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ABSTRACTS

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3-Minute Oral Presentation Prize
Basic Science
Finalists

3M-B-01

Antibacterial and Antibiofilm Performance of BNNS-reinforced Resin-based Composite

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OBJECTIVES: This study aimed to evaluate the antibacterial and antibiofilm performance of hexagonal boron nitride (h-BN) nanosheets (BNNS) reinforced resin-based composite (RBC) used as dental restorative material against oral cariogenic bacterium Streptococcus mutans (S. mutans).
MATERIAL AND METHODS: A reference flowable composite, formulated with Bis-GMA/TEGDMA mixture and barium silicate glass fillers (40 wt%), was used as the control. Nano-layered BNNS (0.25, 0.5 and 1.0 wt%) were incorporated as a reinforcing filler using ultrasonication, SpeedMixing and vacuum degassing. Disc-shaped specimens were light-cured and sterilised prior to testing. The minimum inhibition concentration (MIC) of BNNS was determined using a broth micro dilution assay with two-fold serial dilutions. Agar diffusion assays were conducted to assess inhibition zones. Antibacterial and antibiofilm performance was investigated against S. mutans in both planktonic and biofilm states using colony-forming unit (CFU) counts (direct viability), resazurin and MTT assays (metabolic activities), crystal violet (CV) staining (relative biofilm mass) and live/dead staining with confocal laser scanning microscopy (CLSM). Biofilm morphology and bacteria-material interactions were further characterised by scanning electron microscopy (SEM). Statistical analysis was performed using one-way ANOVA with Tukey's post-hoc test ($\alpha = 0.05$).
RESULTS: The MIC of BNNS particles against S. mutans was 0.032 mg/mL, while no minimum bactericidal concentration (MBC) was detected up to 1.024 mg/mL. No discernible inhibitory zones were observed around the specimens irrespective of BNNS loading. Increasing BNNS content significantly reduced S. mutans CFU counts, metabolic activity, and biofilm biomass after 24h and 72h incubation, with effects more pronounced for biofilm-associated bacteria than planktonic cells. The 1.0 wt% BNNS group demonstrated antibacterial rates (AR) of 63.3% and 67.0% for 24h and 72h biofilms, respectively. Resazurin and MTT assays showed approximately 50% reduction at 24h and 35%-43% reduction at 72h, while relative biofilm biomass decreased by 41.7% and 50.1% at 24h and 72h, respectively. CLSM revealed a dose-dependent increase in non-viable bacteria with increasing BNNS loadings at both time points. SEM revealed membrane deformation and collapse of S. mutans cells in contact with sharp BNNS edges, indicative of cellular damage.
CONCLUSION: Incorporation of 2D BNNS at low loadings (≤ 1.0 wt%) into light-cured RBCs can significantly enhance their antibacterial and antibiofilm properties against S. mutans. The effects were dose-dependent and more pronounced on biofilm-associated bacteria than on planktonic cells. BNNS therefore represents a promising, aesthetically compatible nanofiller for tooth-coloured restorative materials aimed at mitigating biofilm-related secondary caries.

3M-B-02

Metabolic Reprogramming in Gingivitis, Periodontitis, and Metformin Response

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OBJECTIVES: Periodontal disease encompasses a spectrum from reversible gingivitis to destructive periodontitis, yet the metabolic mechanisms driving disease initiation and progression remain poorly defined. This study aimed to: (i) characterise gingival metabolic reprogramming during gingivitis and periodontitis induction; (ii) elucidate the metabolic effects of metformin in healthy gingiva; and (iii) determine how metformin modulates local and systemic metabolism during periodontal disease progression.

MATERIAL AND METHODS: Two in vivo murine models were employed to independently induce gingivitis and periodontitis. Thirty-six mice were allocated into six experimental groups, including healthy controls, gingivitis, periodontitis, and corresponding metformin-treated groups, with appropriate controls for all conditions. Gingival tissues and systemic blood samples were collected at defined time points. Untargeted LC-MS/MS metabolomics was performed on both local and systemic samples. Multivariate analysis and pathway enrichment were applied to identify disease- and treatment-associated metabolic alterations.

RESULTS: Gingivitis induction produced early metabolic alterations characterised by increased glycolytic activity and partial disruption of TCA cycle balance, representing a transitional metabolic state. Progression to periodontitis resulted in a pronounced “Warburg-like” phenotype, marked by elevated glycolysis, succinate accumulation, and sustained metabolic support for inflammation at both local and systemic levels. Metformin treatment did not simply normalise oxidative phosphorylation. Instead, it induced a distinct, metabolically suppressed state, downregulating glycolytic and TCA cycle pathways in healthy, gingivitis, and periodontitis models. This effect was observed in gingival tissues and mirrored systemically, suggesting coordinated host metabolic reprogramming.

CONCLUSION: These findings redefine gingivitis and periodontitis as metabolically driven inflammatory diseases. Metformin exerts therapeutic effects through active metabolic reprogramming that suppresses the Warburg-like phenotype required for disease progression. Targeting host metabolism may offer a novel preventative and therapeutic strategy to halt periodontal disease before irreversible tissue destruction occurs.

3M-B-03

Understanding Oral Hygiene Behaviour in independent living Older Adults using Ergonomic and Ethnographic Analysis

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OBJECTIVES: Oral hygiene is a complex behavioural process influenced by physical ability, technique, motivation, and environment. In older adults, these factors can interact in subtle ways that are difficult to observe in clinical settings. This study combined in-home video observation, motion analysis, and semi-structured interviews to explore oral hygiene practices, primarily toothbrushing, in a real-world context.

MATERIAL AND METHODS: Participants were recorded brushing their teeth in their own bathrooms using wall- and mirror-mounted GoPro cameras. Videos were analysed using Kinovea motion analysis software to assess total brushing duration, surface coverage, and non-brushing events. These behavioural data were compared with manual dexterity assessments (Purdue Pegboard and 9-Hole Peg Test) and plaque scores. Semi-structured interviews explored participants' experiences, motivations, and perceived challenges around oral hygiene.

RESULTS: Results revealed significant variation in technique, timing, and brushing coverage. Individuals with lower manual dexterity often spent more time brushing, but with increased non-brushing time and less effective plaque removal. The average brushing duration was 124 seconds, with up to 37% of that time being non-contact or idle movement. Interview findings highlighted the role of habit, confidence, and physical limitations in shaping technique. Participants showed clear divergence from professionally recommended brushing patterns, with many focusing heavily on visible surfaces while neglecting lingual and posterior areas. This pattern may in part be explained by ergonomic factors: the design of manual toothbrushes and limitations in wrist mobility made it particularly difficult for participants to brush posterior teeth on the same side as their dominant hand, contributing to consistent under-brushing of these regions. There was also notable variation in the sources of oral hygiene information used, including family advice, internet content, product packaging, and occasional guidance from healthcare providers, which often leads to confusion or conflicting techniques.

CONCLUSION: By integrating motion analysis with qualitative insight, this study offers a multifaceted view of oral hygiene performance in older adults. Observing individuals in their home environment provided valuable context on routine, ergonomics, and behavioural adaptations not typically captured in clinical research. These findings support the development of tailored interventions and underline the value of digital observational tools in capturing the lived experience of oral health behaviours.

3M-B-04

PDL-on-Chip Demonstrates Mechanical Control of BMP2 Responses at the Soft–Hard Interface

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OBJECTIVES: Bone morphogenetic protein (BMP)-2 occupies a paradoxical position in periodontal biology. Although biologically essential for soft–hard interface development in the PDL, its application in tissue engineering/regenerative medicine frequently results in ankylosis, questioning how it truly behaves in different contexts. Mechanical stimulation has long been associated with PDL development. In this study, we inquire if mechanical forces alter tissue responses to BMP-2. The objective of this study was to devise a PDL-on-chip that simulates PDL development in vitro; localize BMP-2 at the interface and observe the effects of mechanical stretch on PDL development.

MATERIAL AND METHODS: Silicone and hydroxyapatite inks were 3D-printed to fabricate a biomimetic microenvironment of the PDL. Mesenchymal stem cells within fibrin hydrogels were treated with BMP-12, cyclic mechanical stretch (8.24%, 0.1 Hz, 6 h/day for 4 days), and macromolecular crowders (MMC). Selected hydroxyapatite microposts were functionalized with sulphonated biomimetic coatings capable of sequestering BMP-2 at the interface. Immunofluorescence, scanning electron microscopy, and proteomic pathway analyses were performed.

