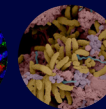
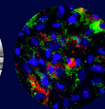
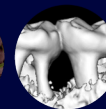
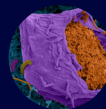




THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Dentistry



Research Day 2024: Bits & Bites

Tuesday, January 23

ABSTRACTS

A Potential Non-Invasive Approach Using DNA-Imaging Cytometry for OC Recurrence

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Objectives: Oral cancer (OC) imposes a significant global health burden, causing substantial morbidity and mortality. Predicting OC recurrence is crucial for prognosis, but repeated biopsy, the current care standard, can be challenging. Our study investigated the use of DNA-imaging cytometry (DNA-ICM), which can detect gross alterations of cellular DNA-content, to screen for OC, specifically exploring its potential in predicting recurrence at a 24-month post-surgery period.

Methods: As a pilot project, we analyzed 106 brushing samples (23 at initial diagnosis) from 48 intent-to-cure surgery patients with at least 24 months post-surgery follow-up. Of these, 20 had local recurrence (LR) and 28 did not (nLR). Samples were collected using a curved interdental brush, preserved in PreservCyte® solution, and stained for DNA analysis using Thionin stains. A digital whole slide scanner system (MoticEasyScan®) and in-house software were employed to automatically segment and calculate the DNA index (DI) for each nucleus. Normalized DNA amount of all nuclei for each sample were grouped into: Group 3, $0.85 \geq DI < 1.1$; Group 5, $1.1 \geq DI < 1.7$; Group 6, $1.7 \geq DI < 2.25$; and Group 7, $DI \geq 2.25$. A Maxstat R-package was used to identify the cutoff to predict LR.

Results: No significant differences were observed in age, sex, and smoking between LR and nLR, nor in T stage, tumour grade, and depth of invasion among the cancer patients. Utilizing a previously published algorithm, all 23 initial brushings showed positive quality control scores. Using recurrence at 24 months as the outcome, Maxstat tests with maximum log-rank statistics identified a cut-off point of 0.32% of DI over 1.7 to distinguish LR (N=51) from nLR (N=32) brushings ($p=0.003$). With this cut-off, study samples showed 0.73, 0.74, and 0.74, in sensitivity, specificity, and accuracy, respectively.

Conclusions: The DNA-imaging method offers a promising, non-invasive tool for post-treatment monitoring for LR in OC. Larger-scale studies are ongoing to confirm these findings.

Acknowledgements: UBC Faculty of Dentistry Undergraduate Student Summer Research Award.

Tooth Survival Following Root Canal Treatment by UBC Students

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Objectives: Dental literature is divergent in pointing at predictors of long-term tooth survival, and guidelines in most clinics and schools still advise restoring endodontically treated teeth with a full crown. We hypothesized that a partial coverage/restoration would be linked to higher tooth longevity. This study measured survival rates (%), in years/follow-ups, of endo-treated teeth (outcome), and pinpointed pre-, intra-, and post-endodontic factors affecting the outcome.

Methods: Electronic charts were accessed if patients had an endo-treated tooth at UBC's Dentistry Clinic (Jan. 2000–May 2023). Sample size indicated the need for 252 partial-coverage events/extraction. Data collected included: patient/tooth features, endo-therapy aspects, and restorative aspects. Survival estimates were calculated using Kaplan-Meier estimates. Multivariate Cox regressions (HR; 95%CI) identified factors associated with failure. A backward stepwise procedure selected covariates (only those with $p < 0.2$ in the unadjusted assessment) to be included in the multivariate analysis. Final model considered $\alpha = 5\%$.

Results: From 4982 patient charts, this study assessed 156 patients/teeth (1 tooth per patient). Twenty-one (13.4%) teeth were extracted and 135 (86.5%) survived. Mean estimate time of survival was 105.4 months (8.78 years) (95%CI: 94.2-116.6); 50% of the tooth survived after 116 months (9.6 years) (median survival time). Unadjusted analysis demonstrated that acute problems, number of providers, number of contact points, terminal arch location, type of restoration (if partial or total), and material for partial coverage (temporary or definitive) were significant. After adjustment, only the type of restoration remained associated with extraction (HR: 0.15; CI 95% 0.05-0.44). Teeth with full coverage had lower HR.

Conclusions: Survival of endodontically treated teeth by UBC students (DMD and Grad Endo) was 105.4 months (8.78 years). Teeth with full coverage (including those with access through the crown) were more likely to be retained in-mouth compared to teeth with partial restorations (temporary or definitive) 8 to 9 years after obturation.

Acknowledgements: Partially supported by the UBC Work Learn Program – Summer 2023.

Towards Efficient Segmentation in Dental CBCT via Convolutional Neural Networks

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Objectives: Creating segmentation masks (categorically separating areas corresponding to morphologically significant entities) for 3D images is a slow manual process. Recently interest has grown in machine learning (ML) methods to automate and increase efficiency of segmentation. However, most contemporary 3D convolutional neural networks for image analysis require significant computational resources and large datasets comprehensively marked for supervised training. This study aimed to:

- Generate a data process that reduces the workload of creating training datasets while ensuring compatibility with accordingly modified ML models.
- Explore alternative ML methods that are both less computationally intensive and less demanding of the decreased dataset requirements.

Methods: Four main methods were trialed: 2D multidirectional, 2D imperfect dataset, 3D standard, and 3D imperfect dataset methods. The 2D multidirectional segmentation model takes convolutions across all planes of the images to retain spatial information. For imperfect dataset models (run on partially segmented datasets), training is explicitly biased towards layers weighed with higher confidence marks. Training was conducted on open-source datasets using Python, TensorFlow, and NiBabel.

Results: We generated a new data process for training dataset creation. Incompletely marked segmentation is now allowed and different levels of confidence (e.g. between valid and interpolated layers) are recorded in the output dataset itself via confidence weights and accessible to the ML trainer. Modified ML algorithms were developed and trained, followed by preliminary analysis of their performance via two metrics—*Balanced Accuracy* and *Log Loss*—proxies for accuracy on the manually segmented training set and generalizability capacity to other datasets/images.

Conclusions: The feasibility of the simplified segmentation process and correspondingly modified training was demonstrated in the context of the test open-source datasets. Future work will apply the process at scale to create training datasets from dental CBCT scans to validate segmentation of endodontic filling materials and out-of-sample performance of model outputs.

Acknowledgements: Funding was obtained from the UBC Faculty of Dentistry Undergraduate Student Summer Research Award.

Modulation of Human Gingival Fibroblast Phenotype in 3-Dimensional Spheroid Cultures

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Objectives: Human gingival fibroblasts (GFBLs) share key properties with mesenchymal stromal cells (MSCs), including multipotent differentiation capacity. In tissues, cells reside in a 3-dimensional (3D) niche that is a key regulator of cell phenotype. We hypothesized that culturing GFBLs in 3D spheroids regulates their phenotype distinctly compared to traditional 2-dimensional (2D) monolayer cultures. The aim of this study was to characterize the morphology, metabolic activity, and gene expression of GFBL 3D spheroids compared to 2D monolayers over time.

Methods: GFBLs were cultured in Dulbecco's Modified Eagle Medium (DMEM) with 4.5 g/L glucose and 10% fetal bovine serum (FBS). To initiate spheroid formation, 10,000 GFBLs were seeded per well in non-adhesive 96-well plates coated with agarose. Spheroid morphology (phase contrast microscopy, histology, quantitative image analysis) and metabolic activity (MTT assay) were assessed at various time points for up to 21 days. Early-stage gene expression was compared to 2D monolayer cultures using qPCR.

Results: Upon seeding, GFBL spheroids reached ≥ 0.9 circularity (1.0 = perfect circle) within 72 hours. Spheroids decreased significantly in diameter until day 10 ($238 \pm 15 \mu\text{m}$) where they remained stable in size up to day 21. Similarly, metabolic activity decreased significantly until day 7 and then remained stable up to 21 days. Cross sections of the spheroids at day 21 displayed cell distribution throughout spheroids with the highest density on the spheroid surface. Of the 23 genes analyzed, 11 were significantly upregulated in spheroids compared to 2D cultures; this included genes involved in osteogenic differentiation and pluripotency.

Conclusions: GFBLs can form 3D spheroids that remain viable for up to at least 21 days in culture. This is associated with significant changes in cell phenotype, including upregulation of osteogenic and pluripotency genes. Spheroid cultures may provide a novel *in vivo*-like model to study stemness, osteogenic differentiation, and regenerative potential of GFBLs.

Acknowledgements: Supported by the Canadian Institutes of Health Research (CIHR PJT-153223), the Natural Sciences and Engineering Research Council of Canada (NSERC RGPIN-2017-05765), and the NSERC Undergraduate Student Research Award (USRA 583222-2023).

Detection of Microbiome from Non-Invasively Collected Oral Brushings: Pilot Study

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Objectives: Ample evidence suggests an important connection between the oral microbiome and the development of oral cancer (OC). There is a growing need to standardize methodology when characterizing the unique microbial composition between individuals. The objectives of this study were to assess the yield of microbiome DNA from different types of oral samples and characterize detected oral bacteria associated with OC.

Methods: As a proof-of-principle study, samples were collected from frozen tumour cores (12), tumour imprints (12), and lesional brushings (9) of pathologically determined OC patients along with non-lesional, contralateral brushing samples (13, 9 paired with lesional brushings). DNA was extracted using the QIAmp DNA Microbiome Kit and quantified at UBC's Biofactorial High-Throughput Biology Facility. V4-V5 regions of the 16S rRNA amplicon were sequenced on the Illumina MiSeq platform to compare the microbiome from various samples. The resulting amplicon sequence variants were used in taxonomic analysis with R.

Results: Even with some of the low DNA yield samples, over half of the samples (24/46) were successfully amplified, generating meaningful data for microbiome analysis: 4/12, 5/12, and 16/22 from tumour cores, tumour imprints, and brushings, respectively. When comparing lesional and non-lesional brushing samples, we observed a higher Shannon's diversity index score in non-lesional brushings. Among bacterial species present in at least 5 samples, *Streptococcus anginosus*, *Fusobacterium nucleatum*, *Parvimonas micra*, and *Peptostreptococcus stomatis* were identified as having increased abundance in OC samples compared to non-lesional brushing samples. *Fingoldia magna* was found exclusively in OC samples. The multidimensional scaling plot showed clustering in Bray-Curtis diversity between the oral microbiome of lesional brushings and non-lesional brushings, irrespective of OC status.

