indirect pulp capping, direct pup capping and partial pulpotomy.The fact that most of the teeth receive vital pulp therapy, necessitate extensive restorations due to the large and deep defects This clinical case series designed to investigate the clinical outcome of pulp preservation in posterior teeth with deep indirect pulp capping and direct pulp capping and partial pulpotomy on molar teeth, which restored with bonded ceramic onlay restorations and ceramic crowns.

Methods: 20 cases (male and female patients) with mean age of 40 years been treated, molar teeth with deep carious lesions and extensively defective previous restorations have received different vital pulp therapy procedures. Pulp capping with bioceramic putty or Parial pulpotomy then the canals orifices were sealed with bioceramic putty. Pulpal diagnosis of all teeth were diagnosed prior vital pulp therapy as reversible pulpitis. Teeth were randomly selected to be restored with ceramic crowns or ceramic onlay. All ceramic restorations were cemented with the same resin cement and same cementation procedure.

Results: for the duration of 2 years follow up all cases have not shown clinical or radiograpic deterioration. the pulp vitality of all molar teeth has been maintained with conservative endodontic approach and advanced aesthetic dental restorations

Conclusions: Succeful vital pulp therapy allow restorative dentist to restore fiunctions and esthetics of molar teeth with ceramic crowns and onlays

CONTROL ID: 3946010

TITLE: Candida albicans biofilm capacity reveals a commensal niche in oral caries.

AUTHORS/INSTITUTIONS: M.C. Butcher, C. Delaney, G. Ramage, University of Glasgow, Glasgow, UNITED KINGDOM|J. Pratten, D. Bradshaw, Haleon LTD, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The presence of Candida albicans has commonly been reported as a potential indicator or risk factor in the development of caries in children and adults. Typically commensal in nature, it has also been well established that the development of pathogenicity in Candida albicans is driven by environmental factors which lead to its overabundance or phenotypic switching to a more pathogenic hyphal morphology. While this has been found to aid in adhesion to oral surfaces, both biological and inert, it also provides a substrate and environmental niche for other micro-organisms.

In this study, we posit that alteration of Candida phenotype directly influences the microbial and cariogenic profile of a multi-species biofilm.

Methods: C albicans isolates with high and low biofilm phenotype were selected for co-aggregation assessment with other organisms of a previously published "caries" biofilm model and profiled based on biomass, metabolism, drug response and response to environmental stimuli such as sucrose. Multi-species biofilm models were grown on bovine enamel and assessed for shifting microbial profile, acidogenesis and alteration of substrate when exposed to environmental stimuli.

Results: C albicans was found to buffer pH profile of "caries" organisms in both dual and multi-species formats. Using sucrose as an environmental stimulus of multi-species biofilms resulted in both a shift in microbial distribution and a higher erosion profile in bovine enamel

Conclusions: We have shown Candida to provide a key role in the aggregation of non-commensal micro-organisms while also providing an obvious impact on the cariogenic profile of a multi-species biofilm model.

CONTROL ID: 3946101

TITLE: Key Interactions between Saliva and Novel Food Proteins in Astringency

AUTHORS/INSTITUTIONS: N. Tahsin, G. Carpenter, J. Garnett, Centre for Host-Microbiome Interactions, King's College, London, UNITED KINGDOM|R. Nicholson, Motif FoodWorks, Inc., Boston, Massachusetts, UNITED STATES|

ABSTRACT BODY:

Objectives: Determine whether protein-protein interactions important in the mechanism of astringency
Identify the key proteins in saliva with novel food proteins, deducing types of bonding. E.g electrostatic, hydrophobic, hydrogen bonding.

Methods: In the present study we aim to identify the key proteins involved in plant and dairy-induced astringency using non-reducing SDS-PAGE and deduce the effect of pH and sodium (NaCl) on astringency. This was achieved by collecting unstimulated whole mouth saliva and combining with food proteins under different conditions, chaging the pH and Na+ ion concentration. The protein distinctive protein bands of saliva and food were analysed in difference of band intensity. These were compared with the interaction between salivary proteins and non-astringent egg white albumin protein as a control. Sensory tests of protein solutions were tested by participants (N = 20) who marked on a 10-point scale their taste perception of astringency and bitterness.

Results: Results indicated that salivary proteins – MUC5B, MUC7, immunoglobulin A (IgA), cystatin and amylase, reacted with most food proteins, including the egg white albumin control. All salivary and food proteins had decreased in band intensity in acidic pH acidic buffers ($P < 0.0001$) and further decreased in sodium concentration (NaCl) ($P < 0.05$). However, MUC5B had increased in these conditions, suggesting a change in oxidation of glycosylation of the protein. In the sensory analysis, pea protein P870 was also perceived as the most astringent food protein.

Conclusions: This suggested that the binding mechanism of astringency involves a combination of hydrophobic, hydrogen, and possible electrostatic bonding. Food proteins in buffers below their isoelectric points (pI), had a stronger interaction with salivary protein. The degree of band intensity loss was greater compared with pH 7 buffers with and without NaCl. MUC5B - a highly glycosylated mucin protein, exhibited an opposite reaction to salivary proteins and the fewest interactions. The post-translational modifications of mucins and the level of oxidation to their glycosylation are key in their bonding interactions and their lubricative function. It is concluded that interactions alone do not explain astringency.

CONTROL ID: 3946841
TITLE: The Impact of COVID-19 on Hospital Admissions for Severe Dental Infection in England
AUTHORS/INSTITUTIONS: J.P. Fraser, D. Robertson, Restorative Department, Glasgow Dental Hospital, Glasgow, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To assess the effect of the COVID-19 pandemic on the number of NHS hospital admissions for significant dental infection in England.

Methods: Data on a hospital admission for dental infection was collected retrospectively, years 2018-2022 from NHS Digital website which annually updates information on admitted patient care activity in English NHS hospitals. Each hospital episode relates to a period of care under a single consultant, rather than the number of patients. The data was collected by searching codes from the number of 'Finished Consultant Episodes' for the diagnosis of 'Periapical abscess without sinus' (K04.7) and 'Periapical abscess with sinus' (K04.6) and for the procedure 'Drainage of abscess of alveolus of tooth' (F16.1). Management of a dental abscess could sometimes be secondary to another care episode. For the purpose of this study, we looked at where this was the 'Main Episode'. Data was free to access and download. The data for each was tabulated according to year.

Results: There was a steady increase in the procedure F16.1 from financial years 2018-2019 to 2019-2020, from 2788 to 3210 episodes. During the peak of the COVID-19 pandemic, 2020-2021, this dropped to 2175 episodes. From 2021-2022, it started to rise again to 2463.

Diagnosis of K04.7 and K04.6 pre pandemic were 11183 and 652, then 11568 and 750 the following year. This dropped to 8579 and 355 episodes during the pandemic then rose to 9839 and 544 the following year.

Conclusions: Despite all dental practices having been ordered to close their doors, the number of admissions for serious infection dropped through the pandemic. The government had a 'Stay at Home' policy and there was fear of contracting COVID-19 from hospitals, which could explain the anomaly to a previous notable trend of increase in hospital admissions for dental infection.

CONTROL ID: 3947390
TITLE: The Role of the Sports Dentist in the Sports and Exercise Medicine Team

AUTHORS/INSTITUTIONS: P. Fine, U. Mohammed, J.P. Haughey, Dept. of CPD, University College London, Eastman Dental Institute, London, Not Applicable, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The role of the Sports Medic in supporting elite athletes and the impact of poor oral health on athletic performance and systemic disease are well documented. The role of the Sports Dentist within the Sports & Exercise Medical Team is less clear. The aim of this study was to determine whether Sports Dentists should be an integral part of the Sports and Exercise Medicine Team.

Methods: This cross-sectional study adopted a mixed method approach, via online questionnaires and one-to-one interviews. Two bespoke questionnaires were designed: firstly for Sports & Exercise Medics (SEMs) and secondly for Sports Dentists (SpDs). The questionnaires enquired about: i) demographic details, ii) experience of working in sport, iii) the value of SpDs to SEMs and iv) the future role of SpDs.

Six personal interviews were undertaken, to increase the qualitative data and triangulate the findings Quantitative data was analysed descriptively; qualitative data was analysed thematically

Results: 46 SpDs and 44 SEMs completed questionnaires. 80% (n=35) SEMs agreed that SpDs can be an integral part of the team. 82% (n=36) SEMs felt that SpDs, are beneficial to the team. 75% (n=33) of SEMs valued the role that SpDs can/could play pitch-side; with 63% (n=29) SpDs repotered feeling valued as a team member. 67% (n=31) SpDs felt confident working alongside SEM team   .

Qualitative data indicated that SEMs were in favour of having SpDs involved. One respondent, commenting that SpDs involvement is "essential" on match days. SpD respondents raised concerns that their involvement was dependant on SEMs "engaging" with them.

Conclusions: Sports Dentists are recognised as an integral and valued member of the SEM team. A pitch-side role is seen to be more beneficial in sports where a higher risk of oro-facial injuries exists. Following further training, SpDs are considered an essential team member when dealing with advanced trauma.

TITLE: Dry Mouth Impacts on OHRQoL in diabetic patients

AUTHORS/INSTITUTIONS: A. Srikong, S.R. Baker, B. Gibson, School of Clinical Dentistry, University of Sheffield, Sheffield, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To examine the impacts of dry mouth on oral health-related quality of life (OHRQoL) in diabetic patients in Songkhla, Thailand utilising the Wilson and Cleary model as the guiding framework.

Methods: Two hundred and ten diabetic patients were included in the study. Data collection was by self-reported questionnaires collected via telephone interview including symptom and functional status, general health perceptions, psychological distress (depression and anxiety), sense of coherence, health locus of control and self-esteem. Clinical data retrieved from medical records included underlying diseases, medications, blood sugar levels and duration of diabetes, alongside demographic characteristics (age, sex, income, education level). Structural equation modelling (SEM) was used to analyse the direct and indirect pathways between the variables according to the Wilson and Cleary model.

Results: The main results were that worse symptoms status was linked to lower oral and diabetic-related functional status which, in turn, were linked to worse OHRQoL. The psychological variables (sense of coherence, health locus of control and self-esteem) played a key role at each stage of the model. Furthermore, polypharmacy and multimorbidity impacted on symptom and functional status.

Conclusions: The findings indicate that dry mouth impacted on daily lives of diabetic patients in a range of ways including eating, drinking, and socializing. Interventions targeted at reducing multi-morbidity, managing polypharmacy, and improving psychological adaptation were also found to be important suggesting potential avenues to minimize impact of dry mouth and improve quality of life.

TITLE: Assessment of Novel Remineralizing GIC and its Behaviour in Artificial Xerostomic Saliva

AUTHORS/INSTITUTIONS: R. Mansouri, S. Shahid, Institute of dentistry, Queen mary university of London, London, UNITED KINGDOM|R. Mansouri, Faculty of dentistry, King Abdulaziz University, Jeddah, SAUDI ARABIA|N. Karpukhina, School of medicine and dentistry, Queen mary university of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To formulate an artificial salivary composition that simulates xerostomic patient saliva based on a systematic review of the literature and to evaluate the mechanical properties, fluoride release, and remineralization potential of the experimental glass ionomer cement (GIC) containing apatite in normal and xerostomic artificial saliva (AS).

Methods: Based on a systematic search of the literature, AS was formulated to represent patients with xerostomia. The xerostomic and a non-xerostomic AS were used for the immersion of the experimental GIC and Fuji IX control cements. The experimental cements were made using three groups of Fluro-alumina-silicate glass with varied fraction of apatite induced on glass heat treatment (non-heat-treated, heat-treated at Tg+50, and heat-treated at Tg+80). Compressive strength and fluoride release of each group were tested at six-time points. MAS-NMR analysis was carried out on crushed cement powder.

Results: Cement samples of all formulations including the commercial had significantly higher release of Fluoride when stored in xerostomic saliva in comparison to non-xerostomic saliva across all time periods. The experimental cements with the Tg+80 heat treatment glass resulted in significantly higher compressive strength compared to the cements with non-heat-treated glass. In addition, the compressive strength of all experimental cement groups has mainly enhanced with time with the Tg+80 cements the compressive strength progressively increased at every long-term duration point. In ^{31}P MAS-NMR spectra of these cements substantial amount of apatite crystals was revealed which were present at all immersion points and the fraction of apatite phase did not decrease with time.

Conclusions: The cements with a substantial amount of apatite phase revealed the most beneficial properties that can be further optimized to the level of the commercial formulations. These experimental formulations will deliver improved remineralization in clinical applications particularly where it is most needed in high-risk xerostomic patients.

CONTROL ID: 3949465

TITLE: Characterization of a steerable single cell-based microrobot composed of SCAP with in-situ oxygen generation and neurogenic niche

AUTHORS/INSTITUTIONS: K. Chan, University of Hong Kong, Hong Kong, HONG KONG|

ABSTRACT BODY:

Objectives: The study aims to characterize a novel steerable single cell-based microrobot that was fabricated utilizing gelatin methacrylate (GelMA) hydrogel, calcium dioxide (CaO_2), brain-derived neurotrophic factor (BDNF), and magnetic iron oxide nanoparticles (MIONs).

Methods: A single stem cell from apical papilla (SCAP) was encapsulated into the magnetic BDNF-loaded CaO_2-GelMA hydrogel by applying the droplet microfluidic platform in which the pre-treated SCAP and hydrogel precursors were mixed with a photoinitiator to be the aqueous phase, and surfactant was added to mineral oil to form the oil phase. Subsequently, each droplet was polymerized by exposure to UV and a SCAP was encapsulated within magnetic BDNF-loaded CaO_2-GelMA hydrogel to form a steerable single cell-based microrobot.

Results: The microstructure of magnetic BDNF-loaded CaO_2-GelMA hydrogel was observed using SEM to confirm that it had a suitable shape and size. In addition, the capacity of oxygen release was detected by oxygen sensor meter indicating the CaO_2 was distributed among the GelMA hydrogel. Moreover, the biocompatibility of the MIONs, SCAP viability, and cytotoxicity of microrobot were examined by live/dead viability assays showing the SCAP to have high level of viability and proliferation. Furthermore, the results of immunocytochemistry revealed that the SCAP had expressed neurogenic biomarkers and differentiated into the neuronal lineage. Finally, the microrobot could also achieved safe, effective, and controllable locomotion when it was actuated within a microfluidic channel under an external magnetic field that was generated by the electromagnetic coil system.

Conclusions: This research has developed an advanced steerable single-cell microrobot which can transport therapeutic stem cells such as SCAP to a precise location, direct stem cells toward a pre-destined cell lineage, and support its survivability, proliferation, and differentiation.

CONTROL ID: 3949506

TITLE: Artificial intelligence for diagnostic processing of dental panoramic tomograms.

AUTHORS/INSTITUTIONS: C. Platais, J. Davies, B. Thomas, Department of Dental & Maxillofacial Radiology, Guy's and St Thomas' NHS Foundation Trust, London, UNITED KINGDOM|L. Jackson, H. Shuaib, Clinical Scientific Computing, Guy's and St Thomas' NHS Foundation Trust, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The dental panoramic tomogram (DPT) has an estimated frequency of 2.7 million exposures per year within UK primary care dentistry alone. DPTs are complex and clinicians are often unsure how to interpret incidental findings. The objectives of this work are: (1) To appraise the literature that describes artificial intelligence (AI) applications that diagnose disease on DPTs. (2) To develop and implement an AI-based clinical application that assists the diagnosis of disease presenting on DPTs.

Methods: Scopus, Medline and Web of Knowledge were systematically searched to retrieve records that describe the application of AI to diagnose diseases that present on adult DPTs between 2012-2022. 674 DPTs showing biopsy-proven disease and 505 normal controls were anonymised and used to develop a classification model. Performance was assessed with precision, recall and F1-score. A multidisciplinary team of clinicians and computer scientists defined user requirements, system requirements and potential hazards to develop a clinical application that deploys the classification model.

Results: 61 records were included in the review. These records applied AI to the diagnosis of jaw cysts and tumours (12), periodontal disease (9), caries (6), endodontic diseases (6), osteoporosis (5), soft tissue calcification (5), maxillary sinus disease (5), maxillofacial trauma (4), developmental anomalies (3), temporomandibular joint disease (3), osteonecrosis (1), dental implant failure (1) and multiple radiological findings (1). The included records described AI models that applied classification (72%), object detection (48%) and segmentation (21%) to diagnose disease, with some records involving multiple tasks. Our classification model performed with an F1-score of 0.9. Further details of the clinical application will be presented, pending review by our Trust Intellectual Property Team.

Conclusions: AI has the potential to address clinical demand for assistance in the interpretation of DPTs and could have a role in prioritisation of referrals for patients with significant disease.

CONTROL ID: 3949516
TITLE: Differential Binding Affinities of Saliva and Colostrum-Derived Secretory IgA
AUTHORS/INSTITUTIONS: J. yan, G. Carpenter, king's college london, London, UNITED KINGDOM|
ABSTRACT BODY:

Objectives: Previous research suggests that bacteria actively bind to salivary proteins to avoid being washed away by saliva. However, is it possible that salivary proteins, e.g. secretory IgA (SIgA), actively encourage the attachment of certain bacteria. This study aims to investigate the binding characteristics of SIgA derived from different sources, such as colostrum and saliva, binding to particles possessing varying charge properties. If discernible, potential conformational disparities in SIgA from different sources may facilitate selective binding to particular bacteria.