RESULTS: A hard/soft tissue interface with evident tissue integration and extracellular matrix (ECM) remodeling was achieved, including greater fiber alignment in bulk regions and crimped fibers (~3–5 µm diameter). Cyclic stretch enhanced differentiation (Scleraxis ≈ 2.5-fold), preserved interface integrity (82% ± 2.3), and upregulated collagen-associated ECM pathways. The presence of localized BMP-2 reversed induced interface failure, restoring tissue integration (>65%). Proteomics analysis indicated that BMP-2 generated a biomimetic matrix-induction profile but upregulated osteogenic pathways only in the absence of stretch; the opposite occurred in the presence of stretch, demonstrating that mechanical loading modulates the effect of BMP-2.

CONCLUSION: BMP-2–mediated interface development is context-dependent. Mechanical stimulation applied to BMP-2–functionalized interfaces promotes interface remodeling rather than ankylosis. The PDL-on-chip provides a reproducible, high-fidelity platform for dissecting PDL remodeling and for preclinical evaluation of periodontal regenerative interventions.

3M-B-05

Cellular basis of palate morphogenesis and clefting in Wnt5a-/- mice

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OBJECTIVES: Orofacial clefts are the most common congenital craniofacial anomaly, with cleft palate (CP) arising from failed palatal shelf outgrowth, elevation, or fusion. While mesenchymal proliferation is considered central to shelf growth, the roles of other cellular behaviours remain poorly defined. Pathogenic variants in WNT5A and related non-canonical Wnt/planar cell polarity (PCP) pathway genes are associated with syndromic and non-syndromic (Robinow syndrome) clefting. This study aimed to determine how Wnt5a/PCP signalling regulates directional growth and elevation during secondary palate morphogenesis.

MATERIAL AND METHODS: A multiscale analytical framework (PROMASS) quantified tissue morphometrics, proliferation, oriented cell division (OCD), clonal behaviour, and nuclear and cellular geometry in wild-type (WT) and Wnt5a−/− mouse palatal shelves. Palate development was analysed across key stages (E12.5–E14.5) using genetic lineage tracing, immunofluorescence, histology, confocal imaging, and ex vivo elevation assays following tongue removal.

RESULTS: Wnt5a−/− embryos closely phenocopied features of human Robinow syndrome, including skeletal dysplasia and fully penetrant CP. Mutant shelves were consistently shorter and broader, reflecting truncated proximodistal outgrowth. Ex vivo assays demonstrated that mutant shelves retain a WT-like capacity to elevate following release of elastic pre-stress, indicating partial mechanistic uncoupling of outgrowth and elevation and implicating extrinsic obstruction by the laterally expanded tongue. Mesenchymal proliferation dynamics were comparable between genotypes and insufficient to explain the marked morphological differences. In WT embryos, mesenchymal organisation was regionally patterned, with elongated and aligned nuclei and modestly biased OCD along the growth axis. Loss of Wnt5a disrupted this coordinated polarity landscape, producing a more isotropic mesenchymal organisation despite similar tissue cross-sectional area and extracellular space.

CONCLUSION: These findings support a model in which Wnt5a acts as a spatial organiser of palatal growth, coordinating mesenchymal polarity, organisation, and mechanics to bias directional outgrowth. Disruption of this coordination, within an altered mechanical context, leads to CP independent of a primary proliferation or elevation defect.

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3M-C-01

Aesthetic Considerations in Caries Management of Primary Teeth

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OBJECTIVES: Dental aesthetics are becoming increasingly recognised in paediatric dentistry due to its focus in social media and apparent growing importance in society. This project aimed to understand the value of aesthetics in managing dental caries in primary teeth by examining stakeholder perspectives, available tooth-coloured crowns, supporting laboratory evidence, and parental decision-making in the UK.

MATERIAL AND METHODS: A mixed-methods approach comprising three components was adopted: 1) a scoping review (ScR) of aesthetic perceptions among parents, children, and clinicians; 2) a market assessment (MA) of prefabricated tooth-coloured crowns and supporting laboratory evidence; and 3) a discrete choice experiment (DCE) examining UK parental preferences, trade-offs, and willingness to pay for aesthetic crown options.

RESULTS: The ScR included 54 studies (parents: 32; parents and children: 15; children: 2; clinicians: 5). Aesthetic concerns were most frequently reported for anterior primary teeth. Parents and children generally preferred tooth-coloured options, while other factors influenced their preferences. Clinicians' opinions were mentioned less frequently. There were 16 restorative materials identified, including seven types of full-coverage crowns (n=27) and silver diamine fluoride (n = 25), which were most frequently reported. The MA identified 16 brands, with their main features and preparation guidance, across eight countries. Manufacturers' information focused on promotion, with limited scientific evidence. This included 19 laboratory studies assessing properties across six brands; data for other brands was absent.
The DCE is ongoing.

CONCLUSION: Aesthetic preferences influence dental treatment decisions for primary teeth, yet their role in decision-making is poorly explored. Limited laboratory data and inconsistent product information, especially for aesthetic crowns, restrict evidence to inform choices for both dentists and parents. This work highlights a gap in evidence supporting currently available aesthetic crowns. The ongoing DCE will inform parental preferences and willingness to pay to support shared decision-making.

3M-C-02

Patient perspectives of NICE endocarditis prophylaxis guidelines: a systematic review

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OBJECTIVES: Infective endocarditis (IE) is a rare but potentially life-threatening condition for which NICE issued guidance in 2008 on antibiotic prophylaxis before dental procedures. This review aimed to explore perspectives and experiences of patients at increased risk of IE in relation to this guidance within dental settings.

MATERIAL AND METHODS: A mixed-methods systematic review was undertaken to identify studies reporting perspectives/experiences on the NICE guidelines. Quantitative, qualitative and mixed-methods studies were eligible. Electronic searches were conducted across MEDLINE, Embase, PubMed, PsycInfo, Web of Science, CINAHL and ProQuest, supplemented by reference list screening and citation searching. Studies were screened against predefined criteria and assessed for risk of bias. Data was extracted and synthesised using a convergent integrated approach, with quantitative findings qualitised and coded for thematic analysis.

RESULTS: Three studies involving 133 participants met the inclusion criteria. Comprising two survey-based and one semi-structured interview study, the latter contributing to most of the data. Key themes included trust in clinicians, preference for cardiologist involvement, perceptions of IE risk, fear and reassurance, uncertainty around the evidence and influences such as cost effectiveness and antibiotic adverse effects. Some expressed relief at avoiding antibiotics due to previous side effects and reassurance when the guidance aligned with recommendations in other areas. Conversely, concerns were raised regarding poor communication between dentists and cardiologists, the seriousness of IE, and the use of adverse effects to justify guidance where patients have no history of allergy. Survey findings echoed similar variability, with greater acceptance of guidance delivered by cardiologists and varied willingness to undergo dental treatment without antibiotics.

CONCLUSION: The findings suggest study participants' concerns regarding the guidance are largely driven by uncertainty and inconsistent communication. As the latest included study was published in 2013, further research is needed to evaluate whether patient perspectives have evolved, particularly following guidance updates and the introduction of SDCEP recommendations.

3M-C-03

Perceptions of patient requests for antibiotic prescribing: a survey of general dental practitioners in the UK

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OBJECTIVES: To investigate general dental practitioners' (GDPs) perceptions of patient requests for antibiotic prescriptions in the United Kingdom, and to examine how these perceptions vary across different practitioner characteristics and practice environments.

MATERIAL AND METHODS: This quantitative study analysed anonymised data from the British Dental Association (BDA) annual survey of GDPs conducted during June-September 2024.

RESULTS: Most GDPs (58.8%) reported receiving antibiotic requests from patients at least weekly, with GDPs working as supervisors for Dental Foundation Training/Vocational Training Educational reported the highest frequency (71.8%). The perception of being stressed due to abusive, demanding or hostile patients was significantly associated ($p<0.001$) with their perception of weekly requests for antibiotics. Other stressors significantly associated ($p<0.001$) with weekly requests included financial pressures specifically from increasing unviability of National Health Service (NHS) dentistry, hitting NHS targets, and inability to provide pre-COVID care levels.