Conclusions: Non-invasive brushing samples show promise for characterizing oral microbiomes in OC settings. Sample collection for a larger cohort study is ongoing to ascertain differences in brushing location and the microbiome of OC patients.

Oral Cytology: Comparison of Cytobrush Plus GT® and Orcellex® Brush

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Objectives: Oral lesion screening often entails analyzing oral mucosa cells using an oral brush biopsy, a minimally invasive method for cell collection, and liquid-based cytology (LBC) to prepare monolayer cells on slides for analysis. The key to successful screening using this procedure is obtaining an accurate cellular representation from all layers of the lesion. Two popular brush designs available for performing LBC are the Orcellex® brush and the Cytobrush Plus GT®. The objective of this study was to compare and analyze the number of cells obtained with each brush.

Methods: Two student experimenters, one experienced in brushing and one with no prior experience, collected samples from one another's oral cavities for 6 rounds at 1-week intervals. The brushing protocol followed sample collection protocols outlined by the brush's respective manufacturers. Samples were collected from three sites (buccal mucosa, lateral borders of the tongue, and floor of the mouth) on both the left and right side of the oral cavity.

Results: There was no statistically significant difference in the total number of cells collected using the Cytobrush Plus GT® and Orcellex® brush. This held true across all sites within the mouth, on both sides of the oral cavity, and regardless of whether the samples were collected by a more experienced or less experienced collector.

Conclusions: Neither brush model proved to be superior in the total number of cells collected. Instead, the results suggested that the expertise of the sample collector, the site of sample collection, and the technique used for the collection and processing of the data may be the major factors contributing to the number of cells collected in each brushing procedure.

Acknowledgments: This work was supported by the BC Cancer Research Center and funded by the Fanconi Anemia Research Fund.

Integrating Case Base Learning in Pharmacology

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Objectives: The goal of this project was to understand and practice the routine of being a professor from behind-the-scenes preparation to live lecture presentation. Clinical skill competencies are challenging, but the application and integration of clinical skills are in the new wave of teaching. Therefore, we hypothesized that, further interaction, application, and practice of clinical knowledge in the classroom setting will increase student confidence. The aim of this project was to build a teaching framework in pharmacology and medical emergencies in the dental office.

Methods: Various measurements were used to measure student responses including: pre-survey google forum questions, a pre-quiz of 10 questions, review of the pre-quiz answers, watching videos for additional review of previously studied material from FMS 1 and Pharmacology courses, delivery of cases with incorporation of medical emergencies, class discussions, review of cases, and post-survey google forum questions.

Results: Despite getting a good grade, as the year passed, over 50% of the respondents felt they were not progressively getting more confident in answering pharmacology exam questions. The results after case presentations and review videos may support student weak areas and concerns, as 70.4% felt that the case was challenging but manageable and 96.7% of students felt that the case reinforced class material. With an increase in patient care perspectives by all students (100%), the teaching aid presented through this project had potential to increase student confidence throughout dental school and in practice as 78.6% of students felt this case would make them feel more self-assured while taking block exams.

Conclusions: In conclusion, this work supports findings that further integration of case-based learning and interactive activities that challenge students to connect concepts can increase student confidence. This aids in their knowledge when taking standardized tests, which can also be generalized to dental schools in Canada and international schools.

Acknowledgements: The American Dental Education Association (ADEA) Academic Dental Careers Fellowship Program (ADCFP) and the Faculty of Dentistry.

Assessing Deep Learning Cell Segmentation Performance in Multiplex-Stained Images

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Objectives: In recent years, quantifying the spatial relationships among cells within the tumour microenvironment (TME) has gained importance for diagnosing and prognosticating oral cancer. Traditional TME analysis relies on time-consuming and observer-dependent manual methods with high inter- and intra-observer variability. To address this, deep learning aids have been introduced in image analysis digital pathology platforms. We hypothesized that the incorporation of a hyperspectral unmixing and deep learning segmentation pipeline will enhance accuracy, precision, and sensitivity of cell nuclei identification and delineation in oral dysplasia, compared to ground-truth manual segmentation methods.

Methods: Using an automated hyperspectral imaging system, oral dysplasia tissues previously stained with a multiplex immunohistochemical panel of immune markers were scanned and spectrally unmixed to create separate images of each marker, as well as the nuclear counterstain. A deep learning application was used to identify and count cell nuclei. Ground-truth annotations for 40 randomly selected regions of interest within the epithelium and stroma were created in collaboration with an experienced graduate student and the study pathologist. A confusion matrix was tabulated to distinguish true and false outcomes, and standard performance metrics calculated.

Results: The intraclass correlation coefficient (ICC) analysis revealed moderate to good agreement between raters within both the epithelium (ICC = 0.774) and stroma (ICC = 0.732). Performance metrics comparing the deep learning algorithm to human ground truth annotation was as follows: DICE score (F1) of 77.6%, IoU or Jaccard index of 61.2%, accuracy of 80.3%, precision of 70.0%, sensitivity of 82.8%, and specificity of 91.0%.

Conclusions: The deep learning application performed at a high level of accuracy, specificity, and sensitivity, comparable to expert annotation. Although precision was slightly reduced by occasional over-segmentation, deep learning segmentation offered a practical alternative for manual cell counting, saving time and resources.

Acknowledgements: Supported by the UBC Faculty of Dentistry Undergraduate Student Summer Research Award and the Canadian Institutes of Health Research (CIHR FBD-170852).

Dental Resin Loaded with Natural Photosensitizers: A Comprehensive Property Analysis

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Objectives: Natural compounds such as curcumin (Cur) and riboflavin (B2) exhibit spectral peaks within the 420-480 nm range, a favorable characteristic for potential photosensitizers to be linked to dental applications, such as loaded in dental resins for antimicrobial photodynamic therapy to mitigate secondary caries, for example. This study aimed to explore resin blend (RB) formulations loaded with different concentrations of Cur and/or B2 for a potential antimicrobial photodynamic effect while maintaining its original chemical, physical, and mechanical properties.

Methods: The experimental RB (BisEMA, TEEGDMA, HEMA, ethanol, photoinitiators) was loaded with different concentrations (0.00, 0.05, or 0.1wt%) of Cur and/or B2, establishing nine groups: RB (control); RB-0.05Cur; RB-0.1Cur; RB-0.05B2; RB-0.1B2; RB-0.05Cur+0.05B2; RB-0.05Cur+0.1B2; RB-0.1Cur+0.05B2; RB-0.1Cur+0.1B2. Next, uncured and cured (60 s; 450 nm, ~850 mW/cm²) samples were analyzed by FTIR to calculate the degree of conversion (DC; n=6) of the different formulations. Then, resin disks (1x6 mm) were made to evaluate water sorption (WS; n=6) and solubility (SL; n=6). In addition, resin bars (1x4x12mm) were prepared to assess flexural strength (FS; n=12) after 24-hour and 6-month aging. Statistical analyses (ANOVA/Tukey tests; $\alpha=0.05$) were performed.

Results: Incorporation of different concentrations of Cur and B2, either alone or in combination, had no significant impact on the DC, WS, or SL of the resin blends ($p>0.05$). FS results did not show significant differences among formulations after 24 hours ($p>0.05$). However, after 6 months of aging, the RB-0.1B2 exhibited higher FS values compared to RB-0.1Cur+0.1B2 ($p=0.006$). Additionally, RB-0.05B2 and RB-0.1B2 demonstrated increased FS values after 6 months ($p<0.001$).

Conclusions: Low concentrations of Cur and/or B2 loaded into an experimental dental resin did not compromise its chemical, physical, and mechanical properties. Notably, the incorporation of B2 contributed to enhanced flexural strength after 6 months, indicating a positive impact on the long-term mechanical performance of this novel biomaterial.

Acknowledgements: Supported by the Academy of Dental Materials (Rafael L. Bowen Early-Stage Investigator Collaborative Research Award); UBC Faculty of Dentistry Undergraduate Student Summer Research Award; and UBC Faculty of Dentistry Start-up Funds (AM)

Synthesis and Characterization of 3D-Printed Titanium Posts with Lattice Structure

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Objectives: While fiber posts and metal cast post/cores are commonly used to enhance the retention of dental restorations in non-vital teeth with significant loss of coronary structure, there are limitations to both approaches, necessitating the exploration of novel strategies. The aim of this study was to develop and characterize different designs of titanium posts synthesized by 3D-printing.

Methods: Various lattice designs were selected, including solid posts and lattice posts with different units, establishing the following groups: Solid (control); Rhombic Dodecahedron 20%; Thin Dodecahedron; Medium Dodecahedron; and Diamond. A commercial fiber post was used as a reference for the dimensions of the 3D-printed titanium posts and also selected as an experimental control. After printing the titanium posts, their surface topography and roughness were evaluated. Subsequently, the flexural strength was assessed for the different groups. Data was submitted for statistical analysis (one way-ANOVA/Tukey tests; $\alpha=0.05$).

Results: The 3D images of the 3D-printed titanium posts revealed that the surface topography varied among the groups, although the surface roughness demonstrated a range between 348.8 and 389.4 μm among the groups. Concerning flexural strength, the Solid group demonstrated the highest values ($p<0.001$). However, the Rhombic Dodecahedron 20% and Thin Dodecahedron groups exhibited flexural strength results similar to the fiber posts ($p>0.05$). Conversely, the Medium Dodecahedron and Diamond groups showed significantly lower flexural strength compared to the fiber posts ($p<0.05$).

Conclusions: All lattice structures of the 3D-printed titanium posts resulted in lower flexural strength compared to the solid design and demonstrated values similar or even lower compared to commercial fiber posts. Therefore, through this preliminary study, it was possible to demonstrate the promising application of metal 3D-printing for the synthesis of personalized dental posts.

Acknowledgements: Supported by the Faculty of Dentistry Undergraduate Student Summer Research Award and Start-up Funds (RMC).

Intelligent Responsive Peptide-Based Hydrogel System for Oral Drug Delivery

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Objectives: Contemporary drug delivery systems for oral disease treatment suffer from short retention time and poor local concentrations at the target site. The increased amount of matrix metalloproteinase-8 (MMP-8) from microbial biofilm formation is linked to the severity of periodontal disease. Therefore, we hypothesized that an MMP-8-responsive drug delivery system may be useful for on-demand oral drug delivery. The aim of this study was to develop an MMP-responsive antimicrobial peptide-based hydrogel system and evaluate its controlled degradation and release behaviours in response to MMP activity.