Methods: The primary focus of this study centers on evaluating the binding interactions between SIgA derived from colostrum and saliva and particles exhibiting disparate charge characteristics. Colostrum SIgA was procured from commercial sources, while salivary SIgA was isolated from whole mouth saliva via fast protein liquid chromatography (FPLC) and subsequently verified through western blot analysis. The SIgA samples were subjected to a one-hour incubation period with hydrophobic (polystyrene), positively charged (melamine resin), and negatively charged (silicon dioxide) disks, respectively. Following incubation, the samples were eluted using LDS sample buffer. Subsequently, the outcomes were assessed using SDS-PAGE, and the resulting intensities were recorded and analysis. This experimental procedure was performed three times to ensure reliability and reproducibility.

Results: The findings revealed that saliva-derived SIgA exhibited a higher affinity for binding with silicon dioxide disks compared to colostrum-derived SIgA.

Conclusions: The dissimilarities observed in the binding affinities between saliva-derived SIgA and colostrum-derived SIgA indicate potential variances in their charge properties, suggesting the presence of distinct structural characteristics.

CONTROL ID: 3949518

TITLE: Structure-function relationships of low molecular weight alginate oligosaccharide therapy

AUTHORS/INSTITUTIONS: M.F. Pritchard, L. Powell, J. Adams, G. Menzies, S. Khan, S. McKenna, N.J. Buurma, D. Farnell, K. Hill, D.W. Thomas, Cardiff University, Cardiff, UNITED KINGDOM|L. Powell, Swansea University, Swansea, UNITED KINGDOM|A. Tøndervik, H. Sletta, SINTEF, Trondheim, NORWAY|O. Aarstad, G. Skjak-Brak, NTNU, Trondheim, NORWAY|P. Rye, Algipharma, Sandvika, NORWAY|

ABSTRACT BODY:

Objectives: OligoG CF-5/20 is a low molecular weight alginate oligosaccharide (>85% G-blocks) that has previously been shown to possess both antimicrobial and antibiofilm properties, including potentiation effects with specific antimicrobial agents. Its mode of action is thought to involve disruption of calcium-DNA binding and dysregulation of quorum sensing (QS). To further investigate the role of calcium-binding and QS, structure/function relationships between G-blocks (OligoG) and M-block alginate oligosaccharides (OligoM) with comparable degrees of polymerization (DPn 19) were compared.

Methods: Molecular dynamics simulations (MDS) and isothermal titration calorimetry (ITC) were performed to investigate the binding of tailored alginate oligosaccharides with bacterial lipopolysaccharide (LPS). Planktonic assays of the alginate oligosaccharides with Pseudomonas aeruginosa using Fourier Transform Infrared spectroscopy (FTIR) and growth curves were used to investigate cell membrane binding and antimicrobial properties respectively. Confocal laser scanning microscopy (CLSM) of P. aeruginosa biofilms and QS assays using Chromobacterium violaceum were conducted to analyse differences in the antibiofilm properties of both alginates. Antibiotic potentiation of azithromycin was studied using a minimum inhibitory concentration (MIC) and biofilm assays.

Results: MDS and ITC revealed that OligoG exhibited stronger interactions with bacterial LPS than OligoM, although this difference was not mirrored by differential reductions in bacterial growth. Whilst CLSM showed that both agents demonstrated similar dose-dependent reductions in biofilm formation, OligoG exhibited a stronger QS inhibitory effect and increased potentiation of the antibiotic azithromycin in both MIC and biofilm assays.

Conclusions: This study demonstrates that the antimicrobial effects of alginate oligosaccharides are not purely influenced by Ca^{2+}-dependent processes but also electrostatic interactions that are common to both G-block and M-block structures. The potentiation of antimicrobial agents by naturally occurring oligosaccharides such as OligoG may represent a novel, safe adjunct to conventional therapy of oral conditions such as peri-implantitis.

CONTROL ID: 3949523

TITLE: In vitro topical antimicrobial activity of epoxy-tiglianes against oral pathogens

AUTHORS/INSTITUTIONS: W. Xue, M.F. Pritchard, S. Khan, L. Powell, J. Stokniene, J. Wu, N. Claydon, D.W. Thomas, K. Hill, Advanced Therapies Group, Cardiff School of Dentistry, Cardiff, UNITED KINGDOM|J. Stokniene, Drug Discovery Group, QIMR Berghofer Medical Research Institute, Brisbane, Queensland, AUSTRALIA|P. Reddell, QBiotics Group Ltd, Yungaburra, Queensland, AUSTRALIA|L. Powell, Microbiology and Infectious Disease Group, Swansea University Medical School, Swansea, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: With dental implant placement now routine, peri-implantitis has become a major complication affecting implant longevity. Peri-implantitis is characterised by biofilm formation and chronic inflammation at the implant-host interface, both of which resist mechanical and chemical displacement, making them challenging to treat. We recently described the antimicrobial epoxy-tiglianes (EBCs), which are diterpene esters derived from the Queensland blushwood tree, which were shown to not only target biofilm disruption (resolving infection) but also induced wound healing by stimulation of the innate immune response in chronic and diabetic skin wounds (doi:10.1126/scitranslmed.abn3758). EBCs may offer an important novel therapeutic approach in implantology.

Methods: In vitro antimicrobial testing of EBC structures (EBC-46, EBC-1013, EBC-147) against three important oral pathogens, Streptococcus mutans, Aggregatibacter actinomycetemcomitans and Porphyromonas gingivalis was performed using minimum inhibitory concentration, growth curves and permeabilisation assays. Antibiofilm activity was assessed using minimum biofilm eradication concentration (MBEC) experiments. Biofilm formation and disruption assays on plastic and titanium substrates were analysed using confocal laser scanning microscope, scanning electron microscopy and direct plate counting.

Results: The antimicrobial activity of the test compounds (EBC-1013 > EBC-46 > EBC-147) was directly related to significant membrane permeabilisation and growth inhibition ($p < 0.05$) against planktonic S. mutans and P. gingivalis. Furthermore, MBEC assays revealed potent antibiofilm activity, with biofilm formation assays of S. mutans, A. actinomycetemcomitans and P. gingivalis revealing significantly lower biomass volume and increased DEAD:LIVE cell ratio following EBC-1013 treatment ($p < 0.05$). In addition, biofilm disruption assays on titanium discs (EBC-1013 > EBC-46) induced significant biofilm disruption in both S. mutans and P. gingivalis ($p < 0.05$).

Conclusions: EBC-1013 is a semi-synthetic, epoxy-tigliane, which demonstrates antimicrobial potential for direct and indirect disruption of the biofilm in peri-implantitis. Phase I/IIa human clinical safety trials treating chronic wounds with the compound are planned to commence in late 2023.

CONTROL ID: 3949526
TITLE: Nanoscale Differences in the Outer Membrane of Antibiotic Resistant Bacteria

AUTHORS/INSTITUTIONS: M.F. Pritchard, J. Wu, K. Hill, E.L. Ferguson, D.W. Thomas, Advanced Therapies Group, Cardiff University School of Dentistry, Cardiff, UNITED KINGDOM|J. Davies-Jones, P.R. Davies, Cardiff Catalysis Institute, School of Chemistry, Cardiff, UNITED KINGDOM|L. Powell, L. Francis, Microbiology and Infectious Disease Group, Swansea University Medical School, Swansea, UNITED KINGDOM|H. Otaif, N.J. Buurma, Physical Organic Chemistry Centre, School of Chemistry, Cardiff, UNITED KINGDOM|Y. Yu, D.O. Andrey, Q. Yang, O.B. Spiller, Cardiff University, Department of Medical Microbiology and Infectious Disease, Division of Infection and Immunity, Cardiff, UNITED KINGDOM|P.R. Davies, M.A. Isaacs, HarwellXPS, Research Complex at Harwell, Harwell, UNITED KINGDOM|M.A. Isaacs, Department of Chemistry, University College London, London, UNITED KINGDOM|J. Beames, School of Chemistry, College of Engineering and Physical Sciences, Birmingham University, Birmingham, UNITED KINGDOM|T.R. Walsh, Ineos Oxford Institute of Antimicrobial Research, Department of Zoology, University of Oxford, Oxford, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The emergence of pan-drug resistant Gram-negative bacteria is currently one of the greatest challenges to global health and poses a threat to the prevention and treatment of surgical site infections in maxillofacial surgery. Nanoscale analysis of cell-membrane modifications is crucial to aid our understanding of antibiotic-outer membrane interactions and to develop effective antimicrobials to penetrate the bacterial cell envelope.

Methods: Key biochemical differences between Escherichia coli J53 and isogenic strains harbouring an mcr-1 (pE30) or mcr-3 (pWJ1) plasmid with modified lipid A moieties were investigated. Nanoscale analysis of cell morphology (atomic force microscopy) and surface properties (electrophoretic light scattering, permeability and hydrophobicity) were conducted alongside colistin-binding efficiencies using Alexa 594 colistin-conjugates. Chemical composition of the cell membrane was mapped using cryogenic X-ray photoelectron spectroscopy (cryo-XPS), Fourier-transform infrared spectroscopy (FTIR) and nano-resolved IR absorption spectra using Photo Induced Force Microscopy (PiFM).

Results: Comparable differences in cell surface charge and hydrophobicity of resistant strains in the presence of colistin were found, although E. coli J53(pWJ1) was more permeable than J53(pE30) and demonstrated colistin cell-surface binding at low concentrations. However, bulk changes in surface chemistry utilising cryo-XPA and FTIR failed to detect gross differences between the resistant strains. PiFM demonstrated differences in the phosphate P-O bond in both resistant strains. While changes in the protein structure of Amides I and II were evident between J53 and J53(pE30). In contrast, J53 and J53(pWJ1) differed in specific carbohydrates, such as vibrations of complex sugar ring modes arising from the peptidoglycan within the bacterial cell wall. PiFM provided a clear distinction between the strains using principal component analysis.

Conclusions: PiFM provides new insights for the design of membrane-active antimicrobials and could be a powerful label-free tool for the development of targeted and cost-effective novel therapeutic agents to treat antibiotic resistant bacteria.

CONTROL ID: 3949527

TITLE: Time to complete contemporary dental procedures

AUTHORS/INSTITUTIONS: C. Bannister, A.L. Cope, P. Harper, I.G. Chestnutt, Cardiff University, Wales, UNITED KINGDOM|A. Karki, Public Health Wales, Cardiff, UNITED KINGDOM|S. Peddle, B. Walters, PPI Representative, Cardiff, UNITED KINGDOM|M. Allen, Cardiff and Vale UHB, Cardiff, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: There are few contemporary studies on the time taken to complete dental procedures, those most heavily relied on in the United Kingdom date back to 1999. This work aimed to establish how long members of the dental team took to complete specific dental procedures, relevant to their scope of practice.

Methods: Data were collected via a purposive sample of 96 dentists, dental hygienists/therapists and dental nurses. Via an on-line survey, participants were asked to state the mean, minimum and maximum time they estimated that they took to complete individual dental procedures.

Results: The mean time taken to complete procedures common to both dentists and dental hygienists/therapists ranged from 3.7 / 4 minutes respectively for clinical note reading prior to seeing patients to 30.1 and 28 minutes to undertake root surface debridement. There were no significant differences between the time taken by dentists and dental hygienists/therapists to treat adult patients but in all but one procedure, dental hygienists/therapists reported taking longer ($p < 0.04$) to treat child patients.

Conclusions: The data provided here represent an up to date assessment of the time taken to complete specific tasks by different members of the dental team. These data will be of value to service planners and commissioners interested in evolving a dental care system that employs a greater degree of skill-mix and preventively oriented care.

CONTROL ID: 3949533
TITLE: Antimicrobial and antiviral activity of hexylresorcinol lozenges against oropharyngeal pathogens

AUTHORS/INSTITUTIONS: P. Sharma, C. Richards, J. Adams, A. Razzak, E.L. Ferguson, M.F. Pritchard, D.W. Thomas, K. Hill, Advanced Therapies Group, Cardiff School of Dentistry, Cardiff, UNITED KINGDOM|K. Bentley, R. Stanton, Division of Infection & Immunity, School of Medicine, Cardiff University, Cardiff, UNITED KINGDOM|G. Coutinho, T. Hallett, A. Kulasekaran, Global Medical Sciences, Reckitt Healthcare, Hull, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The substituted dihydroxybenzene, hexylresorcinol (HR) is routinely used in mouthwashes and lozenges for the relief of sore throats in upper respiratory tract infections due to its anaesthetic/antiseptic properties. Although the in vitro antimicrobial activity of HR (Strepsils® lozenges) was recently defined against planktonic bacteria, this does not directly relate to effectiveness in vivo as, bacteria exist in highly structured biofilm communities within the oropharynx. Hence, direct evidence of HR bactericidal and virucidal activity in lozenge formulations is limited.

Methods: In vitro antimicrobial activity of HR (pure or directly released from Strepsils® lozenges) was determined by dissolution in Mueller-Hinton [MH] broth or Artificial Saliva [AS] against a library of 41 (reference and clinical) bacterial and fungal pathogens using minimum inhibitory concentration (MIC) and Log_{10} reduction assays. Antiviral activity against SARS-CoV-2 and Influenza virus was determined by suspension test (EN14476). Antibiofilm activity was determined using minimum biofilm eradication concentration (MBEC) assays, as well as confocal laser scanning microscopy (CLSM) and COMSTAT image analysis of established (24 h) biofilms.

Results: HR exhibited MICs ≤64 µg/mL against 28/41 organisms. High lozenge antimicrobial activity (> 3_{log10}; >99.9% reduction) was observed within 10 mins (Blackcurrant) and 30 mins (Honey & Lemon) in 9/10 test strains. Log_{10} reductions in infectivity were observed for HR against SARS-CoV-2 (>3) and influenza virus (>1.5) at 20 mins. CLSM revealed HR induced significant concentration-dependent biofilm disruption in S. pyogenes at 64 µg/ml, with significant decreases in bio-volume (p<0.05) and cell viability (p<0.05). Importantly, HR demonstrated anti-biofilm activity at concentrations 3-fold lower than those attained following dissolution of lozenges in artificial saliva (500 µg/ml).

Conclusions: The antimicrobial activity of HR was demonstrated at concentrations >10X lower than that in marketed lozenges, highlighting its potential usefulness in the management of oropharyngeal infections.

CONTROL ID: 3949541

TITLE: Effect of NovaMin Glass Particle Size on Dentine Tubule Occlusion

AUTHORS/INSTITUTIONS: B. Harding, K. Rankin, P. Schneider, R. Cook, Mechanical Engineering, University of Southampton, Southampton, UNITED KINGDOM|J. Thompson, Biomedical Imaging Unit, University Hospital Southampton NHS Trust, Southampton, UNITED KINGDOM|B. Mahmoodi, U. McDonnell, Oral Health R&D, Haleon, Weybridge, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: NovaMin is a bioglass and desensitising agent incorporated into Sensodyne Repair and Protect toothpaste. The influence of particle size on NovaMin reactivity is a largely unexplored concept. Patent dentine tubules causing hypersensitivity are 1-3µm in diameter. This study aimed to investigate the reactivity of different NovaMin particle sizes between 2-15µm by measuring the occlusion of, and penetration into, patent dentine tubules.

Methods: Human dentine samples were split into 8 groups: untreated, artificial saliva (AS) control, NovaMin-free control, and 5 NovaMin sizes (2µm, 4µm, 7µm, 10µm, 15µm). All groups (except untreated) were brushed twice daily for 2 days with 0.5ml AS and 0.2mg dentifrice (as appropriate). Blocks were cut from the samples after days 1 and 2, creating 24 and 48hr time points. These were air-dried, embedded into resin, and imaged using Serial Block Face Scanning Electron Microscopy (SBF SEM). A field-of-view of 180x180µm was covered with a 40nm pixel size, and a minimum of 500 100nm slices was taken per sample, resulting in a depth of 50µm imaged. At least 70 tubules per group were randomly selected, isolated, resliced longitudinally, and the depth of penetration of material into the tubules was measured using the grey value of the images in Fiji ImageJ.

Results: SBF SEM was an effective imaging technique to capture the hydroxyapatite surface layer in-situ and the material present inside the tubules. A partial surface layer was present on treated samples after 24 hours. Deposits were also found inside the tubules of treated samples. Progressing to 48 hours showed greater hydroxyapatite surface deposits and tubule penetration. The mineral density was compared using the grey values between the treated and control samples to showcase NovaMin's ability to mineralise exposed dentine tissue.

Conclusions: All NovaMin-containing dentifrices were able to provide a level of tubule occlusion, penetration of material, and additional mineralisation after 48 hours of treatments.

