1. Antibacterial Effect of Extract from *Commiphora gileadensis*: *In Vitro* Study

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Objectives: This *in vitro* study aims to investigate the antimicrobial effect of extracts from *Commiphora gileadensis* (CG) on 1- and 3-week-old oral anaerobic multispecies biofilms and to compare them to 2% chlorhexidine (CHX).

Methods: Hydroxyapatite discs were coated with type I collagen and immersed in Brain Heart Infusion broth infused with an oral subgingival plaque obtained from two donors. The discs were then incubated under anaerobic conditions for 1 or 3 weeks. After biofilm growth, the discs were exposed for 1 or 3 minutes to the following solutions: 1) CG 1 mg/mL water, 2) CG 0.1 mg/mL water, 3) CG 1 mg/mL 0.5% DMSO, 4) CG 0.1 mg/mL 0.5% DMSO, 5) water, 6) 2% CHX, and 7) 0.5% DMSO. After exposure, all discs were stained with a viability stain and scanned using a confocal laser scanning microscope. The percentage of dead bacteria was calculated using Imaris software. The data were submitted to Univariate analysis of variance and Tukey statistical tests ($P < 0.05$).

Results: CG 1 mg/mL water killed significantly more bacteria than all other groups ($P < 0.05$). 2% CHX and other groups of CG killed bacteria without a significant difference among themselves ($P > 0.05$). In the 0.5% DMSO and water groups, only a few bacteria were killed.

Conclusion: *Commiphora gileadensis* extract (1 mg/mL) in water killed significantly more bacteria in oral anaerobic multispecies biofilm than 2% CHX.

2. Cyclic Fatigue Testing of the New EndoSequence Controlled Memory File

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Objectives: The aim of this study was to compare the fatigue resistance of the thermomechanically treated files (EndoSequence controlled memory (ESCM), Vortex Blue, K3XF) and the traditional files (EndoSequence (ES) and K3) in five different curvature locations in relation to their phase transformation behaviour.

Methods: Five different file systems, size (25/0.04), were subjected to fatigue tests inside five artificial canals with a single 60° curvature, 3-mm radius, and different locations of curvature. A 19-mm-long file segment from the tip was introduced into the canal and immersed in water at 37°C, and the number of cycles to fracture (NCF) was recorded. The fracture surface of all fragments was examined with a scanning electron microscope (SEM). Phase transformation behaviour was estimated by differential scanning calorimetry (DSC). Data were analyzed using one-way ANOVA and linear regression analysis.

Results: The NCF of all files was significantly influenced by the type of NiTi metal alloy ($p < 0.01$) and the location of the canal curvatures ($p < 0.01$). ESCM files had the highest NCF of all groups ($p < 0.01$). The SEM topographic appearance of the fracture surfaces showed typical features of cyclic fatigue. DSC testing showed a two-stage phase transformation.

Conclusions: Thermomechanical treatment can improve the fatigue resistance when the canal curvature was both in the coronal and apical third.

3. Effect of Canal Dimensions on Fluid Hydrodynamics by Multisonic Irrigation

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Objectives: Success in endodontic treatment is based on the quality of cleaning and disinfection of the canal system. The GentleWave system (Sonendo, Inc., Laguna Hills, CA), is a novel innovative method to clean, remove debris, and disinfect the entire root canal system simultaneously. Current studies have indicated its superiority over other sonic and ultrasonic methods in both tissue dissolution and antimicrobial effect. Our study aims at evaluating the effects of canal dimensions on the penetration depth of liquids by the GentleWave system.

Methods: 3D plastic models were made with 1–3 artificial canals mounted on an artificial pulp chamber, canals with different diameters and lengths, and seven (7) different groups. The canals were filled with a coloured liquid before using the GW instrument. Depth of clearance of the color by GW irrigation was measured for each canal.

Results: The depth of clearance of the colour (irrigation depth) in the canals varied between 20.2 and 64.2 mm. When one or more canal openings at the pulp chamber floor were blocked with a temporary filling, the depth of irrigant penetration in the remaining open canal(s) increased, with irrigant penetration between 32 and 54 mm. The time for the GW irrigants to reach the maximum depth in the canals in most cases was between 4 and 10 seconds.

Conclusions: Irrigation with the GentleWave system quickly reached the maximum depth in each canal, the minimum length was far beyond the average length of upper or lower molar roots.