Methods: The hydrogel was synthesized from polyethylene glycol-norbornene (PEG-NB) and MMP-8-cleavable peptide (KCGPQG↓IWGQCK) with a thiol:ene ratio of 1:1 via a Michael-type addition reaction. The antimicrobial peptide (DJK-5) was incorporated into the hydrogel precursor, and the final hydrogel was generated under UV light-curing for 30 seconds using LAP. An MMP-8-irresponsive hydrogel was fabricated for comparison. The gelation, ultrastructure, rheology, swelling, and chemical properties of the developed hydrogels were characterized. The MMP-8-responsive hydrogel degradation and peptide release behaviours were examined by high-performance liquid chromatography (HPLC).

Results: The photoinitiated MMP-responsive peptide-based hydrogel was successfully fabricated with injectable capacity. The physical and chemical properties of the hydrogel, including the gelation, rheology, swelling, and ultrastructure, were maintained after the incorporation of DJK-5. Furthermore, the MMP-8-responsive hydrogel system was proven to be controllably degraded with DJK-5 release in a manner that responds to MMP activity.

Conclusions: The findings suggest that the MMP-8-responsive peptide-based hydrogel system serves as a promising platform and candidate for on-demand oral localized drug delivery. The development of a responsive release hydrogel system tailored to the disease microenvironment optimizes the design of drug delivery systems. This shows promise for further studying the utility of intelligent responsive hydrogel for periodontitis treatment.

Acknowledgements: Supported by the UBC Faculty of Dentistry Undergraduate Student Summer Research Award.

Examining How CSF1R+ Cell Depletion Impacts Nerve and Musculoskeletal Development

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Objectives: Disrupting colony-stimulating factor-1 receptor (CSF1R) activity, which is essential for macrophage and osteoclast proliferation, differentiation, and survival, results in malformed limb bones in adult mice. Therefore, we hypothesized that disrupting CSF1R activity during gestation would impact nerve and musculoskeletal development in the embryonic limb. The aim of this study was to define any nerve and/or musculoskeletal phenotypes in the limbs that result from depleting CSF1R+ cells during gestation using the pharmacological inhibitor PLX5622.

Methods: To explore the contribution of CSF1R+ cells to nerve and musculoskeletal development, pregnant mice were fed the CSF1R inhibitor PLX5622 across gestation. Embryonic day 11.5 (E11.5), E12.5, E13.5 and E15.5 embryos and postnatal day 1 (P1) pups were collected from mice fed control or PLX5622-laced chow during gestation. Immunostaining was performed on whole-embryos and cryosections to visualize cell depletion, apoptosis, osteoclasts, and nerve and muscle development using antibodies against CSF1R, cleaved caspase-3, Cathepsin K, 2H3, and MF20, respectively. Tartrate-resistant acid phosphatase (TRAP) staining was performed on cryosections of E15.5 mouse embryo limbs to examine osteoclast activity. P1 pups were stained with Alcian blue and Alizarin red to visualize cartilage and bone, respectively.

Results: In E15.5 embryos that were exposed to PLX5622 *in utero*, we observed a significant decrease in CSF1R+ cells surrounding the humerus, depletion of osteoclasts and osteoclast activity within the humerus, as well as increased apoptotic cells surrounding the humerus. No noticeable nerve or muscle phenotypes were observed in embryos exposed to PLX5622 *in utero*. Shorter limbs and changes in ossification of the hind-foot bones were also observed.

Conclusions: Our findings suggest that CSF1R cell depletion significantly disrupts and reduces the length of bones in the limbs. These findings can serve as a foundation for future investigation into the broader range of skeletal phenotypes that may arise as a result of CSF1R dysfunction.

Acknowledgements: R.Z. was supported by a UBC Faculty of Dentistry Undergraduate Student Summer Research Award. F.M. was supported by an NSERC PGS-D (579343-2023) and a UBC 4-Year Fellowship. This work was also supported by a Natural Sciences and Engineering Research Council of Canada (NSERC) Grant (RGPIN-2022-03718) to J.M.R. J.M.R. also holds a Tier 2 Canada Research Chair (CRC) in *Immune Regulation of Developmental Programs*.

Characterization of Dental Resins Containing Riboflavin/ZnO for Photodynamic Therapy

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Objectives: This study aimed to evaluate the impact of incorporating riboflavin (B2) and zinc oxide (ZnO) nanoparticles (NPs) on the chemical-physical properties and antimicrobial photodynamic therapy (aPDT) potential of an experimental dental resin (DR).

Methods: Different concentrations of B2 (0, 1, or 1.5 wt%) and ZnO-NPs (0, 5, or 10 wt%) were added into an experimental DR, resulting in the following groups: DR (control), DR-1%B2, DR-1.5%B2, DR-5%ZnO, DR-10%ZnO, DR-1%B2+5%ZnO, DR-1%B2+10%ZnO, DR-1.5%B2+5%ZnO, and DR-1.5%B2+10%ZnO. Initially, the degree of conversion (DC) was evaluated, followed by flexural strength (FS) and flexural modulus (FM) tests at 24 hours and 3 months. Subsequently, the DR-control, DR-1.5%B2, DR-10%ZnO, DR-1%B2+5%ZnO, and DR-1.5%B2+10%ZnO groups were selected to assess their antimicrobial and photocatalytic potential under dark and blue-LED irradiation (81 J/cm²) conditions against a dual-species biofilm of *Streptococcus mutans* and *Candida albicans*, immediately and after 3-month aging. Data were statistically analyzed (ANOVA/Tukey tests; p<0.05).

Results: DR-1%B2 and DR-1.5%B2 showed significantly increased DC compared to the control (p<0.001). Although DR-10%ZnO showed lower DC compared to the DR-control (p<0.001), DC was not affected when both ZnO and B2 were loaded simultaneously into the DR (p>0.05). Conversely, the FS was affected when B2 was incorporated alone or in combination with ZnO in the DR after 24h (p>0.05). Additionally, after 3 months, only DR-5%ZnO and DR-10%ZnO maintained a higher FM compared to the control. However, loading of B2 and/or ZnO reduced FS compared to the control after 3-month aging (p<0.05). The microbiological results showed that DR-10%ZnO, DR-1.5%B2, DR-5%ZnO+1%B2, and DR-10%ZnO+1.5%B2 significantly reduced the colony forming units (CFUs), after blue-light irradiation for both species, when compared to the DR control group immediately and after 3-month aging (p<0.05).

Conclusions: The combination of lower concentrations of ZnO and B2 (DR-5%ZnO+1%B2) was able to sustain the aPDT effect and stabilize chemical-physical properties of the experimental DR long-term.

Acknowledgements: Supported by the Alpha Omega Foundation of Canada and Faculty of Dentistry Start-up Funds (AM).

Antimicrobial Effect of Triton vs. Common Irrigants on Multispecies Biofilms

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Objectives: Reduction of intracanal bacteria during root canal treatment is mainly due to the antibacterial effects of the irrigant. Triton is an all-in-one irrigation solution that simultaneously removes organic and inorganic debris. Therefore, we hypothesized that Triton has the same antibacterial effect as traditional irrigants (NaOCl + EDTA). The aim of this study was to examine the antibiofilm effect of Triton, used either alone or in sequence, against multispecies biofilms in dentin canals with or without a smear layer and compare it to traditionally used solutions (NaOCl + EDTA).

Methods: Ten infected dentin specimens with a smear layer and 10 specimens without a smear layer were prepared. Multispecies bacteria were introduced into dentinal tubules according to a previous protocol. After a 3-week incubation period of infected dentin blocks, the blocks were subjected to exposure to disinfecting solutions including sterile water, 2% sodium hypochlorite (NaOCl), 2% NaOCl + 17% EDTA, Triton, and 2% NaOCl + Triton. Confocal laser scanning microscopy and viability staining were used to analyze the proportions of dead and live bacteria inside the dentin.

Results: The mean amount of bacteria killed in the 2% NaOCl + 17% EDTA group with a smear layer was 33.2% and in groups with no smear layer was 43.5% ($P=0.001$). In the Triton only group, 48.9% of bacteria were killed in groups with no smear layer, with no significant difference compared to groups with a smear layer (46.7%; $P<0.05$). However, 46.4% of bacteria were killed in the 2% NaOCl + Triton groups with a smear layer, with the highest proportion of dead bacteria in the groups with no smear layer (52.8%).

Conclusions: Triton may be more effective than conventional irrigants to remove the smear layer and debris, and performs equivalently or better than NaOCl for tissue dissolution and antimicrobial testing.

Virtual vs. In-Person Consultations for Full Mouth Rehab at BCCH

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Objectives: Our primary objective was to determine if differences exist between the estimated and actual numbers of teeth requiring treatment and the time required under general anesthesia for treatment resulting from virtual and in-person dental consultations. Secondly, we assessed the distance from the primary residence to BC Children's Hospital (BCCH) for families who used these consultations. We hypothesized that virtual dental consults can be used for successful dental treatment planning under general anesthesia.

Methods: A retrospective chart review was conducted on patients who underwent full-mouth dental rehabilitation under general anesthesia at BCCH. Charts were gathered and data collected for July 2020, November 2020, March 2021, and June 2021. One-way ANOVA with Tukey's post hoc testing and unpaired T-tests were performed using Prism V10.0. Human ethics # H21-02433.

Results: A total of 321 patients (Mean Age = 76.277 ± 49.4 months) were included. There were 183 (57%) in-person and 138 (43%) virtual consultations. The average difference in the predicted versus actual time needed for treatment was significantly higher in virtual consultations without pretreatment photographs (31.2%) compared to both in-person consultations (22.3%, $p = 0.007$) and virtual consultations with pretreatment photographs (21.9%, $p = 0.01$). No significant differences were found in the percentage difference in teeth treated between the conditions. Significant differences ($p = 0.003$) were observed between the average distance traveled to the hospital between all virtual (138 km) and in-person (60.8 km) patient consultations.

Conclusions: Our findings suggest that virtual dental consultations can be effective for planning dental treatment under general anesthesia, especially for families who live farther away. Our study highlights the importance of photographs in treatment planning for VH patients. Our study may lead to the more widespread adoption of virtual consultations for a variety of dental treatments.

Acknowledgements: Supported by the Graduate Student Initiative Award.