CONCLUSIONS: Patient requests for antibiotics were perceived as frequent occurrences among UK dental practitioners, with difficult professional-patient relations revealed to be a particular issue. Other systemic pressures within dental practices treating NHS patients were also identified as potential influences. Further research to understand these perceptions could enable new approaches for targeted stewardship interventions to optimise antibiotic use in dentistry.

3M-C-04

Oral and dental management and complications of head and neck cancer survivors: An umbrella review

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OBJECTIVES: Head and neck cancer (HNC) survivorship is rising, yet the oral and dental consequences of treatment remain a major driver of long-term morbidity and reduced quality of life. Survivors frequently experience dental caries, oral mucositis, xerostomia/salivary gland hypofunction, dysgeusia, dysphagia, trismus, and osteoradionecrosis. Despite a large evidence base, this population has been studied in silos, leaving clinicians without a unified and credible evidence base for survivorship oral care. The objective of this study was to synthesise and appraise the totality of systematic review evidence on oral and dental complications in adult HNC survivors, evaluate the effectiveness of management strategies, quantify evidence overlap and identify priority gaps for practice and research.

MATERIAL AND METHODS: A PROSPERO-registered umbrella review (CRD420251063188) followed JBI and Cochrane guidance and was reported according to PRISMA. MEDLINE, Embase, Cochrane Database of Systematic Reviews and Scopus were searched from inception to 19 June 2025 (post-hoc restriction to ≥1 January 2015). Eligible studies were systematic reviews (±meta-analysis) of adults treated for HNC reporting oral/dental complications or interventions. Two reviewers independently screened, extracted data and appraised methodological quality using AMSTAR-2. Primary-study overlap was quantified using Corrected Covered Area (CCA). Findings were synthesised narratively by domain, with de novo meta-analysis undertaken where extractable controlled data addressed a clinically pivotal comparison.

RESULTS: From 7,748 records, 125 systematic reviews were included. Evidence was extensive but heterogeneous and frequently low confidence. The most consistent signals of benefit were observed for interventions reducing severe oral mucositis and for radiotherapy technique modifications associated with reduced xerostomia. Topical fluoride regimens consistently reduced radiation-related caries; de novo meta-analysis supported benefit despite substantial heterogeneity, low certainty and high overlap. Evidence for dysphagia and trismus rehabilitation was fragmented and limited by inconsistent outcome measurement.

CONCLUSION: Oral and dental morbidity is a major component of the survivorship burden in HNC, with cumulative functional, psychological and social impacts- yet current evidence is undermined by variable quality, inconsistent outcomes, and gaps in modern trials. Pragmatic, survivorship-focused intervention studies are urgently needed.

3M-C-05

The Influence of Maternal Multimorbidity on Childhood Caries: Mixed-methods Study

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OBJECTIVES: Multimorbidity, the presence of two or more long-term conditions, is increasing globally and poses challenges for health systems. Dental caries remains a major public health issue in the United Kingdom, affecting approximately a quarter of children in Scotland. While individual maternal health conditions have been associated with poorer child health outcomes, including poorer oral health outcomes, no study has examined the relationship between maternal multimorbidity and childhood caries. This mixed-methods study addresses this gap.

MATERIAL AND METHODS: A population-based cohort of 332,502 mother–child pairs was constructed using linked administrative health datasets. Maternal multimorbidity was identified using ICD-10 diagnostic codes and prescribing data. Childhood caries was defined using outcomes from the National Dental Inspection Programme (NDIP) basic inspection at approximately age five. Modified Poisson regression models estimated unadjusted and adjusted relative risks. To complement these analyses, qualitative interviews were conducted with mothers and children to explore experience of maternal multimorbidity and its impacts on child oral health. Data was analysed using thematic analysis.

RESULTS: The study included all children born in Scotland between 2010 and 2020 with NDIP data. In unadjusted analyses, children of mothers with multimorbidity had an increased risk of dental caries (RR=1.14, 95%CI:1.12–1.16, p<0.001). After adjustment for behavioural and physical variables, maternal multimorbidity remained significantly associated with increased risk (aRR=1.10, 95%CI: 1.09–1.12, p<0.001).
Eleven interviews conducted between September and December 2025 identified themes relating to systemic and social support gaps, child-related factors, and facilitators of positive oral health practices.

CONCLUSION: Linked national data provides the first evidence of an association between maternal multimorbidity and childhood caries. Qualitative findings highlight the barriers and opportunities for targeted prevention. As population health needs evolve, these results support integrated prevention strategies and demonstrate the value of national data infrastructure for public health research.

POSTER
Abstracts

P-01
Co-designing for oral health in Parkinson's: the story so far

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OBJECTIVES: People with Parkinson's (PwP) experience progressive motor and non-motor symptoms that can impair their ability to maintain oral health. This study aims to co-design a mouth care support programme to help PwP improve and maintain oral health at home.

MATERIAL AND METHODS: Inclusive recruitment strategies were employed for PwP, partners in care, and healthcare professionals, using both digital and face-to-face approaches, and supported by patient and public involvement (PPI) contributors. Broad inclusion criteria and minimal exclusion criteria were intentionally applied to support recruitment of a diverse and representative sample. Preferred modes of contact and reasonable adjustments were discussed to facilitate participation. Co-design was undertaken through a series of activities guided by the Design Council's four-stage Double Diamond framework and underpinned by behaviour change theory using the Behaviour Change Wheel. Co-design activities were tailored according to the intended aim or purpose, and the intended audience drawing on co-design literature and PPI feedback. Participation was offered through multiple formats, including postal activities, telephone discussions, and digital contributions via email or video call.

RESULTS: Early learning indicates that flexible recruitment pathways and accessible materials support engagement from PwP. Iterative development of co-design activities improved participant confidence and depth of contribution. Inclusion of partners in care supported participation for some PwP and enhanced discussion of oral health behaviours within everyday contexts. Reflexive evaluation, PPIE input, and designer involvement enabled ongoing adaptation of co-design approaches.

CONCLUSION: Inclusive recruitment and flexible, iterative co-design methods can support meaningful involvement of PwP in oral health research. Early findings emphasise the importance of adaptability, anticipatory adjustments, and reflexivity when working with populations with progressive neurological conditions and will continue to inform intervention development.

P-02

Genetic screening of Amelogenesis Imperfecta patients using an smMIPs reagent

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OBJECTIVES: Amelogenesis imperfecta (AI) is a genetic disorder affecting tooth enamel formation. Patients have thin or weak enamel due to reduced quantity or mineralisation. Pathogenic variants in ≥38 genes cause isolated AI. Genetic screening studies have mostly used exome sequencing, but this is expensive, requires complex data processing pipelines and large data storage capacity. Use smMIPs (single molecule molecular inversion probes) to create an AI-disease-specific reagent for robust, and more cost effective high-throughput screening.
MATERIAL AND METHODS: We developed an smMIPs reagent targeting 19 genes implicated in isolated AI and used it to screen 181 AI probands. In total, 609 probes were designed using MIPGEN and used to sequence 599,967 nucleotides covering the 19 targeted genes. For each proband, 100 ng genomic DNA was used to generate barcoded libraries for paired-end 150 bp read sequencing. MIPVAR v.0.1.0 was used to align reads to the human reference genome. Non-reference bases were identified using GATK's HaplotypeCaller v.3.7 and annotated using Annovar. ExomeDepth v1.1.12 was used to perform CNV analysis. A validation cohort of 8 DNA samples with known variants was used to assess the sensitivity of the reagent and pipeline.
RESULTS: While this analysis was intended as a pre-screen to prioritise exome sequencing more efficiently, its use led to molecular diagnoses for 63 probands (35%). 97% coverage at >20x read depth was achieved for the target regions. The cost per sample screened was approximately £40/$50/48€. Variants in three genes; COL17A1, FAM83H (dominant AI) and MMP20 (recessive AI) accounted for approximately half of the solved cases. The smMIPs reagent can be improved by incorporating additional probes targeting regions of reduced sequencing coverage, or novel disease-associated genes, as they are published.
CONCLUSION: The smMIPs reagent provides a robust, flexible, high-throughput, low-cost approach to AI screening, and is available from the authors as a resource to the AI research community.