TITLE: Enamel Tissue Mineralisation Assessed with Concurrent Imaging and Diffraction at the DIAD beamline

AUTHORS/INSTITUTIONS: B. Harding, R. Cook, Mechanical Engineering, University of Southampton, Southampton, Hampshire, UNITED KINGDOM|H. Deyhle, Biomaterials Science Center, University of Basel, Basel, SWITZERLAND|F. Alvarez-Borges, μ-VIS X-ray Imaging Centre, University of Southampton, Southampton, Hampshire, UNITED KINGDOM|B. Mahmoodi, Oral Health R&D Sensitivity& Acid Erosion, Haleon, Weybridge, Surrey, UNITED KINGDOM|S. Ahmed, DIAD, Diamond Light Source, Oxford, Oxfordshire, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Enamel erosion is a common problem, whose prevention can be enhanced by oral healthcare formulations that are specifically designed to penetrate and protect the apatite of the enamel surface. There is little known about the specific mode of action of the active ingredients, in terms of their influence on the existing crystal matrix within the enamel tissue.

Methods: 4 samples of human enamel were divided into two groups, 'treated' (n=3) and 'control' (n=1). The 'treated' samples were immersed in a 1:3 slurry of Sensodyne Pronamel Active shield toothpaste and deionised water for 2 minutes, twice a day, for 5 consecutive days. The 'control' sample followed the same procedure, however only immersed in deionised water. The DIAD beamline at Diamond Light Source was utilised for its imaging-led diffraction capabilities, allowing for concurrent X-ray computed tomography and diffraction of the sample surface. Initial tomography scans were performed using a 22keV beam energy, 0.5μm pixel size, and 1.2mm x 1.4mm field-of-view. Immediately following this, a series of diffraction scans were performed with a beam energy of 20keV , and a beam size of 35μm x 35μm. These were performed in a 10 x 10 grid spaced every 35 pixels (17μm) from the surface to the bulk and 100 pixels (50μm) along the sample face.

Results: Changes in the mineral density of the surfaces were analysed using the tomography scans. The diffraction patterns demonstrated an increase in the intensity of hydroxyapatite crystal peaks in the treated regions of the sample and clear differentiation of the crystal structure of the enamel at the surface.

Conclusions: The Pronamel treatment penetrated the enamel surface affecting both the mineralisation and enamel crystals in the treatment zone.

CONTROL ID: 3949570

TITLE: Soluble Phosphate Glasses For The Potential Treatment Of Periodontal Bone Defects

AUTHORS/INSTITUTIONS: A. Almudhi, Queen Mary University, Queen Mary University, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Background: PerioGlas® is a silicate bioactive glass that has been used commonly for the treatment of periodontal diseases. However, during glass dissolution, this glass generates an alkaline pH which induces the growth of P.gingivalis (periodontopathic bacteria). Alternatively, phosphate glasses generate a broad range of pH on dissolution from acidic to alkaline depending on their composition. This is advantageous for regulating the bacteria environment and stimulating bone formation. Phosphate glasses release much higher orthophosphate amount, which can also be regulated by the presence of alkaline phosphatase enzyme.

Objectives: The aim of this project was to characterize soluble phosphate glasses and investigate their potential for the treatment of periodontal bony defects.

Methods: Binary phosphate glasses $xR_2O/RO-P_2O_5$, where R= Na/K/Ca/Sr/Zn, x=45/50/55 mol%, were synthesized. The structure was characterized using solid-statePhosphorus-31 Nuclear Magnetic Resonance (^{31}P NMR). Glasses were dissolved individually in Tris-buffer solution containing ALP for enzymatic hydrolysis of phosphate glasses. The pH of solutions was measured. The dissolution products were investigated by solution-state one- and two-dimensional ^{31}P NMR.

Results: Solid-state ^{31}P NMR spectra showed variety of phosphate species (figures 1&2). This was compared to the solution-state ^{31}P NMR spectra with the varieties of phosphate species (Figure 1). The solubility of the glass was affected by modifier cation. Phosphate glasses with monovalent cations were more soluble than glasses with divalent cations. The pH values were influenced by phosphate contents in the glasses. the pH of the solution produced an acidic medium. In addition to this, ^{31}P chemical shifts appeared to be affected by the pH.

Conclusions: phosphate glasses can be used for the treatment of periodontal defects by lowering undesirable pH values and releasing orthophosphate ions to enhance HAP formation and mineralization. ALP plays a substantial role in the hydrolysis of P-O-P linkage in phosphate glasses.

CONTROL ID: 3949571

TITLE: The Potential of Hydrotalcite Charged with Various Fluorides for Oral Care

AUTHORS/INSTITUTIONS: F.E. Alaqil, M. Patel, N. Karpukhina, A. Agha, Centre for Oral Bioengineering, Dental Physical Sciences, Queen Mary University of London, London, --None--, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Dental caries is a prevalent oral health problem, and incorporating a nanostructure capable of fluoride release into dental materials has been proposed as a promising approach to caries prevention. This study aimed to investigate the potential of layered double hydroxides (LDHs) charged with different fluoride solutions: sodium fluoride (NaF) and sodium monofluorophosphate (MFP) for releasing fluoride and other anti-caries cations for use in oral health products to promote dental hygiene and prevent dental caries.

Methods: Two types of LDH (2:1 ZnAl and MgAl) were synthesised using a co-precipitation method. The fluoride LDH (F-LDH) products were obtained indirectly using the precursor ion-exchange technique by two different fluoride solutions (0.012 M of NaF and MFP). Fluoride uptake (from NaF and MFP) and the release of fluoride and other cariostatic ions (Phosphorus and Zinc) in deionised water (DW) at room temperature were determined using an Ion Selective Electrode and ICP-OES (cation release), respectively.

Results: Our key finding was that MgAl-LDH released more fluoride compared to ZnAl-LDH when charged in both media. MgAl-LDH has released more fluoride ions (8.4 ppm) when charged with NaF solution compared to the amount released when charged with MFP solution (6.7 ppm) after immersion in DW for 24 h. However, additional phosphorus ions (7.5 ppm) were released from MFP-charged MgAl LDH. The results of ICP-OSE analysis indicated that a negligible amount of aluminum ions was released in DW.

Conclusions: These results suggest that LDHs can intercalate fluoride-containing ions and release them over time, making them a good filler for incorporating into caries prevention oral health products. The potential of LDH compositions charged with different fluoride solutions should be further investigated for use in oral health products followed by clinical studies investigating cariostatic effects.

CONTROL ID: 3949579

TITLE: Stimuli responsive silica nanoparticles for treatment of bacterial biofilms

AUTHORS/INSTITUTIONS: M. Odyniec, Z. Pikramenou, Chemistry, University of Birmingham, Birmingham, UNITED KINGDOM|S. Kuehne, A. Walmsley, Dentistry, University of Birmingham, Birmingham, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The design of an ultrasound responsive drug delivery system based on silica nanoparticles for efficient eradication of oral biofilms.

Methods: In this work we explore a one-pot synthesis of silica nanoparticles encapsulating an antimicrobial. The morphology and composition of the silica nanoparticles before and after stimulus are characterised by UV Vis spectroscopy and scanning electron microscopy (SEM). Obtained nanoparticles efficacy was studied against relevant oral bacterial biofilms and biofilm eradication was studied by LIVE/DEAD staining and confocal microscopy.

Results: Silica nanoparticles containing antimicrobials are shown to have stimuli-controlled release of included antibiotics. Biofilms treated with ultrasound and particles showed significantly more dead bacteria than biofilms treated with the drug alone, ultrasound alone or plain particles. Treatment of biofilms with antimicrobial loaded particles in absence of ultrasound show significantly more alive bacteria.

Conclusions: Antimicrobials can be released from nanoparticles using ultrasound as a trigger leading to eradication of biofilms.

CONTROL ID: 3949597
TITLE: Characterisation of Bacteriophage for the Treatment of Canine Periodontal Disease

AUTHORS/INSTITUTIONS: L. Rowan, C. Delaney, G. Ramage, M. Riggio, University of Glasgow, Glasgow, UNITED KINGDOM|G. Smith, Fixed Phage, Glasgow, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Periodontal disease (PD) is a condition that feature inflammation of the gingiva, bone, and periodontal ligament. PD is caused by the build-up of bacterial biofilm around the tooth. PD is one of the most common conditions diagnosed in small animal veterinary practices. Treatment options for PD in companion dogs are limited. Bacteriophages are viruses that infect bacteria, and have demonstrable use as alternatives to antibiotics.
The aim of the project was to identify and characterize bacteriophage isolates that have activity against Porphyromonas gulae, a keystone pathogen in canine PD.

Methods: The phage genomes were sequenced through use of a Nanopore MinION Sequencer, a method that allows a more streamlined approach to DNA sequencing. In addition, the phage activity against Porphyromonas gulae biofilms were investigated. The activity of the phage was compared to canine enzymatic toothpaste and chlorhexidine, the current standard treatments.

Results: Sequencing revealed that the phage genomes are around 30kbp in length. Through the use of BLAST, it was found that the phage isolates have highest similarity to Cutibacterium (known previously as Propinobacterium) phage. Obligate lytic phage were selected through the absence of lysogeny genes. The presence of phage toxin, integrase, and antimicrobial resistance encoding genes were examined, to ensure phage is safe for use. In addition, these isolated phage were shown to significantly impact biofilm development characteristics of P. gulae as assessed by metabolism, biomass and microscopy.

Conclusions: The results will aid in the selection of the best phage candidates to develop a novel treatment for PD in companion dogs.

CONTROL ID: 3949633

TITLE: Virtual Learning Experiences of Undergraduate Dental Students During COVID-19 Pandemic at University of Nairobi

AUTHORS/INSTITUTIONS: A. Shaalan, N. Seoudi, Queen Mary University of London, London, UNITED KINGDOM|
L. Sabaya, N. Seoudi, College of Medicine and Dentistry, Birmingham, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: During Coronavirus 2019 (COVID-19) pandemic, online learning in dentistry became predominant. This cross-sectional survey analysed undergraduate dental students' satisfaction and identified barriers and facilitators to improve students' future virtual learning (VL) experience at the University of Nairobi in the Republic of Kenya.

Methods: A questionnaire was designed, peer reviewed and validated then administered online. This was supplemented by a qualitative online focus group discussion (FGD) among class leaders. Percentage of responses in the different groups was used as descriptive statistics. While analytical statistic was conducted using Chi-square and multiple linear regression. Thematic analysis was employed to analyze qualitative data.

Results: Eighty eight percent (88%:177/200) response rate was achieved. Three responses were considered ineligible and excluded. 68.9% of respondents indicated that they are satisfied with the VL, most of them were in their second year. Suffering from mental health problems such as depression and anxiety had a significant impact on students' levels of satisfaction. As demonstrated by linear regression analysis, poor instructor-student communication and difficulty adjusting to VL environment were two factors that significantly predicted negative student's experience.

Poor internet connectivity was identified as a major technological barrier. Students' preferences revealed that the majority preferred availability of revision tools (92.5%:161/174), blended learning modes (66.7%:116/174), 1-hour lectures (63.8%:111/174), and synchronous learning (56.3%:98/174). Furthermore, linear regression analysis showed that most students agree on the positive impact of all enablers on their VL experience except keeping the camera ON.

Conclusions: Students appreciated virtual learning as it enabled continuity of learning during COVID-19 pandemic. They, however, considered it inadequate to replace face-to-face interactions during clinical training. A blended learning approach could be the future of dental education with large group theoretical teaching delivered through online teaching with all learning material available in advance through VL platform. While small group practical/clinical training is delivered face-to-face.

CONTROL ID: 3949639

TITLE: Hydrophobic Binding Ability of Statherin in Saliva

AUTHORS/INSTITUTIONS: S. HUANG, R. Austin, G. Carpenter, Faculty of Dental, Oral & Craniofacial Sciences, King's College London, London, LONDON, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To explore hydrophobic interaction between statherin and HAP and how calcium ions affect hydrophobic binding of statherin.

Methods: 1ml uWMS and 50ug/ml or 100ug/ml of synthetic statherin with various concentrations of calcium (0mM/1mM/4mM) were put into petri dishes to explore if a film mainly consisting of statherin can be formed on the surface as parotid saliva . For assessing the eluting effect of statherin on different particles, 1.5ml unstimulated whole mouth saliva(uWMS) was incubated with 30ul HAP slurry to preliminarily purify statherin from saliva after which proteins bound on it were eluted using EDTA to further incubate the eluent with the following particles with same available binding areas: Polystyrene particle(PS, hydrophobic surface), Melamine resin particles(MF, positive surface) and silica dioxide(SiO2, negative surface) respectively. Statherin bound were eluted by TBST(tris buffered saline with tween 20) or EDTA, followed by electrophoretic analysis of these eluents. For studying the effect of calcium ions on hydrophobic interaction of statherin, uWMS or synthetic statherin with increased calcium (0mM/1mM/2mM/4mM) were incubated with PS particles and proteins bound were eluted by TBST. Electrophoretic analysis of the density of statherin bands from eluents were quantified.

Results: Film cannot be formed in uWMS and synthetic statherin solution even with increased calcium ions. In addition, statherin binding on particles can only be eluted by TBST rather than EDTA and PS particle had the highest amount of statherin binding on it compared to rest particles. Plus, high concentrations of calcium increased the binding of both synthetic and salivary statherin on PS particles.

Conclusions: The eluting effect of statherin on particles verified that hydrophobic interaction can involve the binding with HAP and hydrophobicity of statherin may be influenced by bound calcium. Plus, different film formation between uWMS and parotid saliva was not due to the different concentrations of statherin between them.

CONTROL ID: 3949670
TITLE: Remineralisation and apatite formation potential of an alkasite-based restorative material

AUTHORS/INSTITUTIONS: M. Dahiya, M. Tiskaya, R. Hill, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Most commercial composite restorations won't warranty prevention of secondary caries as polymerisation shrinkage causes marginal leakage. The aim of this study was to determine ion release properties and the apatite formation ability of commercial dental restorative materials -Cention Forte (CF) and an inert composite-Tetric Powerfil (TP) for secondary caries prevention.

Methods: Discs of CF and TP were prepared and immersed in artificial saliva at pH7 (AS7), pH4 (AS4), and tris-buffer (TB, pH 7.3) for seven time points (6h-12wks). These discs were characterised using Fourier-transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD) for apatite formation. The supernatant solution was analysed using an ion selective electrode (ISE) and inductively coupled plasma-optical emission spectrometry (ICP-OES) to quantify the ion release and the pH changes were also measured. To assess the mineralisation potential, standardised cavities were prepared in extracted teeth and demineralised using sodium acetate (pH 4) for 48 hours. The teeth were restored with CF and TP dental materials and immersed in AS4 and AS7 for up to 12 weeks. X-ray microtomography (XMT) was used to determine the mineral density and remineralisation.

Results: CF when immersed in AS7 displayed fluctuations for the calcium, phosphorus and fluoride concentrations, indicating the release and consumption of these ions for fluorapatite formation. FTIR and XRD diffraction analysis of CF in AS7 confirmed the formation of apatite. TP did not show any significant ion release or apatite formation. The XMT line profile and subtraction images for CF demonstrated that there is stronger evidence for the prevention of demineralisation rather than remineralisation in teeth restored with CF.

Conclusions: CF restorative material has the potential for ion release and apatite formation in AS7 and demonstrated the potential to occlude marginal gaps and inhibit secondary caries.

CONTROL ID: 3949711

TITLE: Is vimentin C328 a gatekeeper to regulating EMT and stemness?

AUTHORS/INSTITUTIONS: S. Usman, A.M. Bushaala, A.S. Jamal, H. Tummala, M. Teh, A. Waseem, Queen Mary University of London, London, UNITED KINGDOM|W. Yeudall, The Dental College of Georgia, Augusta University, Augusta, Georgia, UNITED STATES|

ABSTRACT BODY:

Objectives: Background: Vimentin, a type III intermediate filament protein, is a mesenchymal marker in normal tissues but it is induced in large number of solid tumours including oral cancer. It has diverse and dynamic roles in several cell functions. A single cysteine at 328 has been implicated in filament assembly, organisation, stability, lysosomal positioning, aggresome formation and stress response to different oxidants and electrophiles.
Objectives: To study the role of cysteine 328 in vimentin to regulate EMT and cancer metastasis.

Methods: We have mutated cysteine 328 in vimentin into serine and transduced the mutant VIMC328S into MCF-7 cells lacking endogenous vimentin. These mutant vimentin expressing cells were used to study the effect of mutation on different cell activities. The wild-type vimentin was used as a control in these assays.

Results: Our data showed significant increase in cell proliferation, migration, invasion and decreased cell adhesion in cells expressing VIMC328S compared with VIMWT. In addition, RNA-Seq analysis, qPCR and western blotting showed upregulated EMT transcription factors, mesenchymal markers, cancer stem cell markers and downregulated epithelial markers (e.g. keratins) confirming induction of EMT-like features in VIMC328S expressing cells. Our data also show upregulation of XIST, a long non-coding RNA, by VIMC328S, which is known to be dysregulated in a large number of solid tumours. Interestingly, introduction of VIMC328S mutation into MCF-7, which are normally oestrogen-dependent tumorigenic cells, made these cells oestrogen-independent in nude mice.