Combined Torsional and Cyclic Fatigue Resistance in Rotary Endodontic Files

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Objectives: This study presents a novel model of instrument testing that combines torsional and cyclic fatigue stresses, aiming to evaluate the impact of torque at the rotary file tip on cyclic fatigue resistance during root canal instrumentation, a largely unexplored research area. We hypothesize that applying torque on the tip of an endodontic file will significantly affect the cyclic fatigue resistance of the file.

Methods: Size F2 ProTaper Ultimate (PTU) and ProTaper Gold (PTG) files from Dentsply-Sirona, Switzerland, were rotated with either a 30° or 60° curvature angle and 5mm radius at a maximum radius of D12 to simulate significant coronal root curvature. The tip of the file was aligned with a torque sensor to measure the braking force applied, replicating file action within the canal. The number of cycles to failure (NCF) was recorded for tip torques of 50, 100, 150, 200, and 250gcm.

Results: In a 60° canal, a 200gcm torque tip led to a 50% reduction in cyclic fatigue resistance in PTG and a 75% reduction in PTU, indicating the presence of a critical threshold. In general, PTU performed better than PTG in the test at lower tip torques. However, PTU was much more sensitive to increasing torques and failed at a lower NCF than PTG when tested at 200gcm in both 30° and 60° canals. File separation occurring in PTU within seconds at 250gcm. Differential scanning calorimetry analyses confirmed that both files were made from the same alloy, and the scanning electron microscope analysis confirmed no samples fractured purely due to torsional failure.

Conclusions: These findings emphasized the critical role of torque control during the instrumentation of severely curved canals. Sole reliance on the manufacturer's recommended torque setting may create a false sense of security, highlighting the need for precise torque management to optimize treatment outcomes.

The Scope of Practice of Geriatric Dentistry in British Columbia

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Objectives: The oral health needs of people who are frail are increasing with an aging population in Canada. The objective of this study was to explore the perceptions of dentists in British Columbia (BC) regarding their view of geriatric dentistry as a distinct scope of practice and in relation to special needs dentistry, a specialty for people with disabilities and medical conditions that require adaptations to access routine dental care.

Methods: The research method that guided this study was interpretive description, which utilized a naturalistic inquiry amongst a purposeful sample and employed inductive analysis of semi-guided interviews to explore whether participants who were key informants in the dental profession perceived geriatric dentistry as a distinct scope of practice in dentistry within BC. Qualitative data was coded and analyzed using a thematic approach.

Results: A total of ten interviews were conducted. The participants perceived a geriatric patient as a person aging with frailty who is dependent on others to access oral health care. Participants expressed that general dentists in private practice had a preference to refer patients aging with frailty to a specialist or special service when treatment was outside their comfort level or when there were behavioural or other patient management challenges that were difficult to manage in the private practice setting. Participants perceived the ability to provide place-based care through a holistic team-based approach was a core competency of geriatric dentistry which overlapped with special needs dentistry.

Conclusions: The study found that participants perceived geriatric dentistry as a unique scope of practice from general dentistry requiring special knowledge in the management of challenges associated with aging with frailty, as well as the ability to work in long-term care. Similar to special needs dentistry, geriatric dentistry requires person-centered care and emphasized the need for interprofessional collaboration in alternative care settings.

Print Orientation, Post-Curing Time, and Aging Effects on 3D-Printed Resins

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Objectives: To evaluate the effects of print orientation, post-curing time, and aging on the mechanical and chemical properties of a 3D-printed resin indicated for permanent dental restorations.

Methods: A commercially available 3D-printed resin composite indicated for permanent dental restorations (Crown, SprintRay) was selected for this study. Samples for mechanical tests were printed at two orientations, 0° and 90°, and were post-cured for 20, 40, and 60 min. Three-point bending (3pb) was used to determine flexural strength (σ_f) and flexural modulus (E_f), and the notchless triangular prism (NTP) specimen test was used to determine fracture toughness (K_{IC}). The samples were stored for 24 h in water at 37°C before testing. The best performing group (0°, 60 min) was also tested after 90 days of water storage. Additionally, FTIR spectroscopy was used to determine the degree of conversion (DC) on 1mm thick disks. ANOVA followed by Tukey post-hoc multi-means comparisons were performed, $p < 0.05$.

Results: All groups showed higher σ_f , E_f , and K_{IC} with increased curing time, although these results were not significant compared to the control (40 min). The 0° printing orientation/60-min post-curing group had the highest mean values for all of the tested mechanical properties. However, these values were reduced after 90 days of water storage. K_{IC} was significantly higher with 0° compared to 90° print orientation, regardless of curing time. The DC was not significantly impacted by the post-curing time.

Conclusion: Within the limitations of this study, variations in print orientation and curing time did affect some of the mechanical properties of the 3D-printed resin used for permanent restorations. The differences were more evident on K_{IC} results regarding printing orientation. The best performing group (60 min and 0° printing orientation) also demonstrated that artificial aging for 90 days in water had a negative impact on the measured properties.

Assessing Three-Dimensional Soft and Hard Tissue Changes Following Orthognathic Surgery

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Objectives: To investigate the application of virtual surgical planning (VSP) for three-dimensional (3D) hard and soft tissue assessment in orthognathic surgery patients using a novel digital workflow with the Artec Space Spider. The overarching question was: “How do the 3D soft and hard tissues change 2 and 6 months after orthognathic surgery?”.

Methods: Twenty-one consecutively treated pre-surgical patients were selected from two oral surgeon’s offices. Soft tissue facial scans with the Artec Space Spider and intra-oral scans were taken 1 month before surgery (T0), then 2 (T1) and 6 months (T2) after surgery. Cone beam computed tomography (CBCT) images were taken at T0 and T1. Serial 3D soft tissue region and landmark changes were assessed after superimposing the T1 and T2 scans over T0 in Geomagic Control X software. The achieved hard tissue landmark changes were compared with the VSP values. The correlation of hard and soft tissue changes, along with differences in soft and hard tissue changes between the Invisalign® and fixed appliances samples, were also evaluated.

Results: From T1 to T2, there was clinically significant soft tissue relapse of the maxillary and mandibular regions and landmarks which was highly variable and asymmetric. Predicted virtual surgical movements were highly accurate for hard tissue landmarks. Ratios of soft to hard tissue changes measured in 3D 2 months post-surgery were similar to findings in literature measured in 2D. There were generally no differences in changes in soft and hard tissue landmarks or VSP for fixed versus Invisalign patients.

Conclusions: The Artec Space Spider can be used as part of a novel digital workflow for VSP. Clinicians and patients should have great confidence that VSP is highly accurate and applicable for both fixed and Invisalign cases. Additionally, clinically significant soft tissue relapse can be anticipated between 2 to 6 months after surgery.

Acknowledgements: Supported by University of British Columbia Faculty of Dentistry Start-up Funds.

Caregiver Satisfaction with Virtual or In Person Dental Consultations

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Objectives: The COVID-19 pandemic reduced the capacity for in-person (IP) visits at the BC Children's Hospital (BCCH) due to public health guidelines. Virtual health (VH) consultations were implemented for children who required full mouth dental rehabilitation under general anaesthesia (GA). The objectives of this study were:

1. To determine the satisfaction of primary caregivers with VH vs. IP consultations
2. To evaluate whether improvements can be made to the current VH format
3. To determine whether VH consultations should continue post-pandemic

Methods: Participants were primary caregivers of children who attended a GA consultation at BCCH from January 2021 to July 2023. They were divided into two groups: IP and VH. All caregivers were emailed a link to the anonymous online survey, those who attended IP consultations were also invited to complete the survey in person.

Results: We collected 217 survey responses (21.2% response rate). VH families (N=47) are mostly from rural settings compared to IP families (N=170). There were no statistically significant differences in responses to the Caregiver Satisfaction Questionnaire between the two groups. Once a family had used VH, they were very likely to use this format again (89.8%). The most common benefits in the VH group were time savings, ease of scheduling, and cost savings whereas the most common barrier was difficulty taking intraoral photos. The benefits felt by the IP group were meeting the dental team and ease of communication with the dental clinic whereas the most common barriers were parking and behavioural challenges of their child during the consultation.

Conclusions: The format of both IP and VH consultations was well-accepted by families. At BCCH the VH visits are continuing to the present day; however, in future, VH consultations will need to be made more user friendly to ensure all families can access this type of visit.

Snoring as a Predictor for Oral Appliance Therapy Treatment Outcomes

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Objectives: There are no reliable predictors of treatment outcomes for oral appliance therapy (OAT) in treating obstructive sleep apnea (OSA). Snoring acoustics have shown clinical merit in providing insight on the obstruction sites in the upper airway. Consequently, we hypothesized that analyzing baseline snoring can help determine if OAT is an appropriate treatment for OSA patients. The purpose of this study was to determine if baseline snoring can be used as a reliable predictor of treatment outcomes for OAT.

Methods: This study involved retrospective analysis that extracted snoring data from two trials investigating the efficacy of a mandibular advancement device (MAD) and tongue stabilizing device (TSD) to treat OSA. Both trials collected data before and after treatment with a Level III sleep study. Baseline snoring was compared to the treatment outcomes of the MAD and TSD. Treatment outcomes were determined by a reduction in the Apnea Hypopnea Index from the baseline.

Results: There were 38 participants in the MAD trial and 12 in the TSD trial. The MAD showed a greater decrease in the snoring index (snoring events per hour) and duration of snoring events than the TSD. However, these results were statistically insignificant. In contrast, the TSD had a statistically significant increase in the snoring index and duration after treatment. Both appliances had a slight, but statistically insignificant, reduction in snoring loudness after treatment. Multiple linear regression analysis showed that snoring was a strong predictor of treatment outcomes for the TSD, but not for the MAD. However, both findings were statistically insignificant.

Conclusions: The MAD had greater improvements in snoring than the TSD. However, snoring was not a reliable predictor of treatment outcomes for either appliance. Future investigations should consider an advanced analysis using various acoustic properties of snoring to create prediction models for treatment outcomes of OAT.

A Retrospective Study of Identifying Incidental Findings in Digital Radiographs

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Objectives: Dental practitioners, while reviewing their radiographs for the reasons that induced their prescription, may encounter unexpected and otherwise asymptomatic incidental findings (IFs). The recent global COVID-19 pandemic sharply curtailed the practice of clinical dentistry, both in the community and in dental schools. The latter would be hypothesized to impact the quality of dental students' clinical education. The purpose of this study was to assess the prevalence of IFs on dental radiographs and compare the performance of dental students in different cohorts (prior, during, and post-COVID-19) in identifying them.