4. Class II Malocclusions Treated with Twin-Block or Invisalign® Mandibular Advancement

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Objectives: The purpose of this retrospective cohort study was to compare the short-term skeletal, dental, and soft tissue effects in Class II malocclusions treated with a novel Invisalign® with Mandibular Advancement Feature (IMAF) appliance as compared to a traditional Twin-Block (TB) appliance.

Methods: The cephalometric records of 32 Class II malocclusion patients treated with IMAF and 32 patients treated with TB and then full fixed edgewise appliances (FEA) were gathered from two private practices in Vancouver, Canada. Records of an historical sample of 32 untreated Class II subjects, age and gender matched to the IMAF sample, were accessed from the American Association of Orthodontics Foundation Legacy Collection. Demographic information was collected and the lateral cephalometric radiographs at three time points (T1-baseline, T2-immediately post-advancement, T3-final) of the total sample were anonymized, traced in random order and cephalometric analysis performed. A quarter of the radiographs were re-traced for intra-operator error. Descriptive statistics, paired and independent T-tests, were performed with a significance value of $p<0.05$ applied.

Results: The ANB angle decreased in all groups from T1-T2, with IMAF and TB groups demonstrating restraint of the maxilla. From T2-T3, IMAF and TB groups demonstrated relapse of mandible posteriorly. Neither IMAF nor TB significantly affected mandibular vertical position. Both treatment groups decreased overjet and overbite by a combination of changes in incisor position; U1-SN retroclined, with TB improving torque during T2-T3. Mandibular incisors were protruded by IMAF and TB; the TB group began less proclined and finished with similar proclination as the IMAF group which did not procline significantly during treatment. **Facial c**onvexity decreased in all groups (T1-T3), with no significant changes to the nasolabial angle.

Conclusions: IMAF with Invisalign treatment and TB followed by FEA are effective in correcting a Class II dental malocclusions. Minor differences in incisor position were noted between groups, warranting further investigation.

5. Is the Standard Periodontal Probe Effective in Diagnosing Peri-implant Diseases?

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Objectives: Bleeding on probing (BOP) remains the most widely used clinical parameter to assess the peri-implant mucosal health of an implant. Although the absence of bleeding, along with other indicators of inflammation, is correlated with mucosal health, the presence of BOP may offer varied information. Factors that could influence bleeding tendencies may be site-specific, patient-related, iatrogenic, and even perhaps the instrument used to obtain the assessment. This study serves to examine the efficacy of a standard periodontal probe in assessing BOP to support diagnosing peri-implant health and to determine the false-positive rates of bleeding on probing and the diagnosis of peri-implant diseases using a standard periodontal probe at the University of British Columbia (UBC) Nobel Biocare Oral Health Centre.

Methods: A retrospective study of patients with osseointegrated implants at the UBC dental clinic from 2012-2019 was performed. An evaluation of 750 charts resulted in 111 implant cases meeting the criteria. Data was collected on the implant and/or abutment system, pocket depths, BOP, suppuration, plaque index or oral hygiene index, recare interval, keratinized tissue levels, and bone levels at baseline, 1, 3, and 5 years post-operation.

Results: Descriptive statistics revealed an increase in bleeding tendencies amongst implant cases over 5 years (4.50%, 50.5%, 58.6% at years 1, 3, and 5, respectively). BOP resulted in greater odds of healthy diagnose s (OR 1.52 95%CI 1.23–1.88), as compared to peri-implant mucositis (OR 0.055 95%CI 0.008–0.400) and peri-implantitis (OR 0.307 95%CI 0.850–1.11). Cross-tabulation of cohort diagnoses over the 5 years report inconsistent patterns in disease progression.

Conclusions: Within this study sample, bleeding tendencies increased amongst implant cases over 5 years. Diagnoses were inconsistent with BOP findings and suggested that dichotomous scoring lacks descriptors in identifying peri-implant infection. Adjunctive methods or indices for accurately assessing and diagnosing peri-implant gingival inflammation are needed and should be explored.

6. Can DNA Ploidy Predict Cancer Progression in Low-Grade Oral Dysplasia?

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Objectives: A majority of oral cancers develop from oral potentially malignant lesions (OPML). The grade of dysplasia is considered the gold standard to predict malignant transformation. However, histopathology has poor reproducibility and oral cancer often arises in the absence of high-grade dysplasia. Risk prediction among low-grade dysplasia is challenging. The aim of this study was to assess the role of DNA image cytometry (DNA-ICM), which measures DNA content imbalance and nuclear morphometric features to predict malignant transformation.