Conclusions: Taken together, our data suggest that C328S mutation in vimentin can initiate a complex plethora of EMT and enhance stem cell characteristics in MCF-7. This may suggest that the cysteine 328 in vimentin transmits signalling that regulates cancer cell behaviour and protect them against EMT-like changes and metastasis.

CONTROL ID: 3949745
TITLE: Reducing Human Error in Dynamic Navigation for Dental Implantology

AUTHORS/INSTITUTIONS: M.Y. Al-Jarsha, M. Almgran, C. Liu, A. Ayoub, K. Naudi, Department of Oral Surgery, School of Medicine, Dentistry and Nursing, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, UNITED KINGDOM|M.Y. Al-Jarsha, Department of Oral and Maxillofacial Surgery, College of Dentistry, University of Baghdad, Baghdad, IRAQ|D. Robertson, Department of Restorative Dentistry, School of Medicine, Dentistry and Nursing, College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To objectively quantify the reproducibility of the drill calibration process and its variability attributable to human error in dynamic navigated procedures in order to improve implant placement accuracy.

Methods: Nine different implant drills/implants were tested by 3 operators against a negative control (a trephine drill without a defined centre) following the standard calibration process in NaviDent®. The reproducibility of the calibration was checked by calculating the location of the drill tip via its coordinates produced by the navigation system itself. Intra- and inter- operator reliability for each registration group were reported. Multiple comparisons were conducted to determine the effect of the drill length and the shape of its tip on the reproducibility margin of error.

Results: There was very good inter-rater agreement among the 3 operators in all three drills (deviations from the mean ICC 0.894; error range ICC 0.877; standard deviation ICC 0.889). There was a tendency of less error (more reproducibility) with increasing drill length if the tip shape was pointed. However, with long implants that require an implant adapter, this tendency was reversed. Long-pointed drills had the same low reproducibility error as the short-pointed drills.

Conclusions: There is an inherent source of error in the step of drill calibration in all dynamic navigation procedures. Despite being very small, the operator needs to pay careful attention to this step especially with short implants and drills that don't have sharp tips. Hand stability during calibration capture by the optical camera has a crucial effect on minimising this source of error.

CONTROL ID: 3949769

TITLE: Community Metaproteomics To Establish Functional Responses Within the Oral Microbiome

AUTHORS/INSTITUTIONS: C. Ramalingam, G. Stafford, Clinical Dentistry, University of Sheffield, Sheffield, UNITED KINGDOM|D. Bradshaw, Oral Healthcare R&D,, Haleon Consumer Healthcare, Weybridge, UNITED KINGDOM|J. Pandhal, Chemical and Biological Engineering, University of Sheffield, Sheffield, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The oral microbiome is a complex community of microorganisms residing in the oral cavity. Many studies have taxonomically classified the oral microbiome in health and disease, but rarely examine the functional changes. Common agents like chlorhexidine (CHX) can induce resistance to antibiotics in some bacteria, especially during prolonged sub-lethal usage. We need to study the mechanistic changes in the microbiome in response to additives to elucidate their role in oral diseases. The primary objectives of this study are: i) To determine the taxonomic classification of the oral microbiome; ii) To generate workflows for metaproteomic analysis; iii) To interrogate the level of resistance, resilience and functionality in response to CHX.

Methods: The in vitro biofilms from grown from healthy human saliva and stained with crystal violet and resazurin dye to test the biomass and viability. Biofilm characterization was carried out using LIVE/DEAD staining and SEM analysis. Modified Nanopore pipelines were used for microbiome analysis and R for data visualization. We carried out in-gel digestion of the salivary bacterial proteins followed by mass spectrometry analysis. The biofilms were tested for their response to CHX when treated with a sub-lethal dose.

Results: The salivary biofilm when grown for 7 days had the highest biomass and viability. SEM imaging showed the spatial arrangement of the salivary biofilm. LIVE/DEAD staining showed that large areas of each biofilm was viable after 7 days. Nanopore sequencing of the salivary biofilms isolated multiple bacterial genera. The biofilms were treated with CHX at varying concentrations (0.1%-2%), the minimum inhibitory concentration was found to be 0.2%.

Conclusions: We have shown that we can recreate the complex oral microbial community in vitro and tested the effect of CHX. Improving our understanding of how the oral microbiome reacts to routine antimicrobial use is key to future development of novel actives.

CONTROL ID: 3949785

TITLE: Nuclear translocation of vimentin head domain requires cytoplasmic vimentin

AUTHORS/INSTITUTIONS: A. Bushaala, S. Usman, F. Flores-Borja, M. Tek, A. Waseem, Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Introduction: Vimentin is a type III intermediate filament (IF) protein that is normally expressed in mesenchymal cells. A vimentin monomer is composed of a central rod domain flanked on each side by a head and a tail domain. Head and rod domains are essential for filament formation and the tail domain is required for radial compaction of filaments and their interactions with actin filaments. The head domain is reported to translocate into the nucleus, but the molecular mechanism and functional implications of this phenomenon are unclear.

Objectives: To determine how the vimentin head domain translocates to the nucleus.

Methods: We cloned vimentin head domain with AcGFP tagged at the N-terminus and transduced the construct in several vimentin-deficient (MCF-7, A431) and vimentin-containing cell lines (HeLa, HFF, SW13) to study how the presence or absence of vimentin in these cells can influence the nuclear translocation of vimentin head domain. We also cloned wildtype vimentin and transduced in vimentin-deficient cancer cells to study the effect of ectopically expressed vimentin polypeptides.

Results: Our data demonstrate that nuclear translocation of AcGFP-VIMhead requires the presence of endogenous vimentin, whereas in cells lacking vimentin, the AcGFP tagged head domain was localised primarily in the cytoplasm. We also observed that ectopic expression of the full-length vimentin in MCF-7 or A431 cells (which are both vimentin-deficient) was necessary for the translocation of vimentin head into the nucleus, which was not reversed by chilling the cells at 0°C.

Conclusions: Filamentous form of vimentin was necessary for the nuclear translocation of vimentin head domain to the nucleus.

CONTROL ID: 3949786

TITLE: Solubility and ion-release from experimental ceramic-reinforced resin modified glass-ionomer (RMGIC)

AUTHORS/INSTITUTIONS: D.S. Rekhi, M.A. Alabkal, M. Patel, N. Karpukhina, A. Agha, Dental Physical Sciences Unit, Queen Mary's University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To study the solubility and ion-release from experimental RMGIC. The experimental cements incorporated ceramic (zirconia) reinforced powder and experimental liquids containing hydroxyethyl methacrylate (HEMA) and tetrahydrofurfuryl methacrylate (THFM).

Methods: Experimental RMGIC samples (15mm diameter x 1mm thickness; n=5) were prepared using two commercial powders Fuji-II LC (GC, Japan) and Amalgomer CR (AHL, UK) containing a ceramic filler (zirconia). Fuji II LC was used as a control. Experimental liquids were prepared in-house, where the main monomers incorporated in the liquids were 100% HEMA and 50%/50% THFM and HEMA (50% HEMA), respectively. Powder and liquids were mixed following manufacturer's instructions and poured into PTFE moulds followed by light curing for 20 seconds. Samples were immersed in 100ml deionised water (DW) for 4 weeks, then desorbed and the solubility was calculated. The ions released from samples were tested using Inductively Coupled Plasma-Optical Emission spectroscopy (ICP-OES). All materials and samples were characterised using Fourier Transform Infrared Spectroscopy (FT-IR). X-ray diffraction (XRD) and Nuclear magnetic resonance (NMR).

Results: Fuji-II LC and Fuji-II LC + 100% HEMA significantly showed the lowest solubility values (1.15±0.16% and 1.25±0.07%) respectively, followed by Fuji-II LC + 50% HEMA with (1.54±0.17%). Amalgomer CR + 50% HEMA and Amalgomer CR + 100% HEMA showed significantly higher solubilitiesin DW compared to all other materials (4.27±1.16% and 3.60±0.39%, respectively). FT-IR confirmed polymerisation of commercial and experimental materials. Alongside spectroscopy data, ICP-OES results showed a high release of Al and Ca from Amalgomer CR samples in addition to the release of zirconia.

Conclusions: Earlier studies reported that reinforcing RMGIC powder with ceramic (zirconia) showed improved mechanical properties. However, their high solubility and ion release might demonstrate a lack of bonding between some ions and the glass matrix, which necessitates further research.

CONTROL ID: 3949793

TITLE: Microbiological Profiling of the Surfaces of Used-Masks and Smartphone-Screens

AUTHORS/INSTITUTIONS: A. Wakui, M. Kawachi, T. Sato, Division of Clinical Chemistry, Niigata University Graduate School of Health Sciences, Niigata, JAPAN|A. Wakui, Medical Technology, Niigata University of Health and Welfare, Niigata, JAPAN|J. Washio, Division of Oral Ecology and Biochemistry, Tohoku University Graduate School of Dentistry, Sendai, JAPAN|

ABSTRACT BODY:

Objectives: The purpose of the present study was to profile the microbiota on the surfaces of non-woven fabric masks after wearing and the smartphone touchscreens.

Methods: After obtaining informed consent from seven healthy subjects (22-24 years), the surface of non-woven fabric masks after wearing and the smartphone touchscreens of each subject was wiped with a sterile cotton swab. The samples were inoculated onto the CDC Anaerobe 5% Sheep Blood Agar plates, and incubated at 37°C for 7 days under anaerobic condition. Genomic DNA was extracted from individual colonies, and bacterial species were identified by 16S rRNA gene sequencing.

Results: The bacterial concentrations of the surface of non-woven fabric masks after wearing and the smartphone touchscreens were $(1.9 \pm 1.8) \times 10^3$ and $(2.7 \pm 3.1) \times 10^2$ CFU/mL, respectively. Among 334 isolates, Cutibacterium (79.3%), Staphylococcus (16.5%), Streptococcus (2.4%) and Corynebacterium (0.3%) species were predominantly recovered from the surface of non-woven fabric masks after wearing. While, among 163 isolates, Cutibacterium (64.4%), Streptococcus (16.6%), Corynebacterium (9.2%), Staphylococcus (6.1%), Schaalia (2.5%), Actinomyces (0.6%) and Selenomonas (0.6%) species were predominantly recovered from the surface of the smartphone touchscreens.

Conclusions: The bacterial concentrations from the surface of the smartphone touchscreens were fewer than those of the surface of non-woven fabric masks after wearing. The bacterial components of both surfaces were mainly Cutibacterium species, and also some oral bacteria were found such as Streptococcus, Schaalia, Actinomyces and Selenomonas.

CONTROL ID: 3949794

TITLE: 3D-Printed Teeth: Filling the Gap in Dental Education

AUTHORS/INSTITUTIONS: A.J. Cresswell-Boyes, G.R. Davis, Dental Physical Sciences Unit, Centre for Oral Bioengineering, Institute of Dentistry, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|A.H. Barber, School of Engineering, London South Bank University, London, UNITED KINGDOM|A. Baysan, Centre for Oral Bioengineering, Institute of Dentistry, Barts and the London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Pre-clinical training is critical in dental education before students can treat patients. Artificial teeth, called typodonts, are commonly used to facilitate this training. However, typodonts made from polymers differ significantly in mechanical properties from human teeth, leading to dissatisfaction among dental students. Little research has focused on creating biomimetic typodonts capable of replicating the tactile feel of real teeth, which is critical to simulating representative cutting force. The aim of this study is to explore alternative, readily available materials to those outlined in previous research and further enhance the 3D-printed typodont teeth, with the authors intending to create an open-source package to enable dental schools to produce their own haptically-similar typodonts.

Methods: Four alternative materials were utilised and tested in this study: 15 wt.% carbonated hydroxyapatite, 15 wt.% Puraflake®, 15 wt.% zinc oxide, and dental composite resin. Materials were used to produce the 3D-printed typodonts. The haptic response of the typodont teeth was then measured using the same method as in a previous study. Finally, a Likert-scale questionnaire was given to fourth- and fifth-year dental students to compare the 3D-printed typodonts with enamel in extracted teeth.

Results: The 3D-printed typodonts made from all four alternative materials exhibited haptic responses similar to those of extracted teeth. The questionnaire results indicated a difference between the force experiments; however, students agreed the dental composite resin closely matched extracted enamel.

Conclusions: The authors successfully created haptically similar typodonts using alternative materials, which can be used to enhance pre-clinical training in dental education. These 3D-printed typodonts are easy to produce and offer a realistic simulation of the cutting force of real teeth. However, the enamel material still needs improvement. The authors intend to create an open-source package to enable dental schools to produce their own haptically-similar typodonts.

CONTROL ID: 3949796

TITLE: The development of a novel technique for electrophoretic deposition of collagen Type I to guide bioinspired mineralisation

AUTHORS/INSTITUTIONS: Z. Zhang, W. Palin, University of Birmingham, Birmingham, UNITED KINGDOM|Z. Zhang, Univeristy of Wuhan, Wuhan, CHINA|

ABSTRACT BODY:

Objectives: To repair critical-sized bone defects tissue-engineered grafts should be designed to mimic the structure and composition of native bone. To that end, this work has involved the development of 3D-printed metal implants for restoring the shape, porous structure, and mechanical strength of bone tissue whilst incorporating novel surface functionalisation techniques using electrophoretic deposition (EPD) of biomolecules.

Methods: Collagen fibrils were depositied on a titanium surface by EPD and followed by extra-fibril mineralization (EFM) and inter-fibril mineralization (IFM). The mechanism of EPD and mineralization of collagen type I and its initial osteogenic potential and early inflammation response was investigated by ATR-FTIR, XRD, SEM, cell culture, immunofluorescence staining, flow cytometry and RT-qPCR.

Results: Higher crystal growth on both the collagen fibril surface (EFM) and within the interstitial spaces between fibrils (IFM) compared with the Ti surface alone (Ti) or with the deposition of collagen fibrils (CF) was observed. There was an excellent affinity of bone marrow stem cells to each surface. However, macrophages on both EFM and IFM surfaces were more stimulated compared with Ti and CF. The expression of M1-related genes and cytokines for EFM was significantly greater than IFM. No obvious pattern of M2 expression on each surface was observed.

Conclusions: This study has developed a novel technique to mineralise implant surfaces towards osteogenesis and osteoimmune regulation, which could be used to create complex bone-like surfaces for bone defect restoration.

CONTROL ID: 3949798
TITLE: Extracellular vesicle physical characteristics are consistent between health and dysplasia.

AUTHORS/INSTITUTIONS: P. Hankinson, A. Khurram, S. Hunt, Unit of Oral and Maxillofacial Pathology, The University of Sheffield, Sheffield, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: 1. Determine the concentration and size of extracellular vesicles (EV) in saliva from healthy volunteers (HV), patients with oral epithelial dysplasia (OED) and patients with oral squamous cell carcinoma (OSCC).

2. Determine the concentration and size of EV in tissue culture media from normal oral keratinocyte (NOK), dysplastic oral keratinocyte and OSCC cell lines

Methods: Saliva samples were collected from ten HV, six OED patients and ten OSCC patients. The following cell lines where culture in EV free media for 24 hours: FNB6 (NOK), D19 and DOK (dysplastic oral keratinocyte), H357 and SCC4 (OSCC). The collected media and saliva samples were diluted before analysis with the ZetaView® (Particle Metrix) nanoparticle tracking analysis machine. Statistical analysis was completed with SPSS 28.

Results: The median EV sized particle concentration in saliva from HV, OED patients and OSCC patients was 7.9×10^{12} particles/ml, 3.6×10^{12} particles/ml and 1.4×10^{13} particles/ml respectively. The difference in medians observed was not found to be statistically significant (p=0.14). The median particle diameter for HV was 240.35nm, 234.65nm for OED patients and 233.50 for patients with OSCC. There was no difference in diameter between the groups (p=0.538).

The median number of EV sized particles per cell in the tissue culture media was 3337particles/cell for FNB6, 2284particles/cell for D19, 6028particles/cell for DOK, 5530particles/cell for H357 and 16802particles/cell for SCC4. A statistically significant difference was found between SCC4 and all other cell lines (p= 0.001-0.04) excluding the DOK cell line (p= 0.145). The median particle diameter for FNB6, D19, DOK, H357 and SCC4 was 154.05nm, 164.08nm, 173.98nm, 152.15nm and 164.85nm respectively. There was no significant difference in the median diameter (p=0.122).

Conclusions: Saliva EV physical characteristics are consistent across healthy volunteers, OED patients and OSCC patients. Tissue culture models demonstrate similar findings, however, the OSCC cell line SCC4 produces a greater number of EV.

CONTROL ID: 3949812

TITLE: Rate-Dependent Polymer-Structure Influences the Fracture-Resistance of Photo-Polymerised Dimethacrylate Dental Resin-Matrices

AUTHORS/INSTITUTIONS: S. Sirovica, Y. Guo, Centre for Oral Bioengineering, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, UNITED KINGDOM|O. Addison, Faculty of Dentistry, Oral and Craniofacial Sciences, King's College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To investigate how different polymer-structures generated under different polymerisation rates affect the fracture-resistance of experimental dental resins under mechanical load.