Methods: A total of 1598 consecutive radiographs and charts of patients in the UBC dental clinic were reviewed retrospectively. All cases included dental panoramic radiographs (DPR), which give the best overview of both jaws. After the application of inclusion and exclusion criteria, 600 subjects were included; only the first 200 cases were investigated and treated by students for each of the three cohorts. Radiographs and patient charts were reviewed and assessed for IFs. The Chi-square or Fisher's exact tests were utilized to assess the performance of the students.

Results: Dilacerated teeth exhibited the highest occurrence in this study, accounting for 50.3% of the IFs. The next most frequent IFs were the periapical radiolucency of inflammatory origin (PRIO) or residual cyst (45.5%). Notably, the identification of other conditions like impacted teeth and dilacerated teeth saw poorer performance in the cohorts impacted by COVID-19 and post-COVID-19.

Conclusions: Radiographs of patients at the UBC dental school examined in this research reveal noteworthy IFs. Therefore, a thorough examination of these radiographs is highly advisable. The diagnostic proficiency of students varied between cohorts. The ability of pre-doctoral dental students to assess radiographs has been impacted by the constraints imposed due to COVID-19, possibly due to reduced clinical training time.

The Effects of Simulated Arch Constriction on Upper Airway Function

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Objectives: Recently, many hypothesized changes to the dental arch form following extractions may have direct and indirect effects on airway space, from space closure to a subsequent decrease in arch length. In relation to obstructive sleep apnea (OSA), it is expected that this effect decreases space between the soft palate and posterior pharyngeal wall. The goal of this study was to characterize the presence of any airway functional changes with level-3 polysomnography while using an appliance simulating arch constriction.

Methods: This was a single-blinded prospective randomized cross-over trial. 34 participants were recruited from the student/staff population of the Faculty of Dentistry at the University of British Columbia. The Epworth Sleepiness Scale, STOPBANG questionnaire, and lateral cephalograms were gathered. Arch constriction was simulated by adding 5 mm to the lingual/palatal aspects of the dentition using Invisacryl(essix) retainers. Each participant completed three sleep studies with a level-3 sleep monitor: the initial baseline (T0) test, and random allocation of 7 days to either the control appliance (regular essix) or the simulated arch constriction appliance (thick essix), following a crossover of appliances. Mean RDI and PO₂ were gathered.

Results: Paired t-tests of all three groups showed no statistical significance: control vs. regular essix (p=0.896), control vs. thick essix (p=0.051), and regular vs. thick essix (p=0.100). Five of the 34 participants had RDI values ≥ 5.0 for at least one of the studies. Respective RDI calculations showed no statistical significance (p=0.262, 0.803, 0.329). Mean cephalometric values were within normal standard deviation.

Conclusions: Simulated constriction of dental arches did not result in significant changes of the respiratory disturbance index. Claims that orthodontic treatment involving extractions cause sleep related breathing disorders cannot be made based on the results of this study.

Acknowledgements: Supported by the American Association of Orthodontists Foundation Biomedical Research Award.

Covid-19 Impact on Dental Emergencies at BC Children's Hospital

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Objectives: Our objective was to measure the effect of the pandemic on the frequency and types of dental emergencies. We hypothesized there would be fewer dental emergency visits during the most extreme phase of the lock-down in line with the 57% drop in overall emergency visits to BC Children's Hospital (BCCH) during a similar period. We also hypothesized that dental infections would remain the same as in pre-pandemic times but trauma would be sharply decreased.

Methods: A retrospective chart review of dental emergencies from 2018-2021, that required dental staff to attend and treat the patient, was performed. The data was anonymized, entered into REDCap, and exported to Prism v10.0 for statistical analysis.

Results: A total of 283 patients were in the study. Several unexpected findings were revealed. There was no significant difference in the number of emergencies seen pre-pandemic compared to during the pandemic. Interestingly, the pandemic as a whole did not affect the proportion of trauma versus non-trauma associated visits to the emergency department (78% were due to trauma and 22% from other causes). We compared pre-pandemic to pandemic data and found the following significant differences: during the pandemic there was a higher proportion of (i) bike and hit injuries, (ii) outdoor injuries, (iii) photographic records taken during the visit, (iv) cases treated directly by the attending pediatric dentist, and (v) emergencies treated in the dental clinic.

Conclusions: Our null hypothesis was supported. There was no change in the proportion of visits due to odontogenic infections or trauma during the pandemic. However, the location and etiology of traumatic injuries did change. Unexpectedly, children spent more time outdoors on their bikes, scooters, and playing with siblings during the pandemic. Some of the changes in the way care was delivered during the pandemic has continued to the present day.

Prescription Opioid Medications: Risks Among Youth Undergoing Oral Surgery Procedures

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Objectives: Canadian youth have demonstrated the fastest growing rates of opioid-related hospitalizations in the past decade. Prescription opioid medications, although effective in alleviating severe post-operative pain, also have potential for misuse and diversion. Oral surgery procedures are often the first exposure to opioids for youth patients. This population has been understudied despite being substantially affected by the opioid crisis. The purpose of this study was to determine how informed youth (ages 15–24) are about potential risks associated with prescription opioid use following oral surgical procedures.

Methods: An anonymous, 31-item cross-sectional survey was administered through Qualtrics to youth patients following oral surgical procedures to assess behaviour, knowledge, and beliefs about prescription opioid use. Participants were recruited from 10 oral surgery practices in British Columbia during a 6-month period.

Results: A total of 177 responses were recorded. 121 (68.4%) participants received an opioid prescription, with only 2 (2%) participants storing their medication in a locked location. For those who did not, 80.7% indicated that they were not worried about anyone taking it. Of the 84 (69.4%) participants with leftover pills (mean = 17.67 pills/participant), 71 (84.5%) reported still having them in their possession, with 33 (46.5%) wanting to save them for future need. Males, compared to females, were more likely to believe that prescription opioids are safer than other substances ($P=0.006$), and that they are less likely to get into trouble using them ($P=0.046$). Multivariate logistic regression models demonstrated male sex to be a significant predictor of prescription opioid misuse ($P=0.043$).

Conclusions: This study indicates a general lack of knowledge among participants and demonstrates that youth are not well informed of potential risks associated with prescription opioids. It is essential to implement a practical approach to inform youth of implications surrounding prescription opioid use and its potential for adverse health outcomes.

Bioceramic Sealer Antibacterial Effects in a Novel *Ex Vivo* Model

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Objectives: The aim of this study was to compare the long-term antibacterial effect of five bioceramic root canal sealers against multi-species dental biofilms in dentinal tubules using a novel *ex vivo* model. This study also investigated whether the method of sealer application influenced the antibacterial effect of bioceramic sealers using an *ex vivo* model versus open-faced specimens.

Methods: An artificial tooth model with simulated root canal was prepared. A standardized slot in the apical root was created to allow insertion of a precisely cut dentin block. Forty-eight dentin blocks were prepared, and multi-species bacteria were introduced into dentinal tubules by centrifugation. After 3 weeks of incubation, 36 samples were subjected to EndoSequence BC Sealer (BC), AH Plus Bioceramic Sealer (AHBC), Bio-C Sealer (BIOC), BioRoot Flow (BRF), or C-root SP (CR) in the model. After 1, 4, and 8 weeks of sealer exposure, antibacterial efficacy was determined by live/dead bacterial viability staining and confocal laser scanning microscopy. Twelve samples were subjected to BC or AHBC as open-faced specimens. Antibacterial efficacy was determined after 1 and 4 weeks of sealer exposure. Data were analyzed using one-way ANOVA and Tukey's post hoc tests ($p < .05$).

Results: After a 1-week sealer exposure, CR and AHBC resulted in significantly more killed bacteria than BC, BRF, and BIOC. While AHBC's antibacterial activity experienced a significant drop after a 4-week sealer exposure, the activity of all other sealers remained constant ($p > .05$). After an 8-week sealer exposure, CR and BC yielded significantly more killed bacteria. There was no significant difference between model and open-faced specimens in their antibacterial activity in the BC and AHBC groups.

Conclusions: The antibacterial activity of bioceramic sealers were dynamic and all sealers had long-lasting antibacterial effects against multi-species biofilms in dentinal tubules. The method of sealer application had no influence on its antibacterial effect.

Attitudes and Behaviours Toward Support Resources Among First-Year UBC DMD Students

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Objectives: This study investigated the knowledge, attitudes, and behaviours of first-year Doctor of Dental Medicine (DMD) students toward existing student support resources within the University of British Columbia (UBC)'s Faculty of Dentistry (FoD), and the resources needed from the student perspective to inform the development of future support programming.

Methods: An online survey was distributed to all 59 first-year DMD students in April 2022. This survey included three parts: 1) demographics; 2) Likert-scale questions inquiring about the perception and utilization of available support resources; and 3) open-ended questions exploring academic and non-academic experiences. A focus group with 5 students followed to further explore the themes that emerged from the survey.

Results: Forty-six students (RR=78%) participated in the survey. Quantitative analysis revealed that most participants (70%) were familiar with FoD support resources, but only one quarter (24%) have accessed them. Few (26%) were familiar with resources across UBC, and most (98%) have not accessed them. Some (26%) felt stigma prevented them from accessing resources. More respondents who identified with the pronouns she/her knew who to contact for academic support in comparison to respondents who identified with the pronouns he/him (70% vs. 53%; $P=0.03$). No statistical significance was found between age and utilization of resources ($P=0.07$). Themes that emerged from the qualitative analysis included: challenges with transitioning into a professional program, imposter syndrome, stigmatization of accessing resources, suggestions for increasing mentorship with senior DMD students, and unfamiliarity with existing resources. Focus group respondents elaborated on their experiences and challenges, including recommendations to further support student needs.

Conclusions: The findings have informed new initiatives to improve student support programming within the FoD. In 2022-23, a formal peer-mentorship program was developed across all academic programs, and the 2023 orientation program included sessions with returning students to re-familiarize them with existing student support resources and introduce new initiatives.

Acknowledgements: The authors thank Ms. Siobhan Ryan, UBC Faculty of Dentistry's Assistant Manager of Student Services, for her assistance with participant recruitment. This study received funding from UBC Dentistry's S.Wah Leung Endowment Fund (PM012810).