P-03

The effect of FGF-18 on osteogenic differentiation of human periodontal ligament stem cells for periodontal bone regeneration

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OBJECTIVES: Periodontitis is a chronic inflammatory disease that leads to progressive alveolar bone destruction and eventual tooth loss. Periodontal tissue engineering, integrating stem cells, scaffold and growth factors, offers potential for tissue regeneration. However, its clinical remain unsatisfied. Fibroblast Growth Factor 18 (FGF-18), as a key regulator of skeletal development, has shown potential in enhancing bone regeneration. This study aims to evaluate the effects of FGF-18 on osteogenic differentiation of human periodontal ligament stem cells (hPDLSCs), providing insights for its potential application in periodontal regeneration.

MATERIAL AND METHODS: hPDLSCs were cultured in basal medium and osteogenic medium (OGM), supplemented with 1.25, 2.5, or 5 ng/mL FGF-18. Alkaline Phosphatase (ALP) staining was performed at 7 and 14 days. At 7 days, ALP specific activity (ALPSA) was quantified by p-nitrophenyl phosphate system and normalized to total DNA content. Runt-related transcription factor 2 (RUNX2) expression was assessed by Western blot.

RESULTS: ALP staining showed that at 7 days, OGM+2.5 ng/mL FGF-18 exhibited enhanced staining while OGM+5 ng/mL showed weakened staining, compared with OGM only groups. And at 14 days, OGM+1.25 and 2.5 ng/mL increased ALP staining while OGM+5 ng/mL decreased it, compared with OGM only. Basal medium groups showed similar staining across all FGF-18 concentrations. ALPSA at 7 days was significantly higher in OGM+2.5 ng/mL compared with all other OGM groups ($p < 0.001$), while basal groups showed no significant difference ($p > 0.05$). RUNX2 expression at 7 days was elevated in basal+2.5 ng/mL and OGM+2.5 ng/mL compared with each control groups.

CONCLUSION: FGF-18 affects hPDLSCs osteogenesis in a concentration-dependent way, with 2.5 ng/mL giving the most consistent improvement. These results suggest that low-dose FGF-18 could promote periodontal bone regeneration. Future work will focus on understanding the underlying mechanisms and developing suitable delivery methods to enable clinical application.

P-04

Health and Care Organisational Readiness for Artificial Intelligence: Public Perspectives

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OBJECTIVES: To explore public perspectives on health and care provider organisation readiness to implement Artificial Intelligence (AI).

MATERIAL AND METHODS: We convened a patient and public involvement and engagement (PPIE) workshop attended by 45 members of the public. Following two hours of introductory background on AI in health and care contexts, two vignettes of contrasting outcomes of the same AI implementation in health and care were presented to a subset of participants (n=15), followed by small group semi-structured discussions around i) the distinct characteristics of AI (AI-exceptionalism) and ii) transparency. Four researcher-facilitators captured key discussion points.

RESULTS: On AI exceptionalism, participants emphasised that "AI" covers diverse tools and should be described precisely; public-facing language must focus on clear, accessible information. Workforce readiness and training to use, question, and override AI tools were viewed as essential by participants. Clear and proportionate governance that aligns with established safety, information governance and regulatory standards for other non-AI interventions was also called for.

Regarding transparency, equity concerns included risks of digital exclusion and bias and participants called for inclusive design, testing across demographic sub-groups and national consistency of information. Trust required transparency about data use, performance, error handling and accountable oversight, with preference for assistive rather than fully autonomous use and clear routes for patient feedback. Transparency at point of care was however considered less important than having a trustworthy system. Participants suggested national education campaigns to signpost where AI is used in health and care, and how safety is assured.

CONCLUSION: From the perspective of the public organisational readiness for AI implementation in health and care centres on trust, good governance, workforce capability and equity by design. A risk-based approach, co-developed with the public, can help providers to implement AI in health and care in a way that aligns with public values.

P-05

Information Needs of Dental Providers for an HPV Education Package

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OBJECTIVES: Dental providers are well placed to promote human papillomavirus (HPV) vaccination due to their role in head and neck cancer screening. This review aimed to systematically summarise global evidence on dental providers' knowledge of HPV and HPV vaccination programmes, their willingness to engage in HPV promotion activities, and preferences for educational packages to support this role.

MATERIAL AND METHODS: A comprehensive search of six electronic databases was conducted from inception to October 2024. Studies were eligible if they reported dental providers' knowledge of HPV or HPV vaccination, willingness or practices related to HPV promotion, or preferences for educational interventions. No language restrictions were applied. Data from eligible studies were imported into QSR NVivo 14 for organisation and analysis using a coding framework that was iteratively refined.

RESULTS: Forty-four studies met the inclusion criteria. Substantial global variation in HPV knowledge was identified, with more limited knowledge reported in studies conducted in Asia. Although many dental providers were aware that HPV vaccination may reduce the risk of HPV-driven cancers, misconceptions were common, particularly regarding routes of HPV transmission and eligibility for vaccination programmes. While general support for HPV-related education and promotion was reported, discomfort discussing sexually transmitted infections with patients and parents was frequently cited as a barrier. Educational package preferences favoured interactive formats and included resources to support patient education.

CONCLUSION: Gaps in HPV-related knowledge and reluctance to discuss sexual transmission appear to hinder effective HPV promotion within dental settings. Targeted, interactive educational packages addressing these barriers may improve dental providers' confidence, enhance HPV awareness, and support global efforts to increase HPV vaccination uptake.

P-06

Understanding Mucosal Pellicle Binding through the MUC1–MUC5B Interaction

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OBJECTIVES: To develop a surface-bound MUC1 model mimicking epithelial attachment and to investigate MUC1–MUC5B interactions that influence mucosal lubrication and bioactive retention.

MATERIAL AND METHODS: Recombinant MUC1 was expressed via bacterial transformation or mammalian transfection and purified using immobilised metal affinity chromatography. A lubrication assay was performed by covalently crosslinking purified MUC1 to functionalised glass and polymer substrates using UV-activated chemistry to simulate physiological attachment. Following this, reciprocating tribological tests quantified frictional performance between mucin coated surfaces. In another assay, His-tagged MUC1 immobilised on nickel-coated plates enabled mucin-binding assessment using specific antibodies and chemiluminescent detection. The musical pellicle was further assembled through the absorption of saliva or purified MUC5b to the MUC1 anchor.

RESULTS: Recombinant MUC1 was successfully expressed in both bacterial and mammalian systems. While non-glycosylated bacterial MUC1 was readily purified, the mammalian expression posed challenges due to size and glycosylation complexity. Covalent crosslinking enhanced surface lubricity, and subsequent MUC5B association further reduced friction, achieving superlubricity and indicating possible mucin–mucin interactions. Stable immobilisation of recombinant MUC1 confirmed suitability for quantitative binding assays. MUC5B was detected on the plates after incubation with purified MUC5B solutions and saliva, indicating possible binding to MUC1. These engineered mucin interfaces effectively replicate key physicochemical properties of the oral mucosa.

CONCLUSIONS: The developed MUC1-based models validate the creation of hierarchical mucosal models that enable quantitative assessment of mucin–mucin and mucin–drug interactions. It offers a platform for evaluating the formation of the pellicle, and further, oral bioactive retention and optimisation of mucosal delivery systems.

P-07

The binding of statherin micelles on polished or eroded teeth

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OBJECTIVES: Statherin and calcium forms micelles which can bind both hydrophobic surfaces (only eluted by TBST) or positively charged hydrophilic surfaces (only eluted by EDTA) based on our previous experiments using model surfaces. This study evaluates how statherin micelles bind to human teeth with or without polishing or erosion.

MATERIAL AND METHDOS: Zeta potential of statherin with or without calcium was explored. Three polished teeth were incubated with synthesized statherin with or without calcium followed by sequential elution using TBST (tris buffered saline with Tween-20) and EDTA buffers. Plus, three paired unpolished teeth were incubated with statherin with or without calcium using same elution method. Lastly, four unpolished teeth with serial acid attack using citric acid at different time points (0min, 5min and 10min) were incubated with statherin micelles with same elution methods. Immunoblotting was used for quantification of statherin following elution by either TBST or EDTA after incubation.

RESULTS: The zeta potential of statherin was negative which was neutralized with calcium. Only EDTA elution occurred on polished teeth on which bound statherin reduced after forming micelles. On unpolished teeth, no changes of statherin amount in TBST elution while two had increased EDTA elution and one remained stable after forming micelles. On unpolished teeth with short term erosion, half teeth had increased EDTA elution while the rest remained stable; for TBST elution, half had no TBST elution and half had decreased TBST elution after erosion.