Methods: Photo-polymerisable experimental dimethacrylate resins were formulated by combining Bis-GMA and TEGDMA monomers (50:50wt.% ratio) with 1wt.% photo-initiator as either Camphorquinone or Lucirin TPO systems to introduce extremes in the rate of reactive-group conversion. Notch-geometry resin discs (diameter=8mm, thickness=2mm) were fabricated by photo-polymerising resins in a 90° angle central notch mould for 20s at an irradiance of 1200mW/cm^2 (Elipar DeepCure S). Synchrotron X-ray scattering mapping measurements (energy=14keV, beam-size=100μm, x-y step-size=100μm) were combined with in-situ mechanical loading, using a penetrometer with a cylindrical indenter (diameter=4mm) to load the notch-apex, to visualise polymer-network strains. Two mechanical loading regimes were implemented: (i) static loading at vertical loads of 2,4 and 6kg (n=3 per load) and (ii) cyclical loading (vertical force=4kg, loading rate=0.1Hz, no. cycles=1000) (n=3). Data fitting was undertaken using a Voigt model to reveal changes in polymer-chain-segment-extension (normalised to degree of conversion using FTIR-ATR spectroscopy) as a function of load and differences between results was analysed using a one-way ANOVA ($p<0.05$).

Results: Systems photo-polymerised rapidly (TPO) stored greater initial residual-strain within the reactive end groups and ethylene glycol bridges of the respective Bis-GMA/TEGDMA monomer structures. Polymer-network strain was concentrated immediately under the notch structure for all specimens. Faster polymerised systems (TPO) demonstrated significantly greater polymer-network strain for higher static loads (4 and 6kg) and after cyclical loading compared with slower (Camphorquinone) systems ($p<0.05$).

Conclusions: Accelerating photo-polymerisation of light cured dental resin-matrix polymers generates a polymer-network structure with a comparatively poorer strain response than more slowly cured systems. This is attributed to a less ordered initial polymer-structure which is highly sensitive to the rate of reactive-group conversion and less resistant to deformation under load.

TITLE: The Bond Strength Of A Hybrid Calcium Aluminate/Glass-Ionomer Cement

AUTHORS/INSTITUTIONS: A. Esparon, S. Waia, S.K. Sidhu, School of Dentistry, Queen Mary University Of London, London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: This study aims to determine the bond strength reliability between a new hybrid CaAl/GIC, lithium disilicate (LD) and dentine utilising a macro-shear test (SBS) and fractography.

These aims were fufilled by the following objectives:

(1) To assess the bond strength of a hybrid CaAL/GIC (Ceramir C & B), GIC (Fuji I) ,SARC (RelyX Unicem 2) and RC (Panavia V5) to LD and dentine.
(2) To test the influence of water storage on the bond quality, (4) to analyse the fracture interface microscopically for bond reliability and fracture type (adhesive, cohesive or both).

Methods: For the bond strength test, eighty bovine 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 fully immersed in deionised water at 37 °C for 24 hours and another 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 to analyse mode of failure and data analysis (one-way (ANOVA) analysis of variance and Tukey Honestly Significant Difference test and at a significance level of 5%).

Results: There was a significant difference between the SBS of the polymer-based cement (RelyX Unicem 2 (13.17 ± 3.80) and Panavia V (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 statistical 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). Therefore, Ceramir C & B can be recommended as a definitive luting cement for conventional definitive LD and other indirect restorations. However, it is not recommended for adhesives type of indirect restorations until further studies on human dentine are carried out.

CONTROL ID: 3949885
TITLE: Salivary biomarkers in gingivitis: relevance as precursor to periodontitis.

AUTHORS/INSTITUTIONS: S. Gupta, Medical Affairs, Knowledge Centre, WNS Global Services, Gurugram, Haryana, INDIA|A. Weaver, Medical Affairs, Haleon, Weybridge, Surrey, UNITED KINGDOM|A. Weaver, Life and Environmental Sciences, University of Birmingham, Birmingham, UNITED KINGDOM|A. Axe, Medical Affairs, Haloen, Weybridge, Surrey, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Periodontitis is often the focus area of periodontal research, leaving gingivitis as its precursor under researched. To fully understand its pathogenesis and progression to periodontitis, it is appropriate to first understand the precursor stages of the disease. Increasing our knowledge of gingivitis can lead to better diagnosis, prevention, and early intervention of periodontitis. This study aims to conduct a systematic literature analysis with the primary objective to identify salivary biomarkers that are strongly associated with Gingivitis.

Methods: A literature search was conducted across four databases: PubMed, Cochrane, Google scholar and ProQuest. 58 studies met the inclusion criteria from an initial data pool of 1197 studies. Keywords included: Gingivitis, 'gingival inflammation', 'gingival bleeding', biomarker, marker, saliva and salivary. Studies were excluded if they included participants were diagnosed with concomitant diseases (except periodontitis), systemic conditions, or smokers.

Results: We identified 53 articles which met the inclusion criteria that encompassed 1449 participants with gingivitis and 1416 participants with periodontitis. Salivary matrix metalloproteinase (MMP)-8 and Interleukin (IL)-1β were the most commonly studied biomarkers in relation to gingivitis across the publications selected.

Conclusions: Salivary biomarkers show a potential for better and earlier diagnosis of Gingivitis for prevention of the progression to periodontitis. Further research and clinical studies are needed to better understand gingivitis on a biochemical level so we can ensure wider, earlier detection and management.

CONTROL ID: 3949892

TITLE: Comparison of Primary Implant Stability Values Obtained by Two Methods

AUTHORS/INSTITUTIONS: Z.A. muhammad, C. Kristunas, T. Dietrich, School of Dentistry, University of Birmingham, Birmingham, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Resonance frequency analysis and insertion torque are commonly used methods for evaluating the primary stability of implants. This study aimed to assess the association between Implant stability quotient (ISQ) and maximum insertion torque (MIT) values at implant placement.

Methods: We analysed routine care data collected on implants placed in a single oral surgery referral practice in Germany between January 2016 and December 2022. 2,674 patients (mean age 58 ± 14 years, 52.58% females) received a total of 6,209 implants (Neoss ProActive). Bone quality, implant size and location, maximum insertion torque and ISQ values were recorded at the time of implant placement. Statistical analysis was performed with STATA 17 (Statacorp., College Station, TX, U.S.A. A significance level of 0.05 was utilised.

Results: The present study evaluated the primary stability of dental implants (58.2% maxilla, 41.8% mandible) with different lengths (9–17 mm) and diameters (3.25–5 mm). The mean ± SD of ISQ and MIT (Ncm) were (70.6 ± 16.1) and (36.3 ± 15), respectively. The ISQ mean values were higher in the posterior mandible (76 ± 13.28) than in the anterior maxilla (65.82± 18.5). The MIT mean values (Ncm) were higher in the D1 bone (43.20 ± 14.8) than in the D4 bone (32.87 ± 13.8). The statistical analysis found a relevant dependency between implant location (anterior/posterior maxilla/mandible) and the primary ISQ, MIT. The influence of bone quality on MIT values was statistically significant, while no significant effect was observed for primary ISQ. The findings revealed a statistically significant positive linear correlation between primary ISQ and MIT ($p < 0.01$).

Conclusions: The study indicated a significant positive correlation between ISQ and MIT at the implant placement, despite these two parameters representing different aspects of primary stability.

CONTROL ID: 3949898

TITLE: Sodium Binding to Salivary Mucins as a Potential Mechanism for Thirst

AUTHORS/INSTITUTIONS: A. Weston, G. Carpenter, J. Garnett, Faculty of Dentistry, Oral and Craniofacial Science, King's College London, London, UNITED KINGDOM|S. Vladescu, King's College London, London, UNITED KINGDOM|T. Crouzier, KTH Royal Institute of Technology, Stockholm, SWEDEN|

ABSTRACT BODY:

Objectives: To determine the ion binding capacity of mucins and salivary proteins.

To detemine the effect of ionic concentration on the lubrication of MUC5B and salivary films.

To determine the effect of sialic acids removal on ion binding and film properties of MUC5B and salivary films.

To determine the effect of ionic concentration on the film properties if MUC5B and salivary films.

To determine the effect of sialic acid removal and ionic concentration on the conformation of MUC5B.

Methods: MUC5B was purified from saliva using fast protein liquid chromatography.

A novel ion wash assay was used to determine the ion binding capacity of salivary proteins and MUC5B.

A oral tribology mimic was used to determine the effect of ions on the lubrication of mucins and saliva.

QCM-D was used to determine the film properties of saliva and mucin with increasing ionic concentrations.

A NevaMeter was used to determine the spinnbarkeit of saliva with different ionic concentrations.

Negative stain electron microscopy was used to determine the effect of ions and sialic acid removal on the structure of MUC5B.

Results: We determine that ions bind to salivary proteins and mucins in a concentration-dependent manner and sialic acids appear important for the binding of sodium to salivary proteins. Moreover, it seems that this ion binding to sialic acids is not the most important factor in mucin lubrication as sodium still influences the mucin structure in the absence of sialic acids. Our results also suggest that salivary concentration improves the adsorption of saliva, as determined by spinnbarkeit measurements, but increased ionic concentration reduces adsorption. We also determined that increased ionic concentration improves the lubrication of saliva. This suggests that this improved lubrication does not emanate from increased adsorption of mucin and salivary films. Saliva also appears to be approximately 10-fold more lubricating than MUC5B alone, suggesting that mucin isn't the only lubricating factor and that small salivary proteins are important for adsorption.

Conclusions: In conclusion, we propose that ionic concentration influences the mucin structure by making it more condensed, however, the increased number of hydration shells surrounding the counterions improves lubrication.

CONTROL ID: 3949902

TITLE: Understanding the Role of Candida albicans in Interkingdom Oral Biofilms

AUTHORS/INSTITUTIONS: C. Delaney, M. Alshehri, G. Ramage, J.L. Brown, University of Glasgow, Glasgow, UNITED KINGDOM|D. Bradshaw, Haleon, Weybridge, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Candida albicans is commonly identified as a coloniser of the oral cavity. It is frequently co-isolated alongside oral pathogens leading to it recently being classified as a key commensal in oral dysbiosis. We wished to determine the relationship between C. albicans and pathogenic oral bacteria in relation to oral health. Further to this we aim determine the molecular mechanisms underpinning these interactions through phenotypic observations and transcriptional profiling.

Methods: We utilised microscopy, colony forming assays and biofilm assays to determine the ability of C. albicans to support the growth and level of adhesion by oral bacteria. Mechanisms of interaction between Oral bacteria were determined through transcriptional profiling using RNA-Seq. Gene expression was determined for C. albicans in numerous interkingdom biofilms which included oral pathogens such as Porphyromonas gingivalis, Strreptococcus gordonni, Fusobacterium nucleatum. Our gene expression analysis was used to determine the common and unique interactions with oral bacteria within the biofilm. From our transcriptome analysis we were able to identify mechanisms of interest for further interrogation.

Results: Through our investigations we determined that C. albicans is capable of moderating the environment and supporting the adhesion of many oral bacteria within the biofilm. Additionally, we identified that there is a unique functional response from Candida to different oral species. A number of functional pathways, such as iron acquisition, were unique to organisms within the mixed and dual species biofilm environment.

Conclusions: In future studies it is important to consider the role that fungi play within the oral biofilm. Oral research, including microbiome investigations, overlook the importance of fungal commensals. These fungi have the abilitly to provide a scafffold for oral pathogens which could determine the progression of oral dysbiosis

CONTROL ID: 3949904

TITLE: Texture Mapping in Dental Enamel affected by KLK4 mutation

AUTHORS/INSTITUTIONS: A. Harfoush, R.P. Davies, N. Thomson, M. Al-Jawad, Oral Biology, School of Dentistry, University of Leeds, Leeds, UNITED KINGDOM|R.P. Davies, N. Thomson, M. Al-Jawad, Bragg Centre for Materials Research, University of Leeds, Leeds, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To carry out a comprehensive multiscale investigation on the impact of KLK4 mutation on dental enamel structure with special focus towards the crystallographic organization spatial distribution.

Methods: Five intact KLK4 affected and healthy matching control teeth were scanned using a high resolution micro-computed tomography (μ-CT) in order to quantify enamel mineral density. Teeth were then sectioned to obtain a mid labio-lingual slice for crystallographic characterization using synchrotron x-ray diffraction (SXRD) at BM-28, European Synchrotron Radiation Facility (ESRF). Scanning electron microscopy (SEM) was then used to extract and correlate microstructural changes to texture disruptions in both affected and healthy enamel.

Results: our μ-CT data showed mineral density was clearly disrupted as result of the mutation especially in molar teeth, the average decrease was between 14-24% compared to controls. Texture maps extracted from the incisor sample presented crystallite disruptions more detectable at the lingual side while the buccal halves presented relatively similar texture distribution. Our SXRD data also showed that in both normal and KLK4-affected enamel there was co-existence of two populations (POP1 and POP2) of crystallites differing in terms of dominance and orientation, ranging between 20-55 degrees apart. Healthy enamel had higher texture present at the surface gradually decreasing toward inner enamel. Texture analysis of the molar teeth is still undergoing. SEM showed disorganization of the prismatic structure across the whole enamel thickness.

Conclusions: Our μ-CT, SXRD and SEM results indicate that the KLK4 mutation impacts proper enamel formation and function. From our texture data we conclude that KLK4 is not only a critical protein for proper maturation and mineralization but also for hydroxyapatite crystallite organization

CONTROL ID: 3949911

TITLE: Hybrid Design Implants Augment Primary Stability and Assure Robust Osseointegration

AUTHORS/INSTITUTIONS: S. Shahdad, T. Gill, Queen Mary University of London, London, UNITED KINGDOM|B. Pippenger, B. Bellon, Institute Straumann AG, Basel, SWITZERLAND|S. Kuhl, University of Basel, Basel, SWITZERLAND|

ABSTRACT BODY:

Objectives: The aim of the present study was to compare a novel hybrid design implant (TLC) to a well-established parallel walled (TL) tissue level implant in terms of primary and secondary stability over time.

Methods: Test (n = 10/endpoint) and control (n = 10/endpoint) implants were placed in the mandible of minipigs and left for submerged healing for 3, 6 and 12 weeks, respectively. Maximum insertion torque and implant stability quotient (ISQ) were measured for each implant at placement. Osseointegration and cortical bone maintenance were histologically evaluated by measuring bone to implant contact (BIC) and first bone to implant contact (fBIC), respectively.

Results: A significantly higher maximum insertion torque was measured for the hybrid design compared to the parallel walled implant (57.8 ± 24.7 Ncm and 22.6 ± 23.2 Ncm, respectively; p = 0.0002). While the mean values for ISQ were comparable between the two implant types, a lower SD was measured for the hybrid implant design (75.0 ± 6.7 for TL compared to 75.4 ± 3.2 for TLC). Total bone to implant contact was comparable between both implant types at each of the evaluated time points. The first contact of bone tissue with the implant surface (cortical bone maintenance) was found to be significantly more crestal at 12 weeks for the hybrid design compared to the parallel walled implant (0.312 ± 0.828 mm for TLT compared to -0.223 ± 0.845 for TL, p = 0.0273).

Conclusions: The novel hybrid design implant showed improved primary stability and an overall improved crestal bone height maintenance compared to the parallel walled design.

CONTROL ID: 3949915

TITLE: Characterisation and Osteogenic Differentiation of Periodontal Stem Cells Isolated from Osteoporotic Patients

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ABSTRACT BODY:

Objectives: The use of dental stem cells is a promising tool for regenerative dentistry and literature search indicated that there is limited data regarding the effect of osteoporosis on the regenerative capacity of periodontal ligament stem cells (PDLSCs). The aim of the project is to characterise PDLSCs isolated from osteoporotic patients (OP-PDLSCs) and compare them to healthy PDLSCs with a specific emphasis on the osteogenic differentiation capacity of those cells.

Methods: PDLSCs were isolated from healthy (n=3) and osteoporotic patients (n=3). The primary characterisation of PDLSCs was attained by assessing colony forming units (CFUs) and population doubling time (PDT). To compare osteogenic differentiation of both cell populations, cells were either cultured in basal media (control) or osteogenic media (supplemented with 50µM L-ascorbic acid and 10µM dexamethasone). PDLSCs from both populations were assessed at 2, 3 and 4 weeks for each study group using Alkaline Phosphatase Staining (ALP) and Alizarin Red staining (ARS) and quantification assay. RT-qPCR was conducted to assess the expression of the osteogenic markers.

Results: OP-PDLSCs gave rise to an average of 44.17±22.77 CFUs while healthy PDLSCs CFUs, averaged at 71.8±21.29. The average PDT for OP-PDLSCs was 2.5±0.5 days compared to 1.7±0.2 days for healthy controls. Furthermore, ALP staining assay showed intense staining under osteogenic conditions in both groups particularly after 4 weeks. ARS quantification indicated that mineralisation deposition was the highest under osteogenic conditions after 3 weeks in the healthy group (average 0.041±0.033) compared to OP-PDLSCs (average 0.011±0.004). The mineralisation levels remained the same across all time points under both culture conditions in OP-PDLSCs. Gene expression of the osteogenic markers (ALPL, RUNX2, Osteocalcin and Collagen 1A1) indicated that OP-PDLSCs express less the mentioned markers compared to their healthy controls.