Involvement of CSF1R Signalling in Development of Muscles of Mastication

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Objectives: Colony-stimulating factor-1 receptor (CSF1R) signalling is known to facilitate commitment, proliferation, differentiation, and survival of microglia, macrophages, and osteoclasts. However, little is known about the role of CSF1R signalling in craniofacial development, particularly in the development of the muscles of mastication. We hypothesized that disrupting CSF1R signalling during embryogenesis would impact the shape of the muscles of mastication. This study aimed to address this gap in our knowledge using a pharmacological mouse model of CSF1R inhibition.

Methods: Pregnant CD1 dams were administered the CSF1R inhibitor, PLX5622, starting at embryonic day 3.5 and continuing until birth. The heads of 6 PLX5622 diet exposed P1 pups (3 males and 3 females) and 7 control diet exposed P1 pups (3 males and 4 females) were collected and fixed with 4% paraformaldehyde and subsequently stained with 1% phosphotungstic acid in a 90% methanol solution for 2 weeks. The head samples were then micro-CT scanned at a 7 μ M resolution while embedded in 1% agarose. The 5 muscles of mastication: internal and external pterygoids, temporalis, masseter, zygomaticus-temporalis, and tongue, were segmented, landmarked, and subjected to dense correspondence and geomorphometric analysis with 3D Slicer software.

Results: Principal component analysis of control and PLX5622 P1 pup head samples suggested that the variation in shape of the tongue and muscles of mastication, except for the external pterygoids, correlated significantly with the diet the pregnant dam was exposed to ($p < 0.05$). However, this statistically significant variation in shape was not observed in both the right and left muscles consistently. Dense correspondence analysis also produced heatmaps suggestive of shape variation between PLX5622 muscles and control muscles.

Conclusions: Our findings suggest that CSF1R signalling may impact the morphogenesis of the muscles of mastication and tongue to varying degrees—potentially via its role in development of the mandible and craniofacial bones.

Acknowledgements: This work was supported by a Natural Sciences and Engineering Research Council of Canada (NSERC) Grant (RGPIN-2022-03718) to J.M.R. J.M.R. also holds a Tier 2 Canada Research Chair (CRC) in *Immune Regulation of Developmental Programs*.

Orthodontic Brackets and Merging Intraoral Scans with 3D Facial Images

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Objectives: 3D imaging provides accurate records for treatment planning, diagnosis, and monitoring treatment over time. Being able to take 3D images while patients have orthodontic brackets in place is critical for these records to be clinically applicable. The aim of this study was to compare the accuracy of merging Bellus Arc7 facial scans with Trios intraoral scans with and without orthodontic brackets, and to assess soft tissue changes of the lips before and after bonding brackets.

Methods: 25 participants receiving orthodontic braces had two sets of images taken before and after bracket placement. Each set included 5 images (Bellus Arc7 facial scan, two Artec Space Spider facial scans, and two scans with Trios intraoral scanner). For Part I, a 3D virtual patient was created with and without brackets using the Bellus Arc7 scan and Trios dentition scan. Using the root mean square (RMS), alignment was compared to a reference virtual patient generated from the Artec Space Spider scan. For Part II, Artec Space Spider facial scans before and after bonding were superimposed. Point deviations of 20 perioral soft tissue landmarks were analyzed.

Results: For Part I, the RMS of the superimposed Bellus Arc7 scan compared to the Artec Space Spider scan was $1.60 \text{ mm} \pm 0.49 \text{ mm}$ without brackets and $1.54 \text{ mm} \pm 0.49 \text{ mm}$ with brackets. This difference was not statistically significant. For Part II, most soft tissue landmarks had no statistically significant difference in position and all soft tissue changes were below clinical significance. There was a wide range of individual variation between participants.

Conclusions: Orthodontic brackets do not affect the accuracy of merging Bellus Arc7 facial scans with Trios intraoral scans. Bonding brackets do not cause significant soft tissue changes for most perioral landmarks, but it is difficult to accurately predict the changes that will occur.

Assessing the Diagnostic Accuracy of the 2018 Periodontal Classification System

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Objectives: The introduction of the 2018 classification system for periodontal disease has the potential to create uncertainty and confusion among practitioners familiar with the previous system. Persistent disagreements among clinicians may arise due to various factors, including differences in experience, training on the new classification system, and specialty practice. The objectives of this study were to investigate variations in periodontal disease diagnoses based on the 2018 classification system among dental/hygiene students and periodontics residents across Canada. The hypothesis posits that discrepancies exist in periodontal diagnoses made by dental practitioners following the 2018 periodontal classification updates. The gathered responses will contribute to identifying potential grey areas within the classification, refining the periodontal curriculum to enhance comprehension and clinical application of the classification system, and providing updated insights into diagnostic accuracy since its implementation.

Methods: A survey was conducted, including UBC and University of Toronto third- and fourth-year DMD students, third- and fourth-year dental hygiene students, and all 5 of the Periodontics Programs in Canada to answer the Stage and Grade given for each periodontal case (total of 5). A comparison of the data generated identifies the differences based on demographics such as years trained, location of training, and degree of training.

Results: There is a varying level of disagreement of the periodontal diagnoses per case based on the master answers, this is evident amongst all levels of training, educational facilities, and years of training.

Conclusions: This project will support periodontal education at various levels including undergraduate training, CE courses, and workshops to assist in establishing a more accurate diagnosis and treatment plan for patients by dental practitioners. Furthermore, using the results we are able to compare discrepancies in diagnosis at Canadian educational institutions to help facilitate educational training, calibration sessions, discussions in academic settings, and continued education in private practice.

Oral Health Curriculum Indigenization Worldwide and in Canada

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Objectives: Curriculum Indigenization refers to any approach or philosophy of education characterized by delivering Indigenous content and cultural perspectives to dentistry and dental hygiene students. It remains unknown as to whether or not Indigenous content is addressed in the training of oral health providers worldwide, or in Canada. The present study undertook a scoping review and a survey of all Canadian dental and dental hygiene schools to address this unknown.

Methods: The Joanna Briggs Institute's methodology was followed for the scoping review. The search encompassed literature available until November 1, 2023. Two reviewers performed literature screening independently. "Indigenous", "education", and "oral health" were used as initial keywords. An anonymous survey with 29 structured questions was distributed electronically among all 10 dental and 35 dental hygiene schools across Canada between September and October 2023. The survey focused on Indigenous education objectives, content, method of delivery, assessment, barriers, and facilitators to address such content in the curriculum. Descriptive (means and frequencies) and inferential (odds ratio, $p > 0.05$) data analyses were performed using SPSS 27.

Results: From the initial 808 titles and abstracts screened, 101 papers were included for full-text review. So far, from screening 60 of those 101 papers, 22 are included for data extraction. For the survey, 90% of dental ($n=9$) and 71% ($n=25$) of dental hygiene programs responded; of the 34 programs, 32 had Indigenous content (9 dental; 23 dental hygiene). Lecture format is the most employed teaching approach and Indigenous people's health was the most covered topic. A packed curriculum was the most mentioned barrier in offering Indigenous content.

Conclusions: There is a variation in the existing curriculum Indigenization within oral health educational programs, from content to methods of delivery, and there is a need to address the identified barriers to Indigenizing the oral health curriculum.

Acknowledgements: The authors would like to thank all participants from the dental and dental hygiene schools across Canada for their participation in the survey as well as UBC's Faculty of Dentistry for providing a token of appreciation to 5 participants of the study.

Physico-Chemical and Mechanical Behaviour of Interim Restoration Materials

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Objectives: To investigate and compare the physico-chemical and mechanical properties of interim restoration materials in 3D printing, milling, and conventional techniques. The impact of aging on these properties was also investigated. It was hypothesized that the physico-chemical properties of the 3D printable interim polymers are lower than the milled and higher than the conventional provisional polymers. We also hypothesized that aging would affect these properties.

Methods: Argen PMMA Disc (milled; ARGEN, USA), GC Temp (3-D printed; GC Inc. Japan), Mazic D Temp (3D printed; VERICOM. Korea), and Integrity (conventional; Dentsply-Sirona, USA) were used to fabricate the specimens (N = 40/group) according to specifications for flexural strength (FS), Barcol hardness (H), water sorption (WS) and solubility (S) tests. Samples were stored in 37°C ultra-pure water and tested after 24 hours (baseline; n=20) and after 1 month (aged; n = 20). The pH of the storage media was also monitored and recorded. Two-way ANOVA ($\alpha = 0.05$) and Tukey tests were used to analyze the results.

Results: The materials significantly affected the FS and H ($F = 298.024$; $p < 0.001$ and $F = 1939.121$; $p < 0.001$, respectively) and storage time ($F = 25$; $p < 0.001$, $F = 56.739$ $p < 0.001$). The interactions were also significant ($F = 26.724$; $p < 0.001$, $F = 37.032$; $p < 0.001$). At baseline, Integrity showed the highest FS followed by Mazic and GC. WS was also significantly affected by the type of materials ($F=137.739$; $P<0.001$). The pH of the water dropped in all groups; however, a larger drop was measured in Mazic, followed by Integrity.

Conclusions: The physico-chemical and mechanical properties of the interim restorations are influenced by the material, method of fabrication, and water storage.

Teledentistry Perceptions and Practices among British Columbia Dentists

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Objectives: This study aimed to understand what knowledge dentists in British Columbia have about teledentistry, the attitudes they had towards teledentistry, if/how they implemented teledentistry in their practices during COVID-19, and if clinicians intend to continue to use teledentistry following the COVID-19 pandemic. We hypothesized that British Columbian dentists were unprepared to use teledentistry.

Methods: A 21-item online anonymous survey assessing the knowledge, attitudes, and practice of teledentistry was developed. Inclusion criteria were dentists or certified dental specialists who were licensed to practice after the recommendation to suspend elective dental care in British Columbia. Surveys were distributed to dentists in British Columbia through the British Columbia Dental Association and to clinical instructors through the University of British Columbia Faculty of Dentistry. Descriptive statistics, bivariate chi-square analysis, and binary logistic regression analyses were performed.

Results: 198 surveys met the inclusion criteria and were included in data analysis. Just over half of participants had used a form of teledentistry at the time of survey. Over three-quarters of the surveyed dentists had no prior training in teledentistry. Just over half felt unprepared to use teledentistry at the start of the COVID-19 pandemic. Despite a minor majority feeling unprepared for teledentistry at the start of the COVID-19 pandemic, 70.7% of participants felt comfortable using teledentistry subsequently. Participants who were comfortable and felt prepared with teledentistry were significantly more likely to continue using teledentistry. Comfort level was found to be a predictor for future teledentistry.