CONCLUSION: polishing natural teeth decreased binding of hydrophobic statherin micelles due to increased positive charge. Plus, short-term erosion also affected the binding of statherin micelles with changed surface property of natural teeth although variations existed between teeth.

P-08

Computational Dissection of Cellular and Molecular Parallels Between Periodontal Granulation Tissue and Oral Precancerous Lesions

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OBJECTIVES: Oral squamous cell carcinoma (OSCC) represents the most prevalent form of oral malignancy and often evolves from precancerous lesions, particularly those demonstrating moderate to severe dysplasia. Simultaneously, chronic inflammatory diseases like periodontitis result in granulation tissue formation, a hallmark of tissue repair and fibrosis. Despite their differing clinical trajectories—regeneration versus neoplastic transformation—both processes share common features: persistent inflammation, altered stromal signalling, and remodelling of the epithelial-mesenchymal interface. This project aims to computationally analyse and compare the single-cell RNA sequencing (scRNA-seq) profiles of periodontal granulation tissues with those from precancerous lesions of the oral mucosa to elucidate potential convergent cellular mechanisms underlying disease progression.

MATERIAL AND METHODS: Our proposed study will computationally align and compare the scRNA-seq datasets from granulation tissue (series GSE 294615, available at https://www.ncbi.nlm.nih.gov/geo/query/acc.cgi?acc=GSE294615) and early-stage from OSCC (HRA004032, available at https://ngdc.cncb.ac.cn/gsa-human/browse/HRA004032). We will focus on conserved pathways across these two systems, including epithelial-mesenchymal transition (EMT), extracellular matrix (ECM) organization, immune modulation, and angiogenesis. Special attention will be paid to shared fibroblast subtypes (e.g., D_FB1 vs. Mesen_CAF), endothelial subpopulations (e.g., V_EC4 vs. VEGF-active endothelial cells), and pro-inflammatory cytokine networks (e.g., IL6, INHBA). Advanced trajectory inference and cell-cell communication modelling (e.g., CellChat, Monocle, CytoTRACE) will be used to trace lineage transitions and intercellular signalling dynamics that might underlie divergent outcomes: regeneration versus carcinogenesis.

RESULTS: Both datasets have been downloaded, and data generation has initiated. By the time of this conference, we will have our initial analysis consisting of epithelial and fibroblast subpopulations comparisons. Ultimately, this comparative analysis seeks to identify molecular determinants that pivot chronic inflammation toward malignant transformation or resolution.

CONCLUSION: By uncovering shared cellular circuits and bifurcation points in disease progression, this project bridges regenerative pathology and cancer biology through the lens of computational single-cell analysis.

P-09

Developing a High-Throughput Model to Optimise Oral Active's Mucosal Retention

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OBJECTIVES: Characterisation of the model mucosal pellicle (MP) through:
• Staining and imaging hydrophobic regions.
• Particle penetration and release from mucin layers.
• Oral active (OA) retention and release from mucin layers.
Project aims to test the retention of OA's in the in-vitro model MP.

MATERIAL AND METHODS:

• Mucins were dried to a 96-well Nunc Delta plate; • Hydrophobic Nile Red-stain and different-sized particles were applied.
• Mucin gel was imaged on a confocal microscope.
• Diffusion of particles out of MP was measured every 5 minutes over 60 minutes using a fluorometer.
• Fluoride retention and release from the model MP was measured every 5 minutes over 60 minutes using an ion-selective electrode in different buffers (water, PBS, carbonate, model-saliva).

RESULTS: Mucins were immobilised to a 96-well Nunc Delta plate with 80% retention after washing. Hydrophobic regions of the immobilised mucin layers were stained successfully using Nile red and imaged using confocal microscopy.
Both nano- and micro-sized particles successfully penetrated the mucin layer to a depth of 60 µm. Particle release profiles showed release in water 60 minutes after particle application. Larger negatively charged particles (~1um) showed higher retention than smaller neutral particles. Neutral particles showed size-dependent MP penetration, with smaller (4-8kDa) particles being retained up to 5-times more than larger (2000kDa) particles. Simple sodium fluoride solutions in different buffers showed no fluoride retention after 5 minutes of rinsing.

CONCLUSION: The model MP successfully retained and released nano- and micro-sized particles 60 minutes after their application, showing charge- and size-dependent particle retention. Preliminary results showed simple sodium fluoride rinses showed no significant retention in the model MP. The next steps for the project are nanoparticle encapsulation, which may provide a way of effectively targeting OA's to the MP. Enamel blocks with biofilms will be incorporated into the model, measuring the effect of mucosal OA retention on enamel remineralisation and biofilm modulation.

P-10

Notch Signalling: A gatekeeper of periodontal homeostasis under pathological conditions

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OBJECTIVES: Periodontal disease begins as gingivitis, triggered by host immune responses to the oral microbiota, and can progress to periodontitis, marked by tissue destruction and granulation tissue formation. The Notch signalling pathway, a critical regulator of stem cell function, tissue repair, and regeneration, is poorly understood in the periodontal tissues. Recently, our group identified a cell population that is specific to the granulation tissue and highly expresses NOTCH, prompting this study into Notch's role in periodontal health and disease using in vivo models.

MATERIAL AND METHODS: Periodontal disease was induced in six-week-old CD1 mice via ligature placement or oral gavage with Porphyromonas gingivalis. Animals received daily intraperitoneal injections of the gamma-secretase inhibitor LY411/575 (10mg/kg) to inhibit Notch signalling, or vehicle only, for 7 days. Controls received the same regimen of injections without disease induction. Alveolar bone loss was quantified using micro-CT (Bruker SKYSCAN 1172, 15µm resolution) and by measuring the alveolar bone crest (ABC) to cemento-enamel junction (CEJ) distances at six sites per tooth. Statistical significance was assessed using unpaired t-tests, with $p<0.05$ considered statistically significant.

RESULTS: In healthy mice, Notch inhibition caused no significant bone loss ($p=0.1868$). Ligature-induced periodontitis caused pronounced bone loss relative to controls ($p<0.0001$), and this destruction was significantly increased by LY411/575 treatment ($p=0.0052$). In the oral gavage gingivitis model, vehicle-treated mice showed no bone loss ($p=0.2191$), whereas Notch-inhibited gingivitis animals progressed to periodontitis with significant bone loss ($p=0.0022$).

CONCLUSION: These results demonstrate that Notch signalling plays a protective role during periodontal disease, preventing bone loss and the transition from gingivitis to periodontitis. This aligns with our human data, indicating that NOTCH-expressing cells promote repair. Furthermore, this study establishes the first reliable *in vivo* model of the gingivitis-to-periodontitis transition. Collectively, our results suggest that Notch signalling protects the periodontium under pathological stress, positioning it as a promising therapeutic target for periodontal disease.

P-11

AOC1 as a Potential Indicator for Chemotherapy Response in HNSCC

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OBJECTIVES: Cisplatin resistance is a major contributor to treatment failure in Head and Neck Squamous Cell Carcinoma (HNSCC), occurring in 33% of HNSCC patients. To improve treatment outcomes, it is essential to identify molecular mechanisms underlying this resistance. Preliminary bulk-RNAseq data identified that AOC1, a gene encoding a redox enzyme, was differentially expressed between cisplatin-resistant (CR) and cisplatin-sensitive (WT) strains of HNSCC cell lines. Using a 3D spheroid model derived from cisplatin-resistant HNSCC cell lines, this study aims to explore mechanisms of AOC1 in conferring cisplatin resistance.

MATERIAL AND METHODS: The CR strain of SCC4 cell line was produced through long-term exposure to cisplatin for 6 months, then generating a cisplatin-resistant, 3D spheroid model. AOC1 protein expression in WT and CR spheroids were examined using Western Blot. Potential interactions between AOC1 and cancer hallmarks were evaluated by measuring cancer stem cell (CSC) markers expressions using RT-qPCR. To understand associations between AOC1 levels and disease prognosis, Kaplan-Meier survival curves and tumour stage plots were generated on GEPIA using TCGA datasets.

RESULTS: Western Blot detected a AOC1 downregulation in the CR strain compared to WT, hence validating preliminary RNASeq data at a protein level. RT-qPCR results suggested upregulation in CSC markers. Interpretation of TCGA-HNSCC datasets revealed a progressive decrease in AOC1 expression in tumours from stage I to IV, though the effects on overall survival could only be observed in a small subset of patients due to the heterogenous nature of HNSCC.