Conclusions: OP-PDLSCs showed less proliferative, clonogenic and osteogenic differentiation capacities when compared to their healthy counterpart which indicates the lower regenerative capacity of stem cells isolated from osteoporotic patients and the need for external intervention in case of using them for regenerative approaches in those patients.

CONTROL ID: 3949927

TITLE: Effect of Toothboost spray on rehardening of erosive lesions in vitro

AUTHORS/INSTITUTIONS: R.J. Lynch, RJML Consulting Ltd, Weybridge, UNITED KINGDOM|R.J. Willson, Modus Laboratories Ltd, Plymouth, UNITED KINGDOM|C. Rafferty, Dentherapy Ltd, Aberdeen, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Toothboost Non-Fluoride Spray (TBS) is designed for use as an adjunct to fluoride toothpastes, to be applied between brushings, for example following ingestion of food and drink capable of eroding enamel. The aim of this initial study was to assess the ability of TBS to effect re-hardening of erosive enamel lesions.

Methods: Erosive lesions were created on flat, polished surfaces of human permanent enamel specimens (1% citric acid monohydrate, pH3.75, 10min, $37^{\circ}C$). Baseline surface microhardness (SMH) of specimens was measured (Vickers, 0.2N, 20s, 10 indents/sample), specimens assigned to three treatment groups (n=6/group) so that mean SMH values were not significantly different.

Lesions were placed in artificial saliva (AS) for 1h at the start of the study (1mM/l $CaCl_2.2H_2O$, 4mM/l KH_2PO_4, 20mM/l HEPES, 16mM/l KCl, NH_4Cl_2, 1500U/l alkaline phosphatase, pH 7.0), then subjected to the following cycling regime: spray with 0.15g treatment (simulating application following ingestion of erosive foodstuffs), immerse in AS ($37^{\circ}C$, 1h), repeated 5x daily for 5d, stored in AS overnight. Treatments were (1) de-ionised water (DW), (2) TBS, (3) 500ppmF (as sodium monofluorophosphate). Subsequent to cycling, SMH was remeasured and mean percentage re-hardening (%R) calculated. Differences in %R were analysed (one-way ANOVA, Tukey's test). Differences were deemed to be significant at p < 0.05.

Results: Lesions in all groups rehardened as expected. Mean %R (SD) values were 11.8(3.12), 20.5(4.07), 25.4(5.27) $kg.mm^{-2}$ for treatments DW, TBS and 500ppmF respectively. Lesions treated with both TBS and 500ppmF underwent significantly more rehardening than those treated with DW; there was no significant difference between rehardening effected by TBS and 500ppmF.

Conclusions: These in vitro data show that TBS has the potential to reharden erosive enamel lesions. Further study, using more comprehensive model systems, is warranted.

CONTROL ID: 3949928

TITLE: Identifying Internal Changes in the teeth in response to enamel cracks using X-ray Microtomography

AUTHORS/INSTITUTIONS: Y. Jamil, G.R. Davis, R. Hill, D. Gillam, Centre Of Oral Bioengineering, Institute Of Dentistry, Queen Mary University Of London, Greater London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The aim of the project is

1) To study the defence mechanism in teeth using X-ray Microtomography which is sensitive to detect any mineral changes

2) Synchrotron X-ray diffraction (SXRD) and Scanning electron microscopy (EDX-SEM), will also be used to study the reactive mineral responses.

Methods: Extracted tooth samples were collected from different age groups (with ethical approval), many showing evidence of having been subjected to a variety of dental insults before extraction. These were scanned with high-contrast X-ray microtomography (XMT or micro-CT) to identify paths of hypermineralization within the dentine associated with enamel cracks. SEM and synchrotron X-ray diffraction were used to determine the nature of the mineral formed within the crack. 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: Hypermineralisation paths from the pulp to the enamel-dentine junction associated with enamel cracks could be seen in the XMT images. Within these cracks, SXRD exhibited speckle patterns indicating the presence of discrete crystals with sizes of around 2 to 3 microns. Preliminary analysis of the speckle pattern suggests that these are whitlockite crystals, distributed approximately uniformly throughout the depth of the crack. SXRD of calculus formed on the enamel surface and within a fissure (from a different sample) did not show the same pattern.

Conclusions: The results suggest that whitlockite was formed as a result of dentinal fluid flowing through the crack. In future experiments, we will identify teeth with both enamel cracks (with evidence of associated dentine hypomineralization) and enamel calculus on the same sample.

CONTROL ID: 3949931

TITLE: Prevalence of temporomandibular disorders with comorbid migraine: A retrospective study over a 7-year period

AUTHORS/INSTITUTIONS: P. Yakkaphan, Faculty of Dentistry, Oral & Craniofacial Science, King's College London, London, UNITED KINGDOM|T. Renton, Dental Institute, Kings College Hospital Foundation Trust and Guys and St Thomas Foundation Trust, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: This study aimed to determine the prevalence of TMD in adult patients with comorbid migraine and evaluate the psychological impact using Axis II assessments.

Methods: Clinical data from patients diagnosed with TMD at an orofacial pain clinic between January 2016 and December 2022 were retrospectively reviewed. Questionnaires assessing pain severity and its impact on quality of life (BPI), depression (PHQ-9), anxiety (GAD-7), and overall quality of life (EQ5D) were administered to all patients.

Results: A total of 349 patients (78% female, mean age 44.26, SD 14.81) were included in the study. Of these, 64% (n=260) had TMD without comorbidities, while 22% (n=89) presented with comorbid migraine. The majority of individuals with TMD and comorbid migraine experienced myofascial pain (67%), chronic migraine (83%), and pain distribution in V1 area (60%) or V1 and V2 area (24%). Patients with TMD and comorbid migraine reported significantly higher levels of depression (p=<0.001), anxiety (p=<0.001), and pain intensity (p=0.001) compared to those without migraine. The quality of life was greater in the TMD-only population compared to patients with migraine comorbidity.

Conclusions: TMD and migraines often coexist, particularly in individuals with muscle related TMD and chronic migraine. The presence of migraines appears to be associated with higher psychological burden and pain intensity in TMD patients. Therefore, clinicians should be mindful of the presence of migraines and psychological conditions when treating TMD patients.

CONTROL ID: 3949939

TITLE: Characterisation of Commercial Bioactive Composites

AUTHORS/INSTITUTIONS: S. Shahid, A. Devasia, R. Hill, M. Tiskaya, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Some commercially available composites claim to be bioactive. This study investigates whether these commercially available composites are capable of forming apatite.

Methods: RE-GEN (RG, Vista Apex), ACTIVA Presto (AP, Pulpdent) and Predicta (PD, Parkell) were used in the study. Discs were produced by mixing the materials according to manufacturers' instructions and then packed into moulds (10mmx1.2mm) followed by light curing according to manufacturers' guidelines. Discs for each material were produced and divided into 3 equal groups of n=66. The discs were stored in either 10ml of demineralisation buffer (AS4), remineralisation buffer (AS7), Tris-buffer (TB), or the phosphate-buffered saline (PBS). At 0h, 6h, 24h, and 3, 7, 14, 28, and 42 days, discs from each group were removed from their solutions, washed and then dried for investigation using ATR-FTIR, XRD. The solutions after immersion were used to measure pH changes using a pH meter, ISE was used to measure fluoride release, whereas Ca and P release was measured using ICP-OES.

Results: AP released small amounts of Ca, P, F ions and formed apatite (detected by FTIR and XRD) in AS7 and PBS only. RG and PD released very few ions and didn't form apatite. The pH changes were all small and no significant trends were observed for all three composites in the four different immersion media except for RG immersed in AS4 where the pH increased with immersion time.

Conclusions: AP forms apatite that could promote remineralisation and prevent secondary caries.

CONTROL ID: 3949940
TITLE: Physicomechanical Characterization of Four Pit and Fissure Sealants

AUTHORS/INSTITUTIONS: N. Alsufayan, W. Palin, M. Abdul Hadis, S. Kuehne, Dental Materials Science, College of Medical and Dental Science, University of Birmingham, Birmingham, UNITED KINGDOM|S. Alaqeel, Dental Health Department, King Saud University, Riyadh, SAUDI ARABIA|

ABSTRACT BODY:

Objectives: Pit and fissure sealants (PFS) are important for preventing dental caries. However, the physicomechanical properties of these materials are poorly characterized. The aim of this study was to compare the biaxial flexural strength (BFS), modulus of elasticity, and degree of conversion (DC) of Teethmate F-1 (TMF; Kuraray Noritake, Japan), Helioseal F Plus (HSF; Ivoclar Vivadent, Liechtenstein), Clinpro (CP; 3M, USA), and Embrace-WetBond (EWB; Pulpdent, USA).

Methods: Disc-shaped specimens with two different thicknesses (15 mm diameter; 0.5 mm and 1 mm thickness) were prepared and cured for 20 s with an Elipar S10™ light-curing unit (3M). For BFS, the piston-on-three-ball was applied with a universal testing machine (Criterion Universal Test System; MTS, USA) at a crosshead speed of 0.5mm/min. Elastic modulus was determined in the linear region of the load-deflection curve. DC was determined using Fourier transform infrared attenuated total reflectance spectroscopy. Significant differences were assessed using one-way ANOVA and post hoc Tukey comparisons ($p < 0.05$).

Results: CP showed significantly higher BFS (0.5mm: 147.2 ± 50.6 MPa; $P < 0.05$) and (1mm: 167.5 ± 54.3 MPa; $P < 0.001$), and highest elastic modulus (0.5mm: 53.1 ± 24.3 MPa; $P < 0.001$) and (1mm: 196.8 ± 38.1 MPa; $P < 0.001$) for both thickness conditions compared to the other three PFS. However, EWB showed the lowest value of BFS (0.5mm: 84 ± 17.9 MPa) and (1mm: 77.1 ± 21.8 MPa). Significant differences ($P < 0.05$) were also observed in DC: CP (78.3% ± 10)> EWB (43.5% ± 38.4)> TMF (35.8 ± 2.8)> HSF (23.4 ± 8.3).

Conclusions: BFS, elastic modulus, and DC of PFS will aid material selection based on physicomechanical properties. Materials with optimal BFS, elastic modulus, and DC may reduce fracture rates and enhance clinical performance.

CONTROL ID: 3949941

TITLE: Rapamycin loaded phosphorylated vitamin D_3 liposome reverses the senescent phenotype of human bone marrow mesenchymal stem cells

AUTHORS/INSTITUTIONS: Q. Guo, S. Jones, Faculty of Life Science & Medicine, King's College London, London, UNITED KINGDOM|G. Carpenter, Faculty of Dental, Oral & Craniofacial Sciences, King's College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives:

1. Investigate the efficacy of rapamycin loaded phosphorylated vitamin D_3 liposome in reversing bone marrow mesenchymal stem cell senescence and enhancing their viability and longevity following implantation into the periodontal area.

2. Explore the underlying senescence-related molecular mechanisms (such as the mTOR pathway) after the application of rapamycin loaded liposomes on mesenchymal stem cells.

Methods: Vitamin D_3 (cholecalciferol) phosphate (VDP) was synthesised using cholecalciferol and phosphorus (V) oxychloride ($POCl_3$). Phosphorylated vitamin liposomes were fabricated using the thin-film liposome hydration method. The in vitro cell tolerability of VDP, rapamycin, and rapamycin loaded liposomes was examined by measuring cell viability using Cell Counting Kit-8 (CCK-8). Cell senescence was measured using a chromogenic assay to determine the cell SA-β-gal activity. MSC mTOR activity of the rapamycin-loaded liposomes treated cells vs control was measured using Western blot with pAKT/p4E-BP1/β-actin antibodies.

Results: The size of the rapamycin-loaded DPPC-VDP liposomes was 100 ± 20 nm with a polydispersity index of <0.3. The in vitro MSC IC50 was 234.5M for VDP, 28.743M for rapamycin and 40.690 M (based on rapamycin molarity concentration) for the rapamycin-loaded liposomes. The treatment of MSCs with the rapamycin-loaded liposomes delayed their senescence by 28.57% over 24 h. This effect was assigned to inhibition of the mTOR pathway, specifically through a 0.5 fold reduction in phosphate 4E-BP1 activity.

Conclusions: Phosphorylated vitamin D liposomes could deliver rapamycin intercellularly to slow MSC senescence. This effect appeared to be through the inhibition of the mTOR signaling pathway. In vivo data is now needed to assess if this new therapeutic approach can be used to reverse tissue damage and bone loss in periodontitis.

CONTROL ID: 3949943

TITLE: The use of SoproLIFE to assess the changes in root caries severity

AUTHORS/INSTITUTIONS: H. Chen, R. Hill, A. Baysan, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The aim of this study was to evaluate the performance of Light-Induced Fluorescence Evaluator (SoproLIFE) on different severity of root caries.

Methods: A total of 34 teeth with primary root carious lesions(PRCLs) were included. 50 regions of interest were identified. These teeth were brushed by allocated toothpastes and stored in artificial saliva(pH7) for three months: Group-1: BG with 540ppm-F, Group-2: 5000ppm-F, Group-3: 1450ppm-F and Group-4: Using deionised water alone. Visual-tactile assessments and SoproLIFE images were used to classify each region of interest according to clinical criteria used to detect changes in severity index (SI) for RCLs after each treatment. SI was scored as SI0 for hard lesions, leathery-approaching 'hard' and easily cleansable was SI1, whilst SI2 presented with leathery, shallow cavitated with easily maintained plaque free and SI3 was cavitated where pulpal integrity was judged to be at-risk. The specificity and sensitivity for SoproLIFE diagnosis mode were then evaluated.

Results: In visual-tactile assessments, a total of six (46.2%) in Group-1, seven(53.8%) in Group-2, two(15.4%) in Group-3 and two(18.2%) in Group-4 became hard. Inter and intra reproducibility of SI for RCLs were 0.174 and 0.209 respectively at the baseline (p=0.010). The results showed a high reliability in SI for PRCLs (Intraclass correlation coefficient=0.867; 95%CI=0.773-0.924, p<.001). The intra reproducibility of SoproLIFE for PRCLs before and after treatment was 0.892 and 0.705 (p<0.001) respectively. After treatment, the sensitivity was 17% with a specificity at 43% for hardened lesions in the Group-1. The sensitivity and specificity were 57% and 100% respectively in the Group-2, whilst sensitivity(50%) and specificity(82%) were recorded in the Group-3. However, the sensitivity and specificity were 0; 78% respectively in the Group-4.

Conclusions: This SoproLIFE can potentially be useful in conjunction with clinical criteria to detect the changes in SI for early root caries in clinical decision-making process however further evidence is required.

CONTROL ID: 3949950

TITLE: Natural-Derived Agents Modulate In Vitro Polymicrobial Caries-Related Virulence

AUTHORS/INSTITUTIONS: O. Furlong Lopez, A. Banerjee, Centre for Oral, Clinical & Translational Sciences, King's College London, London, UNITED KINGDOM|D. Moyes, Centre for Host-Microbiome Interactions, King's College London, London, UNITED KINGDOM|P. Neelakantan, Department of Endodontics, University of the Pacific, San Francisco, California, UNITED STATES|

ABSTRACT BODY:

Objectives: This study aimed to investigate the efficacy of plant-derived small molecules (Vanillin and Trans-cinnamaldehyde) in combination with exo-polymeric substance-disrupting enzymes (Dextranase and Glucoamylase) in reducing in-vitro dental caries. The objective was to target multiple key microbial virulent factors involved in cariogenic pathogenesis while preserving the beneficial aspects of biofilms.

Methods: Biomass, metabolic activity, and acid pH were assessed using crystal violet staining, XTT assay, and pH measurements on poly-bacterial and multi-kingdom cariogenic biofilm models. Combinatorial treatments consisting of plant-derived small molecules and EPS-disrupting enzymes were applied, and their effects were compared to the control group. Quantitative polymerase chain reaction (qPCR) analysis was conducted to evaluate the microbial composition and gene expression changes. Demineralisation potential was assessed using Raman spectroscopy and Knoop microhardness tests on polished human enamel samples. Electron microscopy analysis was performed to examine the ultra-structural topography of the cariogenic biofilm model.

Results: Combinatorial treatments significantly reduced microbial biomass, metabolic activity, and acid pH compared to the control group ($p < 0.05$). The natural-derived treatments induced significant alterations in the microbial composition and gene expression of the in-vitro cariogenic model. Furthermore, the treatments showed a substantial reduction in demineralisation potential, as indicated by Raman spectroscopy and Knoop microhardness tests ($p < 0.05$). Electron microscopy analysis demonstrated changes in the ultra-structural topography of the cariogenic model following treatment.

Conclusions: Plant-derived molecules in combination with EPS-disruptive enzymes showed statistically significant effects in reducing in-vitro dental caries by modulating microbial biomass, metabolic activity, acid pH, microbial composition, gene expression and demineralisation potential. These findings highlight the potential of plant-derived molecules in combination with EPS-disrupting enzymes as therapeutic agents for dental caries management. Further investigation is warranted to explore their clinical applications.