Methods: Patients with primary mild or moderate dysplastic OPMLs consented into the British Columbia Oral Cancer Prediction Longitudinal Study were included in this study. Brushings prior, or concurrent, to biopsy dates with more than 6 months of follow-up were assessed. Demographics, risk habits, and clinicopathological information were retrieved. Brushings were cytospun on slides and stained with Feulgen Thionin. Slides were scanned using the Getafics Scanner at BC Cancer using machine learning algorithms to identify abnormal cells. Sequential brushings of progressing lesions were also assessed for ploidy changes.

Results: A total of 149 patients with 152 lesions were selected. Nineteen (12.5%) progressed, 5 to verrucous carcinoma, 9 to severe dysplasia, and 5 to squamous cell carcinoma. Among the clinicopathological features, a lesion size greater than 200 mm^2 ($P = 0.009$), ever TB positive ($P < 0.001$), and grade of dysplasia ($P = 0.002$) were significantly associated with progression. To date, 88 samples with 15 progressors have been analyzed. A lesion with 3 or more cells with a DNA Index ≥ 2.5 was defined as aneuploid. Three of the 15 (20%) progressing lesions showed aneuploidy as compared to 3 of 73 (4.1%) non-progressors. Aneuploidy was significantly associated ($P = 0.026$) with progression.

Conclusion: DNA-ICM may serve as a quick, non-invasive, cost effective tool to triage high risk OPMLs to cancer centres for monitoring and early intervention.

7. Influence of Spheno-Occipital Synchondrosis Patency of Fusion on Craniofacial Form

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Objectives: Growth of the facial skeleton is integrated to the growth of the cranial base. This relationship is highlighted in patients with craniosynostosis syndromes (Apert, Crouzon, Peiffer syndrome), in whom premature fusion of cranial base synchondroses is associated with severe midface deficiency. In this study we will evaluate whether similar relationships exist in normal individuals, as we hypothesize spheno-occipital synchondrosis (SOS) patency influences mid-facial projection and morphology in normal individuals.

Methods: Seventy pre-treatment cone-beam computed tomography (CBCT) images were obtained from orthodontic patients, aged 5-10 years (M= 30, F=40, average age = 8.2 years). SOS patency was scored using a 6-stage SOS patency scale utilizing InVivo (Anatomage) software from fully patent (S=1) to fully fused (S=6). 3D Slicer (v 4.10.2) was used to place 3D landmarks on CBCTs. Error analysis was performed by repeat landmarking of 12 volumes (mean error = 0.23 mm). X, Y, Z coordinates for landmarks were used to determine linear and angular measurements assessing cranial base (CB) and maxillary projection. In addition, Geometric Morphometric analyses (GM), will be used to describe the main facial shape differences within our patient population and determine whether SOS patency scores are associated with any of the major principle axes of variation.

Results: There is a large variation in SOS patency status, with older children tending to have higher patency scores than younger children. Patients with fusing SOS displayed anterior CB shortening compared with the patent groups. Additionally, younger patients with patent SOS display a trend toward increased maxillary projection compared to their fused SOS counterparts, as measured by N-perpendicular to A-point distance.

Conclusions: This data suggests that younger children with early fusion of the SOS display features indicative of mild midface hypoplasia and supports the notion that growth between the cranial base and facial skeleton is integrated.

8. Mental Health, Substance Use, and Sexual Diversity: Dental Educational Pedagogies

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Objectives: The aims of this study were to perform a review of the existing pedagogies for educating dental students on providing care for patients with mental health issues, with partake in substance use, and/or who identify as part of the sexual diversity community; and to redevelop three 2.5 h sessions to address each of these topics within undergraduate dental and dental hygiene education. The research questions was: What pedagogies are available to address these three topics in dental education?

Methods: A comprehensive literature review was conducted focusing on evidence-based dental education pedagogical methods to cover each of the three topics. The search was performed through PubMed/Medline® with the keywords ("pedagogy" AND "dental") OR "substance use" OR "mental health" OR "sexual diversity". Two researchers independently scrutinized the publications at title, abstract, and full-text levels until consensus. The selected literature was synthesized and used to redeveloped three separate teaching sessions with the community as co-teachers.