Conclusions: Dentists in British Columbia were unprepared for the provision of care using teledentistry at the start of the COVID-19 pandemic. Education in teledentistry can improve practitioner comfort and aid in the implementation of teledentistry in the dental profession. Future research should focus on how to best implement teledentistry into a dental school curriculum and continuing education resources.

Retreatment Response of Oral Biofilm after Recovery in Nutrient-Poor Conditions

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Objectives: To assess the interplay between antibacterial agents and nutrient depletion in relation to the recovery, metabolism, and microbial composition of oral biofilms, and to investigate how these factors collectively impact the efficacy of antimicrobial DJK-5 peptide and chlorhexidine (CHX) during retreatment. The hypothesis was that the recovery of biofilms, their metabolic status, and microbial composition are all influenced by the initial antimicrobial agents and nutrient availability. This, in turn, could potentially affect the ability of antimicrobial agents to effectively eliminate biofilms during retreatment.

Methods: A total of 624 oral biofilm samples were cultivated anaerobically for 3 weeks and then subjected to treatment with 10-µg/ml DJK-5, 2% CHX, or water, followed by re-culturing in nutrient-rich and nutrient-poor conditions. Sampling occurred immediately after treatment and at intervals of 1, 3, 5, 8, 12, 16, and 20 weeks post-initial treatment. Retreatment was administered at either 16 or 20 weeks using the same agents. The evaluation techniques encompassed Live/Dead, WST, XTT assays, and DNA sequencing methodologies.

Results: Both initial treatment agents and nutrient conditions substantially impacted the recovery, metabolic activity, and bacterial composition of biofilms ($p < 0.001$). Biofilm recovery rates were slower in nutrient-poor groups compared to nutrient-rich counterparts. During retreatment, whether at the 16-week or 20-week point, the antimicrobial effects closely resembled their immediate impacts post-initial exposure. After initial treatment, metabolic activity exhibited a significant decline, which then began to recover within the first 2 weeks in nutrient-rich groups. Nutrient-poor groups experienced a continued decline, reaching a peak at 8 weeks. Nutrient conditions was the most influential variable affecting community composition ($p < 0.001$).

Conclusions: The microbial composition, metabolic activity, and biofilms' recovery are impacted significantly by the initial antimicrobial agents and nutrient conditions. Nonetheless, these alterations did not compromise the effectiveness of DJK-5 or CHX for biofilm elimination during retreatment.

Small Rho GTPases and The Mechanisms Underlying Increased Risk of Cleft Lip

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Objectives: Non-syndromic cleft lip with or without cleft palate (NSCL/P) is among the most common congenital malformations. Etiology involves influences of multiple genes and exposure to environmental risk factors. There is a poor understanding of the cellular risk factors that impact facial development. Variants in *ARHGAP29* may result in increased activity of the small Rho GTPases and have been linked to human NSCL in multiple studies. Here we investigate small Rho GTPases, monomeric proteins that regulate the actin cytoskeleton. Our objective is to determine the effects of a GTPase activator on facial development in avian embryos.

Methods: Microscopic beads were soaked in phosphate-buffered saline (PBS; control), a RhoA agonist (CN03), or a pan RhoGTPase agonist (CN04) and implanted into the maxillary prominence of embryonic day 4 (E4) chicken embryos. Embryos were fixed at early time points for molecular studies (5 or 24 h) or until full skull ossification (E12.5).

Results: CN04 treatment resulted in embryo lethality. Treatment with beads soaked in 10 µg/ml CN03 caused a reduction in size of the maxillary prominence (n = 13/13; Fig. 1A, B) and loss of most of the maxillary derivatives (n = 7/7). Cellular proliferation and apoptosis in the maxillary prominence were not altered.

Conclusions: We showed that targeted activation of RhoA leads to cleft lip in chickens which suggests a possible mechanism whereby variants in *ARHGAP29* lead to cleft lip via effects on the cytoskeleton. The rapid reduction in the size of the maxillary prominence (within 5 h) suggests that there is contraction of the actin cytoskeleton, reducing cell size. This resembles the rapid contraction that occurs during wound healing which is dependent on the actin cytoskeleton. The next studies will investigate regional effects of RhoA activation on cellular size and movement.

Acknowledgements: The research was funded by a Canadian Institutes of Health Research Grant (# PJT-166182) to JMR.

Development and Implementation of a Dental Institution-Based Oral Health Helpline

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Objectives: An oral health helpline was developed to support access to oral health information and resources for underserved community members. The aim of this pilot project was to describe the helpline's development and preliminary outcomes from January 2021 to December 2022.

Methods: The Dental Link helpline provided free oral health information, referrals to suitable oral health care clinics, and aid navigating public dental benefits. Following every interaction, the virtual provider documented the user's gender, reason for contact, barriers to oral health care, and the resources provided. Users were offered a follow-up to assess referral outcomes and asked to participate in an online survey assessing their satisfaction with the service and any suggestions for improvement. Descriptive statistics (e.g., percentages) are used to present the findings.

Results: The development involved establishing infrastructure (phone, e-mail), supporting documents (information database, promotional flyer, participant satisfaction survey, process flowchart), and personnel (dental hygienist, dental hygiene students). There were 118 interactions with 72 individuals, of which 60 (83.3%) were seeking oral health care, 11 (15.3%) requested information, and 5 (6.94%) attempted to reach an existing student. Referrals to lower barrier community clinics were offered to 59 (81.9%) users, while 26 (36.1%) received information on public dental benefits, oral health, and function of the helpline, and 5 (6.94%) were connected to their student provider. Of the 32 users seeking oral health care who could also be followed-up with, 5 (15.6%) received dental services and 17 (53.1%) received free dental hygiene services. Fourteen users (19.4%) completed a satisfaction survey, of which 13 surveys had positive responses and 1 survey had a neutral response.

Conclusion: The helpline facilitated access to oral health care by providing oral health-related information and guidance on pathways to care. Research is needed on how dental education institutions might incorporate teledentistry to support underserved populations.

Acknowledgements: Supported by the UBC Teaching and Learning Enhancement Fund and the Advancing Community Engaged Learning Fund.

Bonding Performance of Contemporary Adhesive Systems to Caries-Affected Dentin

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Objectives: The goal was to evaluate the immediate and long-term bonding strength (BS) and collagen exposure of contemporary adhesives in sound dentin (SoD) and caries-affected dentin (CAD). Therefore, we hypothesized that (i) dental adhesives demonstrate equal bonding capabilities to both SoD and CAD; (ii) there are no significant differences in bonding performance between universal and self-etch adhesives on SoD and CAD substrates; and (iii) the aging of resin-dentin interfaces affect BS and collagen exposure.

Methods: Microcosm biofilms from human saliva were used to form biofilms on dentin discs, which were cultured anaerobically for 14 days to simulate caries. Four adhesives (Single Bond Universal [SBU], Ambar Universal [AMB], Clearfil SE Bond [CSEB], and ADHE-SE [ADSE]) were applied to SoD and CAD bovine dentin, followed by composite resin build-ups to simulate direct restorations. Shear bond strength was tested at 24 hours and 6 months. Goldner's trichrome staining was used for collagen visualization, and pH and degree of conversion (DC) were measured.

Results: CSEB demonstrated significantly higher BS values regardless of the substrate ($p < 0.05$). The immediate BS to CAD exhibited lower values for SBU and CSEB and showed statistically equal values in both substrates for AMB and ADHE-SE. After 6 months of aging, there was no significant difference in BS between CAD and SoD for all the systems. ADHE-SE showed the most acidic pH and had the lowest DC, while AMB showed the highest DC. SBU showed the lowest collagen exposure at 24 hours, while ADHE-SE had the highest exposure for both immediate and post-aging assessments.

Conclusion: CAD showed lower immediate BS values compared to SoD, regardless of the adhesive system used. However, CAD was no longer an unfavourable substrate after 6 months. Therefore, the selection of a suitable adhesive system depends on the substrate and clinical conditions.

Acknowledgements: This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001.

CSF1R-Expressing Macrophages and Osteoclasts Drive Normal Craniofacial Morphogenesis

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Objectives: Disrupting colony-stimulating factor-1 receptor (CSF1R) signaling—which is required for macrophage and osteoclast proliferation, differentiation, and survival—causes craniofacial and dental abnormalities. Here, we aimed to examine how depleting macrophages and osteoclasts using the CSF1R inhibitor PLX5622 impacts craniofacial morphogenesis. We hypothesize that the presence and proper function of CSF1R-expressing macrophages and osteoclasts are required for normal craniofacial morphogenesis, and it is through altered interactions with surrounding cells that the observed phenotypic disruptions are produced. The following three objectives were used to test this hypothesis:

Objective 1: Determine how the CSF1R inhibitor PLX5622 impacts macrophages and osteoclasts across embryogenesis.

Objective 2: Characterize the craniofacial phenotypes that result from depleting CSF1R⁺ cells uniquely during gestation.

Objective 3: Elucidate the signalling effects of CSF1R⁺ cells during craniofacial development.

Methods: To investigate the importance of CSF1R-expressing cells to craniofacial development, pregnant mice were fed PLX5622 across gestation. Flow cytometry and immunofluorescence staining were used to quantify CSF1R⁺ cell depletion in the developing embryo, while TRAP staining was used to assess osteoclast activity. Craniofacial nerves and muscles were visualized using whole-mount immunostaining. Postnatal skeletons were stained with Alcian blue and Alizarin red to characterize cartilage and/or bony phenotypes. Finally, ELISAs were used to identify cytokines/chemokines secreted from cultured craniofacial tissues, which were then applied to neural crest-derived spheres to identify effects on proliferation.

Results: We observed significant depletion of CSF1R⁺ cells in craniofacial tissues across embryogenesis following PLX5622 exposure. While PLX5622 exposure did not impact nerve or muscle development, PLX5622-exposed offspring displayed robust skeletal phenotypes, including cranial suture impairments, abnormal auditory ossicle development, and sex-dependent mandible defects. Moreover, 9 cytokines/chemokines were downregulated in response to PLX5622.

Conclusions: Our findings suggest that CSF1R-expressing macrophages and osteoclasts are essential for craniofacial morphogenesis.

Acknowledgements: Supported by the Natural Sciences and Engineering Research Council of Canada (NSERC Discovery Grant: RGPIN-2022-03718; NSERC PGS-D Scholarship: 579343-2023), a UBC Four-Year Fellowship, and a UBC Faculty of Dentistry Undergraduate Student Summer Research Award.