CONTROL ID: 3949959

TITLE: Combination of Collagen-based Soft Tissue Substitutes and Micro-grafts (periosteum-derived stem cells) : A preclinical study of angiogenesis

AUTHORS/INSTITUTIONS: S.O. Kuswandani, J. Buti, R. Rotundo, F. D'Aiuto, Periodontology Unit, UCL Eastman Dental Institute, London, United Kingdom, UNITED KINGDOM|S.O. Kuswandani, Periodontology, Universitas Indonesia, Jakarta, Indonesia, INDONESIA|E. Garcia-Gareta, Regenerative Biomaterials Group, RAFT Institute, Mount Vernon Hospital, Northwood, UK, UNITED KINGDOM|E. Garcia-Gareta, ARAID (Aragonese Agency for R&D) Scientist, Zaragoza, SPAIN|R. Rotundo, King's College London, London, UK, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Neovascularization after periodontal regenerative surgeries is a crucial component of the wound healing process. Micro-grafts' delivery therapy promises to enhance periodontal regenerative wound healing. This study used a chick chorioallantoic membrane (CAM) model to compare for the first time the angiogenic potential of different collagen-based soft tissue substitutes (STS) in combination with tissue micro-grafts.

Methods: Three different collagen-based STS, including porcine-derived collagen (Mucoderm®, Mucograft®) and bovine cross-linked collagen (Fibrogide®) matrices, were implanted as scaffolds in the CAM assay. STS only and in combination with micro-grafts from healthy donors were the examined groups. Analyses and quantification of a) vascular density and bifurcation points, b) scanning electron microscopy (SEM) images, and c) histological haematoxylin and eosin staining (H&E) data were performed. GraphPad Prism 9 was used to analyse the data. A minimum of n=9 scaffolds were analysed per sample tested with three biological and technical replicates.

Results: Porcine-derived collagen matrices combined with micrografts [Mucoderm®+micrograft (p=0.024) and Mucograft®+micrograft (p=0.0187)] exhibited statistically significant higher angiogenic potential when compared to positive control (vascular endothelial growth factor solution). Intra-STS comparison analyses revealed that the addition of micrografts increased vascular angiogenesis in cross-linked collagen group (Fibrogide®, mean difference 7.92; 95% CI 1.02 to 14.8; p=0.023). Histology analyses confirmed biocompatibility all STS as they all integrated well with surrounding CAM. Fibrogide®+micrograft group was the only one presenting cell penetration from CAM into the STS scaffold.

Conclusions: Micro-grafts delivery into porcine STS scaffolds holds potential in enhancing vascular cells' growth and pro-angiogenesis. These findings could translate into cell-based tissue engineering therapies to enhance clinical outcomes in periodontal soft tissue surgeries.

CONTROL ID: 3949970

TITLE: Is it Possible to Amalgamate Public Health with Clinical Dentistry?

AUTHORS/INSTITUTIONS: P. Mossey, Dundee University Dental School, Dundee, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: In the 1978 Alma Ata Declaration entitled "Primary Healthcare in a changing world" there was a powerful statement of intent on health for all, via the statement "Primary care deals with conditions that are largely preventable and closely linked through the causal chain to their social or environmental cause. This should make primary care and population health intimate bedfellows."

Methods: Dentistry, however has been slow to acknowledge it has anything to do with oral health and largely concerned with treating disease as opposed to preventing it. By combining dental public health in clinical dentistry students can learn how to undertake much needed health surveillance, can have raised awareness of how to identify and tackle inequalities, move towards more upstream approaches for prevention and health promotion in their day-to-day patient care. They could also be guided on the principles of empowering individuals and communities on the improvement of their oral health by anticipatory guidance and health coaching.

Results: A unique Masters programme in a collaboration between the University of Dundee with partners in India aims to fill an existing gap in the training of Dentists worldwide by integrating Dental Public Health with clinical training. This is line with the WHO recommendations and the UN SDG recommending universal health coverage (UHC).

Conclusions: The course proposes to use existing clinical and public health modules delivered by GSL Dental College and the School of Dentistry respectively. The content and mode of delivery will be described and by combining the internship with a Masters degree it would be time and cost-effective

CONTROL ID: 3949972

TITLE: The effect of deproteinising agents as pre-treatments prior to the application of P_{11}-4 in MIH teeth

AUTHORS/INSTITUTIONS: E. Zawia, M. Al-Jawad, B. Drummond, R.P. Davies, School of Dentistry, University of Leeds, Leeds, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Molar-incisor hypomineralisation (MIH) is a challenging condition to treat when considering cost, conservativeness and long term prognosis. Although remineralising agents commonly used for dental caries management are also used for MIH, there is insufficient evidence to support their effectiveness in mineralising hypomineralised enamel. This study aims to assess the use of biomimetic self-assembling peptides (SAPs) as a treatment of hypomineralised enamel in MIH patients, by examining the effect of deproteinisation pretreatment on self-assembling peptides infiltration and their mineralisation ability of the hypomineralised enamel.

Methods: 60 human first permanent molars moderately affected with MIH were selected according to the diagnostic criteria of Mathu-Muju and Wright (2006). Teeth were sectioned and the buccal segments were used to create enamel slabs of hypomineralised enamel (HE); samples were then distributed into different experimental groups according to the pretreatment protocol as follows: 1) No Deproteinisation + SAPs , 2) Deproteinisation using NaOCl + SAPs , 3) Deproteinisation using Papacarie gel + SAPs , 4) No SAPs. To evaluate the crystallographic structure of the hypomineralised enamel, 2D synchrotron X-ray diffraction (2D-SXRD) was employed. Additionally, micro-computed tomography (micro CT) was used to examine changes in mineral density and the infiltration of self-assembling peptides (SAPs) into the hypomineralized enamel was assessed using a confocal microscope.

Results: Preliminary results of 2D- SXRD revealed coexistence of two crystallite populations, with wide variation in texture magnitude among hypomineralised enamel samples. There was an overall low texture magnitude of hypomineralised enamel structure when compared to normal enamel. Following the P_{11}-4 SAPs treatment, data have shown increased texture magnitude in both populations within the lesion area. Correspondingly, the initial micro CT analysis have shown increase in mineral density in hypomineralised enamel after SAPs treatment.

Conclusions: Biomimetic self-assembling peptides P_{11}-4 have shown the potential to be a suitable mineralising agent to treat Molar incisor hypomineralisation without the need for sodium hypochlorite pre-treatment.

CONTROL ID: 3949976
TITLE: Systematic Review on Assessment Methods of Gingival Tissue Volume

AUTHORS/INSTITUTIONS: N. Mohamed Nazari, Department of Restorative Dentistry, Faculty of Dentistry, Universiti Malaya, Kuala Lumpur, MALAYSIA|N. Mohamed Nazari, F. Alotaibi, Y. Yan, J. Suvan, F. D'Aiuto, Unit of Periodontology, Department of Restorative Dentistry, UCL Eastman Dental Institute, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Introduction: Accurate evaluation of the volume of gingival tissue (VGT) holds great significance for clinicians when formulating treatment strategies especially when planning to improve aesthetics. Nevertheless, existing VGT methods are prone to inaccuracies and systematic bias.

Objective: The aim of this systematic review was to investigate different methods to assess VGT with regards to height and thickness in Dentistry.

Methods: Methods: Electronic evidence searches were conducted on CENTRAL, MEDLINE, EMBASE, Web of Science (Core Collection), ClinicalTrials.gov, and grey literature from 01 January 2012 until 25 May 2023 in clinical studies involving human adult participants. Hand-searching was also performed and all relevant data from eligible studies were extracted. Qualitative analysis was performed.

Results: Results: Initial search resulted in 2041 studies after the removal of duplicates. Following titles and abstract screening, 30 studies were retrieved for full-text screening. Data from the studies were collated into an evidence table and grouped according to the study design. This provided an overview of the different methods to assess gingival tissue volume. Most of the studies reported on the methods of assessing gingival tissue thickness such as visual assessment, probe transparency, transgingival probing, CBCT, and ultrasound. Different studies utilised different criteria to classify gingival tissue thickness.

Conclusions: Conclusion: High degree of variation in clinical methods used to evaluate VGT was found indicating that applying these methods in clinical practice is unreliable.

CONTROL ID: 3949983

TITLE: Barium Fluorphlogopite Machinable Glass-Ceramics of Varing Boric Oxide Content

AUTHORS/INSTITUTIONS: R. Hill, N. Karpukhina, M. Mohamed, DPSU, QMUL, London, Uk, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Barium mica, barium fluorphlogopite glass-ceramics can be machined to shape without resorting to using diamond tipped tooling.They are therefore attractive for CAD-CAM dental crowns inlays onlays and veneers. Objectives to investigate the incorporation of boric oxide on the crystallisation, microstructure and hardness of barium fluorphlogopite BFM glass-ceramics.

Methods: Three BFM glasses with varying mole fractions of boric oxide (0. 0.37 and 0.7?) were synthesised by a high temperature melt quench route at Cera Dynamics Ltd Stoke using a proprietary shoe box Kiln. The resulting glasses were characterised by Xray Fluorescence XRF, high temperature differential scanning calorimetry, DSC, X-ray powder diffraction, XRD Scanning Electron Microscopy, SEM. Just above the original Tg and microhardness. Optimum nucleation curves were determined using the Marrotta method.

Results: The XRF analysis of the glasses was identical to the prefired compositions with no significant loss of fluorine. The glass transition temperature Tg reduced with increasing boric oxide content. The two lowest B_2O_3 content glasses exhibited a pronounced optimum nucleation temperatures, which corresponded to the presence of two Tgs, indicating nucleation occurring as a result of prior amorphous phase separation into two glass phases.

Heat treatment in the range 950-1100°C resulted in the development of an interlocked microstructure consisting of BFM plates termed a "house of cards microstructure" associated with machinability. Crystal aspect ratio and crystal size increased with increasing heat treatment temperature and time. The original glasses had a hardness of about 6GPa that reduced on crystallisation of BFM and reduced further on formation of the house of cards microstructure to values less than that of enamel (3.6GPa).

Conclusions: BFM glass-ceramics are attractive for CAD-CAM restorations in Dentistry. Having a restoration with a hardness less that of enamel is attractive in preventing wear of opposing teeth.

CONTROL ID: 3949993

TITLE: PDL Extracellular Vesicles Exert Selective Pro-regenerative Effects on Gingival Cells

AUTHORS/INSTITUTIONS: M. Ghuman, Centre for Host-Microbiome Interactions, King's College London, London, UNITED KINGDOM|A. Birjandi, P. Sharpe, Centre for Craniofacial and Regenerative Biology, King's College London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: There is promising evidence that regenerative dentistry can promote natural repair of the diseased tissue in the oral cavity using stem cells. Stem cell paracrine signalling has been suggested to play a significant role in tissue regeneration and repair. Extracellular vesicles are naturally occurring vesicles with biologically active cargo that can be harvested from the extracellular space. We investigated the effect of small extracellular vesicles purified from PDL on the gingival fibroblasts, and compared them to those derived from dermal fibroblasts.

Methods: Small extracellular vesicles were purified from human PDL and dermal fibroblasts by ultracentrifugation and characterized by SEM, DLS and advanced flow cytometry. Human gingival fibroblast cell culture were treated with vesicles and expression of Wnt, ostegenic and adipogenic markers assessed by qPCR in vitro. Protein content of PDL and dermal fibroblast extracellular vesicles was investigated and compared using label free proteomics with MS/MS analysis.

Results: PDL extracellular vesicles induced the Wnt signalling pathway in gingival fibroblasts and promote osteogenic differentiation, whereas those dervied from dermal fibroblasts did not. Treatment of gingival fibroblasts with PDL extracellular vesicles resulted in induction of Wnt signaling pathway via upregulation of Axin2 expression, and upregulated the gene expression of the ostegenic marker, Runx2, and adipogenic markers, PPARG and LPL. Proteomic data from these sEV demonstrates distinct profiles wound healing and matrix remodelling signatures.

Conclusions: The results of this study shows the potential of the PDL secretome on exerting changes on gingival cells having implications for periodontal regeneration, and exhibits distinct characteristics from that of dermal fibroblasts.

CONTROL ID: 3949994

TITLE: Anodized vs. sandblasted implant surfaces in grafted-dehiscence defect animal model

AUTHORS/INSTITUTIONS: N. Razaghi, T. Gill, A. Patankar, M. Patel, S. Shahdad, Queen Mary University of London, London, UNITED KINGDOM|M. Roccuzzo, Department of Maxillo-facial Surgery, University of Torino, Torino, ITALY|

ABSTRACT BODY:

Objectives: The effect of impact of surface characteristics on osseointegration and bone apposition were investigated by comparing a novel gradient anodised (NGA) functionalized, commercially available, implant (NobelActive, TiUltra NP, commercially pure Titanium, 3.5 × 8.5 mm, Nobel Biocare AG, Switzerland) with custom-made replicas of the NGA implant geometry, modified with the SLActive and SLA surface (Replica of NobelActive, SLActive or SLA, Roxolid, 3.5 x 8.5 mm, Institut Straumann AG, Switzerland).

Methods: Crestal bone formation was analyzed histologically and histomorphometrically using a standardized 3mm acute type buccal dehiscence model grafted with deproteinized bovine bone mineral (DBBM-Bio-Oss™,Geistlich®) and covered with a porcine collagen membrane (Bio-Gide™,Geistlich®) after 2 weeks(2W,n=6) and 8weeks(8W,n=8) of healing. Each animal received one NGA, SLActive and SLA implant. The primary outcome was bone-to-implant contact in the dehiscence defect(dBIC). Secondary outcomes included: first-bone-to-implant-contact(fBIC), new-bone-height(NBH), vertical-bone-creep(VBC) and bone-area-to-total-area(BATA). A multivariate linear regression model, with the factor "animal" modelled as a random effect, was adjusted for multiple comparison using Dunnett-Hsu method with a significance level of $\alpha<0.05$.

Results: At 2W dBIC was higher for SLActive($\mu=17.1$,S.D=7.5,$p<0.05$) compared to NGA($\mu=2.5$,S.D=5.5) and 8W both SLActive($\mu=47.8$,S.D=18.5,$p<0.001$) and SLA($\mu=35.1$,S.D19.0,$p<0.01$) demonstrated higher dBIC than NGA($\mu=3.2$,S.D3.9). At 2W fBIC significant closer to the crest for SLActive($\mu=-14072$,S.D=419.5,$p<0.01$) and SLA($\mu=-1971.5$,S.D=590.6,$p<0.05$) compared to NGA($\mu=-2567.1$,S.D=416.8). At 8 weeks both SLActive($\mu=-461.3$,S.D=643.4,$p<0.01$) and SLA($\mu=-652.1$,S.D=581.8,$p<0.01$) fBIC was significantly closer to the crest than NGA($\mu=-1633.5$,S.D=763.6). At 2W and 8W there was no evidence of a difference($p>0.05$) in NBH or BATA between the groups.

Conclusions: At 2 and 8 weeks the SLActive surface compared to NGA demonstrated significantly higher levels of dBIC, fBIC and VBC. SLA surface demonstrated significantly higher levels of fBIC and VBC at 2 weeks and dBIC, fBIC and VBC at 8 weeks compared to the NGA surface.

CONTROL ID: 3949995

TITLE: <div>Proof Of Principle Study To Measure Palatal Soft Tissue Thickness</div> <div> </div>

AUTHORS/INSTITUTIONS: L. Solanki, N. Claydon, D.W. Thomas, R. Adams, Cardiff University, Cardiff, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To develop a novel, simple and reproducible methodology based on cone beam computed tomography (CBCT) to measure palatal mucosal thickness. Secondly, the study sought to define a standardised protocol for the selection and manipulation of CBCT images for the pre-operative measurement of palatal soft-tissue thickness.

Methods: 20 anonymised, dentate CBCT scans were randomly selected for the purpose of this study. Palatal mucosal thickness was measured in each case with reference to the mid-point alveolar crest from maxillary canine to maxillary second molar. Four reference points were utilised at 3-, 6- and 9mm from the alveolar crest in coronal scans at the mid point of the tooth. In total, 20 reference points were identified per scan. Intra-examiner variability was undertaken with re analysis of 15 CBCT scans. Inter-examiner analysis was performed using 5 randomly selected CBCT scans that were examined by three different categories of observers: Experienced Clinician, Inexperienced Clinician and Non-clinical staff.

Results: The statistical analysis revealed mean absolute difference in measurements for intra-examiner (0.0473 or 1.2%) analysis Wilcoxon Signed-Rank test ($z = 1.937$; $P = 0.053$) is higher than inter-examiner (0.6913 or 15.3%) analysis (Friedman's ANOVA test: chi-square = 4.990; $P = 0.083$). The measurements are not statistically or significantly different for both data sets. The inter and intraclass correlation coefficients are highly (statistically) significant for both data sets ($P < 0.001$).

Conclusions: The measurement of soft tissue thickness plays an important role in appropriate treatment planning in soft-tissue grafting in periodontal- and implant surgery. Currently-available techniques/methods are imprecise, hampering clinical utilisation.The proposed technique is novel, feasible and reproducible by clinicians and non-clinicians with: requisite one-time training associated with the software measurement tools and basic understanding of site-specific dental anatomical landmarks.