CONCLUSION: This was the first study proposing a link between AOC1 depletion, increased stemness, and cisplatin resistance in HNSCC. In vitro evidence from this study, alongside publicly available TCGA-HNSCC datasets, suggested AOC1 as a potential mediator for treatment response rather than a stand-alone prognostic marker for survival outcomes. Ongoing work therefore focuses on mechanistically defining how AOC1 downregulation contributes to cisplatin resistance phenotypes in HNSCC.

P-12

Metabolic responses to oral glucose in health and periodontitis

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OBJECTIVES: Despite the clear bidirectional relationship between glycemic profile and periodontitis in people with diabetes, less is known about the effect of glucose modulation in individuals without apparent metabolic disease. Gingival crevicular, peripheral capillary blood and venous glucose response were compared in people without diabetes between those with a healthy periodontium and those with periodontitis.

MATERIAL AND METHODS: Normoglycemic patients (fasting plasma glucose between 70-99mg/dL and HbA1c between 5.7%), aged over 18 years old, participated in a prospective, parallel control-group study at Saint Leopold Mandic college (Campinas, Brazil; CAAE 75924423.9.0000.5374) between February and December 2024. Peripheral capillary, gingival crevicular blood and venous blood samples were collected from 15 individuals with periodontal health, and 15 with periodontitis, following an oral glucose challenge (75g glucose in 250-300mL water) at baseline (eight-hour fasting glucose), 30-, 60-,90- and 120-minute intervals (an oral glucose tolerance test).

RESULTS: Glycemic responses in gingival crevicular blood from patients with periodontitis were significantly greater than responses in peripheral capillary blood at 30 minutes ($p=0.0484$), spiking beyond the threshold of insulin resistance (150mg/dl) after the glucose challenge.

CONCLUSION: Glucose homeostasis is locally dysregulated within the inflamed oral microenvironment, independent of systemic glycemic control. Such local metabolic perturbations may fuel inflammatory and microbial processes that perpetuate tissue destruction, providing a mechanistic link between metabolism and immunity in periodontitis.

P-13
Withdrawn

P-14

Pectin's Impact on SHED Viability and Mineralization for RET applications

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OBJECTIVES: Regenerative endodontic therapy (RET) is a treatment for non-vital immature teeth. Despite its advancement, challenges remain in eliminating bacterial biofilms while maintaining a cell-friendly environment to promote root growth. Natural materials such as Pectin offer alternatives to overcome the limitations of current intracanal medications. This study aims to confirm biocompatibility and mineralisation ability of Pectin with stem cells from exfoliated deciduous teeth (SHED) in vitro for potential application in RET.

MATERIAL AND METHODS: SHEDs were obtained from deciduous teeth (n=4) through the dental tissue bank at Leeds School of Dentistry and seeded in on bovine dentin slices coated with 2% Pectin hydrogel from Herbstreith&Fox, (Germany). Cell viability (live/dead stain), proliferation (WST-1 assay), and material cytotoxicity (LDH assay) were assessed after 24 h, 3 and 7 days of culture. Moreover, calcium nodule formation and quantification were assessed using Alizarin Red Stain (ARS) and quantification assay after 14 and 28 days.

RESULTS: SHEDs maintained a similar viability to the control group (uncoated group) at all time points. The proliferation rate in the Pectin group was higher than the control group at 3 and 7 days. The Pectin coated group showed a slightly higher cell death rate than the control group at 24 h and 3 days. However, this decreased significantly after cell acclimatisation at 7 days. The Pectin coated samples showed higher ARS and higher quantity of minerals (1.7 ±0.54) in comparison to the uncoated controls (1.4 ±0.50) at 14 and 28 days.

CONCLUSION: This study confirmed biocompatibility and mineralisation ability of Pectin with SHED cells. This finding indicates possible use of Pectin hydrogels in combination with SHED stem cells in RET in children and young adults. Further investigation on the gene expression will be carried out in the future.

P-15

Theory of change workshops for mini mouth care matters

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OBJECTIVES: This study aimed to describe the process of developing a theory of change for Mini Mouth Care Matters (MMCM) implemented at Alder Hey Children's Hospital. MMCM is an oral health intervention designed to empower the healthcare professionals in the hospital wards to assess, provide and promote oral health care among hospitalised children and young people. The theory of change clarifies how and why MMCM is expected works, identifies indicators of success, and outlines the required steps to deliver better outcomes within a complex healthcare system.

MATERIAL AND METHODS: Three workshops were conducted with thirty-three healthcare professionals, including nurses, student nurses and healthcare assistants working in hospital wards, to create a theory of change map. The workshops included several brainstorming exercises to gather insight from healthcare professionals regarding each component of the theory of change.

RESULTS: An initial theory of change for MMCM was formulated. This theory will support further implementation and will be tested and refined during the planned evaluation.

CONCLUSION: The participatory approach ensured healthcare professionals contributed to improving the intervention and advancing the sense of ownership among healthcare staff.

P-16

Retreatability dissolution potential of bioceramic sealers using essential oils

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OBJECTIVES: To identify the dissolution potential of a bioceramic endodontic sealer by different essential oils.

MATERIAL AND METHODS: Fifteen different essential oils (dōTERRA, USA) were mixed multiple times with a small amount of sealer on a glass slab. Distilled water was subsequently used to simulate typical endodontic activation and irrigation procedures, respectively. A visual examination was undertaken to identify if there was a potential dissolution of the bioceramic sealer that would represent its removal ease during an endodontic retreatment procedure. The oils that reacted with the sealer were taken forward, where they were tested against the sealer within an Endo-Vue Block. Each block was filled with sealer, and the oil was added and left initially within the artificial root canal before being activated. Each oil was kept into the root canal again before being removed using saline irrigation and paper points. The three minute total procedure length (one minute per process) was chosen to simulate a typical clinical retreatment length. The effectiveness of each oil was assessed by taking pre and post-treatment plain film radiographs and photographs for further qualitative comparison.

RESULTS: After both parts of the study, the oils that produced the best response resulting in almost complete removal by dissolution of the sealer were Tea Tree and two blends (DDR Prime and Purify), as seen in both assessment methods. Other oils, such as lemon and ginger, presented little reaction surprisingly and, in some cases, big agglomerates were also observed.

CONCLUSION: Essential Oils are currently used in endodontic retreatment processes to good effect, and we have indicated that they could potentially be used in retreatment involving these newer, more resistant bioceramic sealers. Further testing needs to be undertaken to see if the same results can be produced in a clinical environment.

P-17

Influence of simulated toothbrushing on polished CAD/CAM resin-composites

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OBJECTIVES: To evaluate the effect of two brushing periods with linear movement on surface roughness and surface gloss of two CAD/CAM resin-composites after polishing.

MATERIAL AND METHODS: Eight specimens (13.5 × 11 × 3 mm) of each CAD/CAM resin-composite, Brilliant Crios (Coltene, Switzerland) and Tetric CAD (Ivoclar, Germany)-were sectioned with a diamond wire saw and polished using a 2-step Diacomp Plus Twist system (EVE, Germany). Each specimen underwent two successive 18,000 brushing cycles using ZM-3 toothbrush simulator (SD Mechatronik, Germany). Surface roughness parameters (Sa, Sp, Sv, and Sq) were measured using white light profilometry (Proscan 2200, Scantron, UK), considering 6*6mm for scanning with analysing four interested areas (each area of 2 × 2 mm selected from the central point). Surface gloss was assessed with a glossmeter (Novogloss, UK) at three time points: (A) baseline, (B) after 18,000 cycles, and (C) after total 36,000 cycles. Data were analysed at a significance level of ($p<0.05$).

RESULTS: Data shows there is no statistically significant change in surface roughness either within or between composites after 18,000 or 36,000 cycles ($p<0.05$). In contrast, gloss increased with significant change after brushing for both composites, from baseline to 18,000 cycles and further increased from 18,000 to 36,000 cycles ($p<0.05$). For Brilliant, gloss at (A, B and C) points was 42.06±3.33; 48.80±2.55 and 56.46±4.98 respectively and for Tetric was 46.85±6.41; 50.87±5.78 and 55.14±4.27. No significant differences in gloss were observed between the two composites after brushing.