The Learning Environment, Curriculum, and Wellbeing: a Dental Student Perspective

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Objectives: Dental students' wellbeing in preclinical years may be affected by various factors, within and beyond their education. Over time, new challenges have emerged, and a new generation of learners have joined dental programs. Therefore, this study explored wellbeing challenges and their consequences on dental students across two timeframes: academic years 2021–2023 and 2012/2013. Another objective was to identify the wellbeing management strategies students developed in response to challenges.

Methods: A case study was conducted using qualitative data from semi-structured interviews and focus groups with preclinical dental students between 2021–2023. Data was analyzed using thematic analysis, and quantitative data from the Study Habits Survey in 2012/2013 was analyzed descriptively and later used for triangulation.

Results: In total, 15 and 31 students participated in the interviews and focus groups, respectively, and three main themes emerged. The first theme captures the role of the learning environment in shaping students' wellbeing, while the second focuses on hands-on learning activities, particularly with challenges associated with the newness of these activities. The last theme: "Changes in Wellbeing Trends" highlights the commonalities and differences of student wellbeing experiences across the time periods. All interviewee students in the 2021-2023 timeframe reported multi-faceted impacts as a result of environmental and curricular challenges. Several students reported a deterioration in their performance, and others described the negative impact of these challenges on their social, eudaimonic, physical, and psychological health and wellbeing. Similarly, students in 2012/2013 timeframe reported high levels of stress, anxiety, feeling overwhelmed, and physical fatigue. Most students in both periods reported a variety of physical, psychological, spiritual, and social strategies to maintain their wellbeing.

Conclusion: If not addressed, wellbeing challenges can compromise students' health, performance, and motivation. Several curricular and environmental changes need to take place to support students' wellbeing in preclinical years.

The Epigenetic Regulator ANKRD11 Controls Tooth Development

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Objectives: Tooth development involves reciprocal epithelial-mesenchymal signalling. The Ankyrin repeat domain-containing protein 11 gene (*ANKRD11*) interacts with histone deacetylases and, thus, participates in the epigenetic control of cell differentiation. However, the requirement for epigenetic control of tooth shape, mineralization, root formation, and accessory teeth or succession teeth is still poorly understood. Macrodonia of upper incisors, fused teeth, missing teeth, root duplications, and mineral anomalies are frequent in individuals with KBG syndrome, which carry variants in *ANKRD11*. We hypothesized that ANKRD11 is required both in dental epithelium and mesenchyme to ensure normal tooth development.

Methods: Epithelium (*Ankrd11^{oeKO}*) or neural crest (*Ankrd11^{neKO}*)-specific *Ankrd11* mutant mice were obtained by mating *Ankrd11^{flx}* with K14-Cre or Wnt1-Cre2 mice. Embryos and postnatal mice were collected, fixed, and then processed for histology/immunofluorescence. E15.5 *Ankrd11^{neKO}* tooth buds were transplanted under the kidney capsule of adult recipient mice. MicroCT analysis was performed using a Milabs UHT-CT system. Antibodies used were Bmp2, Bmp7, Sp7, non-phosphorylated beta catenin, pSmad1/5/8, Dsp, Keratin 14, Keratin 5, and Ankrd11. Histological analysis was done using hematoxylin and eosin and Picro-Sirius Red.

Results: Ankrd11 expression is observed in both dental epithelium and mesenchyme. *Ankrd11^{oeKO}* mice are born but initially fail to thrive. They show rapid cusp attrition suggestive of reduced enamel quality. Quantification of mineralized tissue verifies that. Epithelial-specific markers show inappropriate gene expression with the various epithelial layers of the enamel organ. *Ankrd11^{neKO}* teeth show abnormal pulp and odontoblast differentiation. Maxillary and mandibular 2nd molars were larger than the 1st molars.

Conclusions: Loss of Ankrd11 illustrates the importance of epigenetic programming during most aspects of tooth development. Together, both mouse models recapitulate many of the reported tooth anomalies in KBG patients. Future studies will focus on identification of molecular targets of Ankrd11.

Acknowledgements: Supported by the Natural Sciences and Engineering Council of Canada (NSERC RGPIN-2022-03272 Graf); China Scholarship Council; Recruitment scholarship from the UofA.

Oral Bacterial Biofilms Induce Disassembly of $\alpha\beta6$ Integrin Adhesion Complexes

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Objectives: Periodontal diseases are caused by dysbiotic bacterial biofilms, leading to inflammation and alveolar bone and tooth loss. In health, $\alpha\beta6$ integrin activates the anti-inflammatory transforming growth factor- $\beta1$ (TGF- $\beta1$) in the junctional epithelium. In periodontal disease, $\alpha\beta6$ integrin expression is lost, resulting in destructive inflammation. To activate TGF- $\beta1$, $\alpha\beta6$ integrin must be localized to an adhesion complex ($\beta6$ -IAC) containing the adaptor protein kindlin-1. We hypothesized that oral biofilms will selectively disassemble $\beta6$ -IACs while retaining other IACs such as those with $\beta1$ integrin and paxillin. This study aimed to quantify the $\beta6$ -IAC disassembly by oral biofilms, elucidating the pathological processes underlying periodontal inflammation.

Methods: Human gingival epithelial cells (hGECs) were treated with TGF- $\beta1$ for 24 hours to promote $\beta6$ -IAC assembly, followed by their exposure to oral biofilm extracts for 48 hours to induce $\beta6$ -IAC disassembly. To isolate IACs, hGECs were incubated in either a detergent (saponin) or hypotonic solution (low ionic strength triethanolamine buffer); a Waterpik was used to apply a hydrodynamic force to remove cell bodies. The isolated IACs were then labeled using an anti- $\alpha\beta6$ integrin antibody in combination with antibodies against various focal adhesion proteins (paxillin, $\beta1$ integrin, kindlin-1). The distribution of IAC components was visualized using immunofluorescence microscopy and protein levels were quantified using immunoblotting.

Results: Oral biofilm extracts induced disassembly of $\beta6$ -IACs, along with kindlin-1 in cultured hGECs, while other IACs ($\beta1$ integrin/paxillin) were not affected. Following IAC isolation by detergent/hypotonic treatment and hydrodynamic force, the selective biofilm-induced downregulation of $\beta6$ -IACs was exemplified by immunoblotting and immunofluorescence microscopy.

Conclusions: Oral biofilms can induce the disassembly of $\beta6$ -IACs in hGECs. Future studies will focus on isolation and identification of $\beta6$ -IAC components using mass spectrometry, immunoblotting, and immunofluorescence microscopy. Understanding the regulation of the $\alpha\beta6$ integrin unveils opportunities to address periodontal inflammation and develop treatments for periodontal diseases.

Acknowledgments: This research was supported by the Canadian Institutes of Health Research (PJT-153379 and PJT-156387).

Summer Student Practitioner Program: Student and Mentor Dentist Experiences

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Objectives: The Summer Student Practitioner Program (SSPP) provides an opportunity for promoted third-year dental students to grow personally and professionally by experiencing the daily operations of a dental office in BC. The aim of this report was to examine the experiences of both students and mentor dentists to inform future directions.

Methods: Surveys were distributed to both mentor dentists and students at the 2023 program completion via UBC's Qualtrics survey tool. Questions asked about treatment opportunities, comfort levels, interprofessional exchange of ideas, the transition from academia to private practice, community outreach with underserved populations, levels of satisfaction with the experience, and suggestions for improvement.

Results: Forty-nine out of 58 students in the class participated in the SSPP. Nineteen students and 24 mentor dentists completed the survey for a 40% student response rate. Comfort level with procedures varied; students were most comfortable with restorative dentistry and least comfortable with crowns. This was consistent with the comfort levels of mentor dentists assigning treatment procedures to students for their patients. 80% of students felt that their relationship with their mentor was extremely compatible. 100% of students felt that their experience improved their understanding of their future role as a dental professional. Testimonials and feedback from students revealed that the SSPP acts as a useful adjunct to dental education, increased their confidence, and helped to establish their professional identity. Dentists enjoyed the exchange of knowledge, association with UBC FOD, and students' willingness to learn.

Conclusions: The SSPP provides experiences for dental students to help prepare them for professional practice. Future directions may be to include other academic programs and extension of the program into the academic year.

Acknowledgements: Thank you to Dr. HsingChi von Bergmann for advising on data organization. Thank you to Siobhan Ryan and Tanja Bogdanovic for their assistance with administering the SSPP.

Faculty of Dentistry Learners' Wellbeing and Use of Support Resources

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Objectives: The study's purpose was to explore factors that affect learners' wellbeing and use of support resources in UBC's Faculty of Dentistry (FoD). An improved understanding of common stress inducers, as well as familiarity, utilization, and satisfaction with support resources within and outside of the FoD, will help inform future support programming.

Methods: Learners completed a UBC Qualtrics survey between March-April 2023. Survey questions were taken from pre-validated questions that were piloted on a wellness survey to students in the previous year. Questions asked about sense of belonging, support resources (familiarity, use, access, and barriers), stress inducers, food insecurity, imposter syndrome, support resource delivery, and suggestions for future support programming (BREB: #H23-00285).

Results: 113 learners from undergraduate and graduate programs participated for a 22% response rate. 41% of respondents agreed/strongly agreed that they felt like a valued member of the FoD community; only 19% felt like a valued member of the larger UBC community. 75% of respondents agreed/strongly agreed that they were familiar with support resources offered within the FoD; only 37% felt familiar with resources offered outside of the FoD. DMD students were the most familiar with support resources within the FoD (87%) followed by DHDP Entry-to-Practice students (75%), DHDP Degree-Completion students (43%), and graduate students (30%), $p < 0.01$. Resources utilized included FoD's Embedded Counsellor, Student Services faculty & staff, peer mentorship program, AMS Food Bank, and Faculty Advisors. Barriers to accessing resources included time, conflicts with academic schedules, uncertainty about whom to access, and stigma. Learners were challenged by sleep and exercise, imposter syndrome, food insecurity, social interactions, financial issues, and family commitments. Suggestions to improve learners' wellbeing included creating time in the academic schedules for self-care and increasing peer mentorship opportunities.

Conclusions: These findings provide greater insight into factors that affect learner wellbeing and offer suggestions to inform future support programming.

Acknowledgements: Thank you to Siobhan Ryan and Tanja Bogdanovic for their assistance with learner recruitment.