CONTROL ID: 3949997
TITLE: HNSCC Cisplatin-Resistant 3D Spheroid Model

AUTHORS/INSTITUTIONS: N. Khera, M. Teh, H. Wan, Institute of Dentistry, Queen Mary University of London, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Head and neck squamous cell carcinoma (HNSCC) is a significant health concern, with a high recurrence rate leading to a 5-year survival rate of approximately 50%. HNSCC cell lines are crucial for studying and evaluating the effectiveness of novel drugs. Cisplatin chemotherapeutic resistance remains a major challenge in HNSCC (33% frequency). The specific molecular events and mechanisms underlying this resistance are not yet fully understood. To address this, tumour spheroids have emerged as in vitro models that may replicate the physiological conditions and cellular interactions observed in solid tumours, providing a realistic representation of the tumour microenvironment. The aims of this study were to determine the optimum conditions and timepoints for the culture of spheroids from HNSCC cell lines, to evaluate wild-type (WT) and cisplatin-resistant (CR) spheroid responses to cisplatin, and to create a CR spheroid model for the purpose of testing novel drugs to find new possible treatments.

Methods: Four HNSCC cell lines (SCC4, SCC15, SCC25 and CaLH$_2$) were subjected to prolonged exposure of increasing concentrations of cisplatin to develop CR cell lines over a 9-month period. All 8 cell lines were seeded in round bottom well ultra-low attachment spheroid plates, and spheroid formation was evaluated, optimised and characterised. The growth of spheroids was monitored and imaged for 7 days. Cell viability within the spheroids was assessed using the LIVE/DEAD Viability/Cytotoxicity Kit and Hoechst Nucleic Acid Stain and CellTiter-Glo. To quantify the DNA content of spheroids, cell cycle analysis was conducted using Propidium Iodide.

Results: Across all cell lines, spheroid formation required 96hrs. All cell lines showed significant IC$_{50}$ shifts between WT and CR (Students T-test, *$p < 0.05$). Analysis of DNA content allowed for the identification of the fraction of cells residing in any of the interphases, showing significant differences in certain cell lines between WT and CR spheroids, as well spheroids on growth day 3 in comparison to day 6.

Conclusions: The results demonstrated the successful formation of usable spheroids (both WT and CR) across all tested cell lines, exhibiting acceptable viability. These spheroids can serve as valuable models for testing novel drugs before their clinical introduction.

CONTROL ID: 3949999

TITLE: Effectiveness of the bleach and opaquer shades to mask discoloured teeth

AUTHORS/INSTITUTIONS: K.0. Al-Khazraji, Al-Mustansyria University, Baghdad, IRAQ|A. Baysan, A. Mustafa, Queen Mary, England, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: The purpose of this laboratory-based study was to compare the masking ability of bleach and opaquer shades applied on discoloured substrate using the spectrophotometer.

Methods: A total of 90 C3 shade composite discs (n=15 per group) were prepared. Different thickness of bleach, opaquer and for the top layer, A2 universal shade composite resins were added to the discs in order to mask the C3 shade. Group A had 0.5mm thickness bleach with 1.5mm A2 shade composite resin whilst Group B had 1mm thickness of bleach shade with 1mm A2 shade resin. Group C presented with 0.5 mm opaquer and 1.5mm of A2 shade. In Group D, 1mm opaquer and 1mm A2 shade resin composite were added to the discs. Group E positive control had 4mm A2 shade only whilst in Group F negative control 2mm thickness of A2 shade resin composite only added to each disc. Three shade measurements were taken using VITA easy shade spectophotometer and the average of these measurements was determined to provide the colour coordinates. Device calibration was performed prior each reading to achieve maximum accuracy. The colour differences were measured using the CILAB colour system with A2 shade as a reference point. One-way ANOVA and independent student t-tests were used to analyse the data.

Results: Results showed that the masking ability of the C3 shade composite discs were for both Group C (Delta E=3.44, p=0.534) and D (Delta E=3.51, p=0.610), since these specimens presented the acceptable masking ability according to acceptability perceptibility AT/PT threshold (Delta E less than 3.7). Both Group B (Delta E=7.31, p<0.001) and A (Delta E=4.65, p=0.049) had low masking ability.

Conclusions: In conclusion, the opaquer (0.5mm-1mm) can mask the discoloured substrate compared to the bleach shade with same thickness.

TITLE: Early Implant Failure: Systematic Review And Meta-Analysis Of Risk

AUTHORS/INSTITUTIONS: N. Nasif, N. Claydon, D. Farnell, D.W. Thomas, R. Adams, Cardiff University, Cardiff, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Dental implants are considered routine treatments with reported survival rates of >95% at 10 years (Howe MS, Keys W, Richards D. Long-term (10-year) dental implant survival: A systematic review and sensitivity meta-analysis. J Dent. 2019; 84:9-21. doi: 10.1016/j.jdent.2019.03.008). Implant failure has been classified as early (failure to achieve osseointegration) or late (failure to maintain osseointegration). Occurring infrequently, the risk of early implant failure and the factors associated with it, are often overlooked in providing informed consent. Here we sought to determine the patient-related factors (sex, smoking status, periodontal status) and surgical factors (antibiotic use, implant length, implant diameter, 1 Vs 2-stage surgery protocols) and their association with the incidence of early failure following implant placement.

Methods: A literature search was undertaken using Pubmed and hand-searching to identify prospective and retrospective studies which documented early failures and patient and surgeon-related factors in the period 2007-2021 with >200 patients in each study. Following abstract screening, studies were excluded in individual analyses if the timing of implant failure was not clearly detailed in the study results.

Results: The initial Pubmed search of key words identified 140 publications, of which 15 studies were included in the final analysis. These included: 69250 implants in 30006 patients. Meta-analysis showed 3 significant risk factors for early implant failure, with significantly more early failures in: a) Smokers (N=7252) vs Non-smokers (N=22016; $p=0.08$; relative risk = 0.51 (95% CI, 0.4-0.83); b) Implants <10mm (N=7278) vs implants >10mm in length (N=45394; relative risk = 0.54 (95% CI, 0.35-0.83) and non-submerged (N=628) Vs submerged implants (N=1462; relative risk = 0.57 (95% CI, 0.36-0.91). As only 2 studies included patients with active periodontal disease in their treatment groups, meta-analysis was not performed.

Conclusions: Smoking, implant length and single-stage surgery are risk factors for early implant failure. These risk factors should be discussed with patients when describing the risk of implant failure in the consent process.

CONTROL ID: 3950001

TITLE: Influence Of Gingival Phenotype On Aesthetic Outcomes Of Implant Treatment

AUTHORS/INSTITUTIONS: S. Paikou, D. Farnell, N. Claydon, D.W. Thomas, R. Adams, Cardiff University, Cardiff, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: It is generally accepted that a "thin" periodontal phenotype presents a risk factor for peri-implant aesthetic outcome (Kao RT, Fagan MC, Gregory J. Conte Thick vs. Thin Gingival Biotypes: A Key Determinant in Treatment Planning for Dental Implants, Journal of the California Dental Association, 36:3, 193-198, DOI: 10.1080/19424396.2008.12221481). Other factors include tooth shape and position, osseous crest position and the degree of gingival scallop. The aim of this study was to determine whether any objective or subjective measures of periodontal phenotype have been able to predict soft-tissue remodelling and peri-implant aesthetic outcome following surgery.

Methods: A systematic review was undertaken of implant-treatment studies to include randomised controlled trials (RCT's) or prospective cohort studies (PCS) published in English, where gingival biotype was characterised using objective and/or subjective assessment pre- and post- implant surgery. Remodelling and aesthetic outcomes were assessed by mesial papilla level (MPL), distal papilla level (DPL) and mid-buccal mucosa level (MBML) using direct and indirect physical measurement. Subjective assessment included the Pink Esthetic Score (PES). Inclusion criteria were >10 patients/study and, a follow-up period of >6-months. Meta-analysis using random and fixed-effects analysis were conducted for the 4 parameters (PES, MPL, DPL, MBML) using Stata O1.

Results: An initial medline search identified 384 articles. Ten studies (8 RCT's and 2 PCS) met the inclusion criteria. PES was reported in 4 studies, MPL/DPL in 3 studies and MBML in 7 studies. Results showed that no difference in peri-implant aesthetic outcome can be determined between thick and thin periodontal phenotype as assessed by PES, MBML, MPL or DPL ($p < 0.01$) irrespective of technique employed in measurement.

Conclusions: Periodontal phenotype as it is currently assessed is not predictive for peri-implant aesthetic outcome. The classification of "thick" and "thin" phenotype is imprecise and in clinical practice aesthetic outcome and remodelling is multifactorial; influenced by the 3-dimensional position of the implant, and the processes of re-epithelialisation, matrix deposition and wound remodelling following surgery.

TITLE: An environment for exposing cells to defined doses of ultrasound

AUTHORS/INSTITUTIONS: D. Gupta, L. Shriane, R.M. Shelton, B. Scheven, A. Walmsley, School of Dentistry, University of Birmingham, Birmingham, UNITED KINGDOM|J. Stevenson, X. Li, H. Metzger, M. Lucas, Centre for Medical & Industrial Ultrasonics, University of Glasgow, Glasgow, UNITED KINGDOM|A. Marek, Faculty of Engineering and Physical Sciences, University of Southampton, Southampton, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Several studies reporting the effects of ultrasound on cells have ill-defined ultrasound parameters due to usage of standard cell culture platforms causing standing waves and delivery of unknown dosage of ultrasound, unsuitable for development of bone healing strategies. Here we report development of a well-defined ultrasound exposure set up for controlled cell experiments in a cell culture cassette.

Methods: The acoustic pressure fields of in-house manufactured 25 and 45 kHz piezoelectric transducers (continuous wave) were analysed in a glass tank (60cm x 30cm x 30cm, filled with degassed water, lined with low frequency ultrasonic absorbers) using a 4mm diameter needle hydrophone. Transverse scans (8mm x 105mm, perpendicular scan of a beam profile) at 5mm and further two scans at 25mm distance with or without the insertion of cell culture cassette were analysed. Longitudinal scans (25mm x 85mm, in direction of wave propagation) at 5mm distance perpendicular to the transducer were analysed. The relationship between the driving current of the transducer and negative peak pressure values was assessed using point measurements.

Results: The transverse and longitudinal scans showed absence of standing waves and combined with the point peak pressure values there was no significant effect on ultrasound propagation due to insertion of a cassette(fig.1). Regression analysis confirmed a linear relationship between the driving current and the pressure generated in water (R^2 values of 0.9937 and 0.9739 for 25 kHz and 45 kHz frequencies at 5mm distance) where the cells would be located during experimentation, and effects of varying pressure and intensity of ultrasound could be assessed more reliably.

Conclusions: An ultrasound exposure system has been developed that does not generate standing waves due to the presence of acoustic absorbers and allows delivery of known parameters of ultrasound to cells for experimentation for bone healing applications.

CONTROL ID: 3950006

TITLE: Diagnosis and management of giant cell granulomas: A case series.

AUTHORS/INSTITUTIONS: A. Gupta, K. Ganesan, T. Janavikulam, Mid Essex NHS Foundation Trust, Essex, England, UNITED KINGDOM|T. Nagpal, Luton and Dunstable Hospital, Luton, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Giant cell granulomas are a rare and benign but aggressive non-odontogenic tumour of bone. They contain fibrous tissue with numerous osteoclasts. It is seen in females twice as frequently than in males and in under thirties.

Intra-lesional biopsies are insufficient to differentiate giant cell rich lesions including central giant cell granulomas, aneurysmal bone cyst and hyperparathyroidism. A definitive diagnosis can be reached by considering radiological features, blood chemistry and genetics.

On radiographic imaging, central giant cell granulomas appear cyst-like, as well rounded, radiolucent areas, faintly loculated or with a honeycomb appearance. The lesion can be destructive and displace the roots of teeth or resorb them.

Methods: The authors' present a case series including the treatment of two peripheral giant cell granulomas and two central giant cell granulomas. The authors discuss investigations that were required to reach a definitive diagnosis. The cases varied in their management dependent upon the size of the lesion and surgical accessibility.

Results:

The two cases of peripheral giant cell granuloma were surgically excised with no evidence of recurrence after five years.

A single case of central giant cell granuloma, was treated with surgical enucleation. The resorbing teeth were extracted at the same time. Serial radiographs taken at follow-up intervals, demonstrated good bony infill at the excision site.

One case of central giant cell granuloma was deemed as surgically inaccessible, the case was approved for medical management via the MDT clinic. Denosumab (RANK-ligand inhibitor) was used and after several months of therapy, the radiographic appearance of the lesion appeared to change from radiolucent to ground glass; a feature of fibro-osseous lesions. Whilst the facial swelling and deformity still remained, the lesion was prevented from expanding further.

Conclusions: Central giant cell lesions have a reported recurrence rate of 15%. The authors discuss the surgical and medical management for giant cell granulomas.

CONTROL ID: 3965171

TITLE: In Vitro Oral Microbiome Modulating Effects of IPMP

AUTHORS/INSTITUTIONS: D. Bradshaw, Haleon, Weybridge, UNITED KINGDOM|H. Thompson, University of Greenwich, London, UNITED KINGDOM|W. Wade, King's College, London, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: To evaluate the microbiome modulation effects of isopropylmethyl phenol (IPMP) using a complex-inoculum in vitro Calgary biofilm model.

Methods: Fresh saliva pooled from 6 subjects was used to inoculate 96-well Calgary Biofilm Device (CBD) microtitre plates, with pegs bathed in pooled saliva and incubated for 18h at 37°C in air/5% CO_2. Pegs were transferred to new plates containing supplemented Brain Heart Infusion (BHI) every 3.5 days. IPMP solutions were prepared in DMSO/PBS, giving final concentrations of 0.1% w/v or 0.05% w/v IPMP. Six replicate 10d biofilms were treated twice daily for 5d with IPMP or 10% DMSO or PBS (as controls), by immersion on a shaker for 1, 2 or 5min. Pegs were washed in PBS for 30s after treatment. Biofilms were harvested before treatment (10d) and at 14d and treated with propidium monoazide (PMA). DNA was extracted (GenElute, Sigma-Aldrich) and the bacterial composition of samples was determined by 16S rRNA gene sequencing (Illumina MiSeq) analysed using mothur.

Results: Alpha diversity indices showed the richness of the IPMP treatment groups were significantly reduced compared to controls. There were significant differences in bacterial composition between treatment groups (AMOVA, $p < 0.01$). Both IPMP treated biofilm groups were significantly different to untreated ($p < 0.01$). LEfSe analysis to identify OTUs responsible for differences showed that IPMP treatment resulted in higher proportions of facultative anaerobes such as Streptococcus and Granulicatella at the expense of obligate anaerobes.

Conclusions: Treatment of biofilms with IPMP reduced proportions of anaerobes compared to the negative control with concomitant increases in relative abundance of streptococci, analogous to the interruption of plaque maturation seen from toothbrushing.

CONTROL ID: 3965173

TITLE: Correlative Microscopy To Evaluate Chemical And Physical Cleaning of Dentures

AUTHORS/INSTITUTIONS: O. Pinel, R. Hawkins, A. Hunt, D. Bradshaw, B. Moghaddam, R. Howlin, Haleon, Weybridge, UNITED KINGDOM|B. Morrison, S. Davis, R. Bonithon, K. Karali, M. Roldo, University of Portsmouth, Portsmouth, UNITED KINGDOM|

ABSTRACT BODY:

Objectives: Ageing global populations mean that removable dental prostheses are increasingly used. They both maintain normal oral functionality, as well as aesthetic appearance for the user but require regular cleaning with specialist methods to avoid the accumulation of bioburden and biofilm. This study developed methods using micro Computed Tomography (microCT) imaging combined with digital volume correlation (DVC) and scanning electron microscopy (SEM) to investigate the effect of both chemical and physical cleaning methods on denture surfaces

Methods: Partial dentures were subjected to 3 months of cleaning with either a commercially available denture cleanser tablet (Polident, Haleon, UK;n = 3) or physical brushing using a standard toothbrush (n = 3). The brushing was executed using a novel setup that controlled the orientation, load and brushing rate. MicroCT imaging was performed using Versa 610 (Carl Zeiss, Germany); datasets were acquired at 50kV/4W with 19.91 μm voxel size, 0.4x magnification, and exposure time of 1 s. DVC analysis was conducted using DaVis 10.053 (LaVision Gmbh, UK); the 3rd principal (ε_{p3}) and shear (γ) strain were extrapolated using a multi-pass process (110 to 30 subvolume size). Areas of high and low strain, identified through DVC, were chosen for SEM imaging at different magnifications, to investigate possible abrasions on the surface.

Results: High shear strain distribution (8000-10,000 με) was found on several areas following physical cleaning using a standard toothbrush. SEM imaging showed a correlation between regions of high strain and apparent microdamage to the denture surface. Conversely, cleaning with a denture cleanser tablet elicited lower shear strain (0-5000 με) across the majority of the imaged denture.

Conclusions: This study demonstrates the use, for the first time, of microCT combined with DVC to assess the material compatibility of denture cleaning methods. Using these techniques, cleanser tablets have been shown to be both an effective and gentle denture cleaning method.