CONCLUSION: Extended linear toothbrushing caused only minimal and still clinically acceptable changes in surface roughness of the polished CAD/CAM resin composites. However, it significantly increased their surface gloss. Both Brilliant Crios and Tetric CAD showed similar resistance to roughness alterations and exhibited comparable gloss trends under simulated brushing.

P-18

Fabrication and optimisation of a 3D printed polyhydroxybutyrate/MXene hybrid scaffold for bone regeneration

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OBJECTIVES: Owing to its intricate anatomy, complete recovery of an osteochondral defect becomes difficult when the lesion reaches the subchondral bone. Polyhydroxybutyrate (PHB), as an optimal thermoplastic printing material, softens at elevated temperatures, allowing extrusion and reforming upon cooling to produce constructs with intricate geometry. However, it has limitations, such as high hydrophobicity. Titanium carbide (Ti_3C_2, MXene), a 2D material, has been shown to improve hydrophilicity of combined materials. Hence, we developed a novel hybrid ink of PHB and polycaprolactone (PCL) with MXene to support cell adhesion in bone-mimicking constructs.

MATERIAL AND METHODS: PHB (BOC Sciences, USA) was mixed with MXene (NANOPLEXUS, UK) and PCL (Sigma-Aldrich, UK) at several ratios (80/5/15, 80/10/10, 80/15/5). Scaffolds were then printed using BIO X6 printer (Cellink, UK). Differential scanning calorimetry (DSC) and water contact angle measurement were employed to investigate the thermal denaturation of PHB and its hybrid samples, as well as the hydrophilicity. Cytotoxicity test was performed. CellTracker™ was used to track the attachment and adhesion behaviour of the human dental pulp stem cells (hDPSCs).

RESULTS: MXene addition increased PHB melting temperature from 166.6°C to 175.7°C and reduced water contact angle from 88.2° to 71.3°, showing better wettability. CCK-8 and Live/Dead staining tests confirmed excellent biocompatibility. On PHB-only scaffolds, pre-treatment with 20% FBS greatly improved initial cell attachment, while plain medium led to minimal adhesion. After two days, cells were fully spread and displayed typical adhesion shapes, confirming that the scaffolds support both early attachment and sustained cell spreading.

CONCLUSION: PHB/PCL/MXene hybrid scaffolds are printable and cytocompatibile. Serum pre-treatment further enhances early adhesion, and the scaffolds support proper cell spreading and morphology over time, highlighting their potential for osteochondral tissue regeneration. More work will focus on comparing cell attachment ability across different MXene content scaffolds and osteogenic ability via ALP (Alkaline Phosphatase) quantification.

P-19

Bonding strength of a new photoactivation system: analysis of aging

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OBJECTIVES: With the limitation within the use of resin cements during the cementation of prefabricated posts that may not achieve complete polymerization due to limited light transmission along the root canal and the decrease of adhesive resistance in deeper thirds, this in vitro study aimed to evaluate the effect of combining a perforated glass fibre post with an optical fibre light transmitting device on the bond strength between the post and root dentin when using a dual-cure resin cement.

MATERIAL AND METHODS: Sixty human teeth were prepared to receive a partially translucent perforated glass fibre post containing an internal canal that allows insertion of an optical fibre throughout its length associated with Allcem Dual (FGM), enhancing light delivery to the apical third. The specimens were divided into six groups, where half were evaluated before thermomechanical cycling: conventional post with conventional light curing unit (C1), perforated post with conventional light curing unit (PC1), and perforated post with optical fibre device (PO1). The remaining groups were evaluated after thermomechanical cycling: conventional post with conventional light curing unit (C2), perforated post with conventional light curing unit (PC2), and perforated post with optical fibre device (PO2). Aging was simulated with 500.000 cicles, using a thermomechanical cycling machine. Bond strength was assessed using the push-out test (EMIC – universal testing machine) on the cervical, middle, and apical thirds.

RESULTS: Data were analyzed using descriptive and inferential statistics after verification of homogeneity and homoscedasticity. Most groups showed normal distribution within the Shapiro–Wilk test ($p > 0.05$), allowing parametric analysis. One-way ANOVA revealed significant differences in adhesive strength among groups ($p < 0.001$), and in Tukey's post hoc test, the PO2 group exhibited the highest bond strength values, particularly in the apical third.

CONCLUSION: Combining a perforated fibre post with an optical fibre device enhanced adhesive strength, representing a promising clinical alternative.

P-20

Can 3D-Printed-Resins Match Mechanical and Structural-Performance of Ethylene-Vinyl-Acetate in Sports-Mouthguards?

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OBJECTIVES: Orofacial injuries are common in contact sports, and EVA remains the gold standard mouthguard material. With the advancement of digital dentistry, new 3D printed resins have emerged, yet their mechanical behavior and protective capability remain insufficiently understood. This study compared the mechanical behavior and structural characteristics of conventional EVA and 3D printed KeyGuard resin before hydrothermal aging.

MATERIAL AND METHODS: Shore A hardness of thermoformed EVA and 3D-printed KeyGuard specimens (25 mm diameter × 6 mm thickness) was evaluated (Shore A durometer, ZwickRoell, Germany). Surface roughness of 12-mm diameter discs (n = 10) using optical profilometry (Proscan 2200, Scantron, UK). Impact testing was performed at a kinetic energy of Ep = 0.5496 J, applied horizontally, using a 35 mm steel sphere against a 3D-printed skull instrumented with strain gauges on the maxilary region.

RESULTS: The results demonstrated significant differences between KeyGuard (94.5 ± 0.50) and EVA (89.5 ± 1.38) ($p < 0.001$). Surface roughness was also significantly higher for KeyGuard than the EVA, including Ra (0.253 ± 0.029 µm vs. 0.127 ± 0.017 µm, $p < 0.001$), Rq (0.973 ± 0.062 µm vs. 0.577 ± 0.108 µm, $p < 0.001$), and Rz (0.973 ± 0.062 µm vs. 0.577 ± 0.108 µm, $p < 0.001$) parameters. Despite these differences, KeyGuard transmitted significantly less strain during impact (283 ± 82) compared with EVA (590 ± 78) ($p < 0.001$), indicating improved impact attenuation.

CONCLUSION: Preliminary findings indicate that KeyGuard may achieve a protective performance approaching. Further characterization will determine whether it can be safely recommended as an alternative material for digitally fabricated sports mouthguards. Scanning electron microscopy (SEM) is being conducted to correlate microstructural features with mechanical behavior. Additional analyses, including digital image correlation, micro-CT, tensile testing, also post thermocycling evaluation conditions; and explicit dynamic finite element analysis are underway to advance understanding of characterization, stress distribution and energy absorption mechanisms.

P-21

Stannous Fluoride Exhibits Antimicrobial And Immunosuppressive Effects In Vitro

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OBJECTIVES: The antimicrobial properties of stannous fluoride (SnF_2) have been widely recognised, though its efficacy can be strain and dose dependent. We report an in vitro exploration of the antimicrobial effects of SnF_2 against oral bacteria and its influence on host-microbial interactions.

MATERIAL AND METHODS: Planktonic commensal and pathogenic oral bacteria (Fusobacterium nucleatum ATCC10953, Porphyromonas gingivalis W83, Prevotella intermedia OMZ248, Streptococcus mutans and S. sobrinus) were grown in tryptone-vitamin base medium with 0-28.97 mM of SnF_2 for 48 h. Bacterial growth was estimated via OD600nm. For host interaction models, TIGK cells (telomerase-immortalized gingival keratinocyte; 50,000 cells/well, 48-well plate) and THP-1 macrophages (MOI 5:1, 24-well plate) were co-cultured with commensals and treated with or without 0.226 mM SnF_2 for 24 h. Culture supernatants were analysed for IL-6 and IL-8 secretion by ELISA.

RESULTS: SnF_2 exhibited both strain- and dose-dependent growth inhibition across bacterial isolates, with significant effects at ≥ 0.453 mM for most strains ($p<0.05$) and complete suppression at 28.97 mM. The concentration of SnF_2 (non-cytotoxic) at 0.226 mM reduced IL-6 secretion from THP-1 differentiated macrophages (at M0 stage) when cells were co-cultured with selected bacterial strains. Similarly, this concentration of SnF_2 suppressed both IL-6 and IL-8 production by TIGK cells in response to bacterial challenge, indicating a potential dual role in microbial control and inflammation modulation.

CONCLUSIONS: SnF_2 demonstrated effective antimicrobial activity while also attenuating pro-inflammatory cytokine responses in host cells. These findings suggest its therapeutic benefits in controlling oral microbial growth and mitigating microbial-associated inflammation. Further research is needed to elucidate the underlying mechanisms and to confirm these potentials in more complex models and clinical settings.

P-22

Development and Mechanical Validation of Multi-Material 3D-Printed Tooth Models for Pre-Clinical Dental Training

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OBJECTIVES: Conventional typodont and single-material resin teeth used in pre-clinical dental education do not adequately reproduce the structural layering or mechanical behaviour of natural enamel and dentine, limiting the development of realistic restorative and endodontic skills. This study aimed to design, manufacture and mechanically test multi-material 3D-printed tooth models that better replicate the tactile and cutting characteristics of human teeth.

MATERIAL AND METHODS: Tooth specimens were fabricated using two 3D printing techniques: stereolithography (SLA; Formlabs) and polyJet printing (Stratasys J5). Seven SLA photopolymer resins and four PolyJet resins were investigated. Materials characterisation included Vickers and Mohs hardness testing, surface roughness measurements and scanning electron microscopy (SEM). Cutting behaviour was assessed using a custom-designed test simulating clinical hand pressure under a controlled 150 g vertical load. Educational and tactile performance was evaluated by 59 participants, including undergraduate and postgraduate dental students and academic staff, using structured questionnaires (Ethics Ref: 064036).

RESULTS: The high glass-filled resin exhibited hardness and cutting resistance comparable to dentine, while ceramic-reinforced and Provisional Restoration resins demonstrated enamel-like behaviour. Alumina N4 showed excessive stiffness and poor cutting realism. Printing orientation significantly influenced canal integrity, with a 0° orientation minimising apical obstruction. Participant feedback indicated enhanced tactile realism and perceived educational value compared with conventional plastic typodont teeth.

CONCLUSION: These findings demonstrate that multi-material 3D printing, combined with appropriate resin selection and print orientation, enable the development of biomimetic tooth models that improve realism in pre-clinical dental education.

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Impact of Scan Orientation on Accuracy of Intra-Oral Scanner Measurements

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OBJECTIVES: Intra-oral scanners (IOS) are clinical digital devices and involve freeform scanning of teeth. They allow a surface to be scanned and measured in any orientation. Measurement error of surface features may be influenced by whether the scan is orientated to the exact plan of measurement. The objective of this study was to determine the effect of orientation on IOS measurement error when quantifying 2D maximum step-height and volume of features on typodont acrylic upper incisor teeth with widths 2000 µm and depths 25 – 400 µm.

MATERIAL AND METHODS: Pilot data indicated a minimum of seven features were required. Eight features were created on typodont teeth using a milling machine or a sandblaster. Baseline scans and pre- and post-feature scans were repeated five times using a white-light profilometer (WLP) (Taicaan Technologies, UK) and an IOS (Primescan, Dentsply Sirona, USA). Scans were registered and analysed using surface metrology software (Geomagic Hexagon, Sweden) both orientated to the z-axis and unorientated. 2D maximum step-height error of the IOS vs. WLP (MountainsMap Digital Surf, France) and volume error data were calculated (BEX Taicaan Technologies, England). Data were analysed in SPSS, step-height data were normal and t-test applied, volume data were not normal and Wilcoxon signed-rank applied.

RESULTS: The IOS step-height error was -24.9 µm to 544.8 µm when unorientated and -19.9 µm to 4.3 µm when orientated, $p<0.0001$. IOS volume error ranged from -0.408 mm3 to 0.012 mm3 when unorientated, and -0.053 mm3 to 0.001 mm3 when orientated $p=0.008$. As the feature volume and depth increased, the impact of orientation error also increased.

CONCLUSIONS: The orientation of data prior to measurement has a statistically significant impact on the measurement error when using IOS scanning for feature depth and feature volume quantification. As feature dimensions increase, orientation of data to the defined plan of measurement becomes increasingly important.

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Investigating Paediatric Evidence-Based Preventive Care Delivery in Saudi Arabia

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OBJECTIVES: to investigate general dental practitioners' (GDPs') attitudes and behaviour with regard to the delivery of evidence-based practice (EBP) of professionally-applied fluoride varnish (FV) and fissure sealants (FS) for children, in Saudi Arabia and to make informed recommendations on interventions to improve the use of EBP.

MATERIAL AND METHODS: A multi-methods design was used, comprising an observational study and an explanatory sequential mixed-methods study. Cross-sectional survey findings were integrated with qualitative interviews to explore and explain barriers and facilitators to evidence-based preventive practice among GDPs in Saudi Arabia.

RESULTS: In the observational study, 35 GDPs were observed delivering routine dental care to 643 children. Although 98% of children met eligibility criteria to receive FV, only 4% received it. Similarly, 74% were eligible for FS, and only 1.9% received one or more sealants. The most frequently delivered preventive measure was brushing instruction.
The mixed-methods study included 382 completed surveys and interviews with 20 GDPs. The mean reported application rates of FV and FS for high-caries-risk children were 31% and 33%, respectively. There were significant regional differences in the application of both FV and FS, and a significant difference by practice setting for FS only. Within the Theoretical Domains Framework, social norms, behavioural regulation, and environmental constraints were significantly associated with FV application, whereas behavioural regulation and knowledge were significantly associated with FS application.

CONCLUSION: Our research provides compelling evidence that general dental practitioners demonstrate a notably low adherence to EBP regarding the application of FV and FS. This is particularly concerning given that most of the children attending the dental clinic are eligible for these preventive treatments. Multiple barriers and facilitators to the application of evidence-based preventive practices in this context have been identified. These findings underscore the need for increased implementation strategies to bridge the gap between current practice and evidence-based guidelines.

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Development of PolyHIPEs Scaffolds as an Intervention for Medication-Related Osteonecrosis of Jaw

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OBJECTIVES: Medication-related osteonecrosis of the jaw (MRONJ) is a severe condition predominantly affecting cancer and sometimes osteoporosis patients treated with antiresorptive medications such as bisphosphonates and denosumab. Following dental procedures or trauma, the jawbone exhibits impaired healing and remains exposed to the oral microbiota, resulting in infection and progressive necrosis. This represents an unmet clinical need requiring both antimicrobial and regenerative interventions. The aim of this study was to develop three-dimensional polymeric scaffolds via emulsion templating, incorporating antibiotics and hydroxyapatite (HA) to achieve a dual approach of infection control and bone tissue regeneration.

MATERIAL AND METHODS: Photocurable poly(glycolide-co-caprolactone) (PGCL) was synthesised through ring-opening polymerisation and methacrylated for photocuring. Porous PolyHIPE scaffolds were fabricated and analysed using scanning electron microscopy (SEM) for morphology and energy-dispersive X-ray (EDX) for HA distribution, while porosity was determined by pycnometry. Mechanical strength and water uptake behaviour were assessed. Cytocompatibility was evaluated using Resazurin assays with L929 fibroblasts and MLO-A5 osteoblast-like cells, along with Live/Dead, and H&E staining. Angiogenic potential was assessed using the chick chorioallantoic membrane (CAM) assay.Antibacterial efficacy was assessed using disc diffusion assays, while antibiofilm performance was evaluated using crystal violet biofilm resistance assays against one aerobic and one anaerobic laboratory reference strain, together with two anaerobic patient-derived bacterial isolates recovered from MRONJ lesions.

RESULTS: Scaffolds exhibited 47 ± 29 µm pore diameter, 66% porosity, 144% water uptake, and compressive modulus of 3–6 MPa. H&E and Live/Dead staining confirmed cell proliferation through interconnected pores, and CAM analysis demonstrated robust vascular infiltration.Antibiotic-loaded scaffolds produced clear zones of inhibition and significantly reduced biofilm formation across both laboratory strains and patient-derived MRONJ isolates compared to non-loaded controls.

CONCLUSIONS: The engineered PGCL–HA PolyHIPE scaffolds exhibit favourable physicochemical, biological and angiogenic properties for MRONJ prevention, showing strong potential for socket preservation and bone regeneration applications. Future work will investigate antibiotic drug release kinetics, osteogenic differentiation potential, and long-term biological performance.

YOUR NOTES