Results: The literature search yielded 511 studies exploring mental health pedagogies, 186 studies exploring substance use pedagogies, and 41 studies exploring sexual diversity pedagogies, which were screened to 24, 14, and 12 records, respectively, after excluding repeated and unrelated publications. Most studies showed a mix of lecture-based and case-based discussions, and self-reflections. The re-developed sessions use flipped classroom pedagogies with pre-readings, community-led seminars, small group case study, community panels and Q&A, and guided self-reflection.

Conclusions: The re-developed, evidence-based, and community-led sessions will be delivered in January of 2020 to both dental and dental hygiene students. Further studies will be conducted to evaluate the impact of these three sessions so that future health care providers can foster their practices based on inclusiveness, fairness, and social responsibility.

9. Is Dual Therapy Better Than Monotherapy For Obstructive Sleep Apnea?

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Objectives: Continuous Positive Airway Pressure (CPAP) and Mandibular Advancement Splints (MAS) are disease-specific therapies for obstructive sleep apnea. The study objectives were to compare the efficacy and effect on symptoms and on CPAP pressure requirements of CPAP and MAS monotherapy versus dual therapy (simultaneous use of CPAP and MAS).

Methods: A double-randomized, cross-over trial comparing CPAP and MAS monotherapies was conducted consisting of a titration/adaptation phase followed by a cross-over phase. Patients were exclusively on one treatment (monotherapy) for a 1-month period, followed by a 1-week washout, then 1 month on the other treatment. In addition, patients used both treatments simultaneously for 1 month. Outcomes were assessed at the end of each 1-month period. Outcomes included: the Oxygen Desaturation Index (ODI), measuring intervention efficacy; the Epworth Sleepiness Scale (ESS), comparing daytime sleepiness; and mean CPAP pressure.

Results: Thirteen patients were assessed; mean ODI at baseline, CPAP-monotherapy, MAS-monotherapy and dual therapy were 26, 3, 11, and 3 events/hour, respectively. Mean ESS scores for the total sample were 11, 8, 9, and 7, respectively. 62% of the sample presented with sleepiness at baseline (ESS≥10), their mean ESS scores were 15, 9, 12, and 8, respectively. Mean CPAP-monotherapy pressure was 10cmH$_2$O for the total sample and 9cmH$_2$O for dual therapy. For those who were at a high pressure with CPAP-monotherapy (mean=12cmH2O), their mean pressure was 10cmH$_2$O with dual therapy.

Conclusions: Dual therapy resulted in a reduction in ODI compared to no treatment and to MAS-monotherapy. CPAP pressure requirement was reduced by dual therapy in comparison to CPAP-monotherapy. Reductions in pressure requirement were more profound for patients who needed a higher pressure with CPAP-monotherapy. Similarly, there was a reduction in ESS score by dual therapy compared to no treatment and to monotherapy. Reductions in ESS scores were more profound for patients who presented with daytime sleepiness at baseline.

10. Awareness of Oral Dysplasia in Newly Diagnosed Patients

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Objectives: Early detection of oral dysplasia is critical, as it provides better outcomes in prognosis. However, patient awareness and risk factor reduction for malignant transformation are dependent on patient understanding and compliance. This study investigated the referral process to the NextGen Oral Dysplasia Clinic (NG) and aimed to determine the patients' awareness surrounding oral cancer and precancer.

Methods: Audio-recorded, structured interviews were conducted on 14 patients referred to NG with biopsy-confirmed dysplasia. The information gathered included: who first identified the lesion, the referral time, the patient's knowledge of dysplasia and oral cancer at the time of referral to the NG, the source of where the patient obtained the knowledge, and the patient's level of concern.

Results: None of the participants were aware of their lesions prior to identification by the dental professional, despite 64.3% experiencing symptom(s). In 57.1% of the cases, the dental hygienist identified the oral abnormality. 57.1% knew smoking and/or drinking is a risk factor for oral cancer; the remaining patients could not identify any risk factors. 50% reported inadequate information from the referring clinician and had to use the internet to further their understanding of the diagnosis. Despite this, all participants were able to identify the location of their oral lesions after diagnosis. 64.3% were able to obtain a referral or biopsy in less than 6 weeks, while 14.3% experienced referral delays due to the limited schedule availability of NG.

Conclusions: Although the majority of participants reported minimal wait times for biopsies and referrals, many were unable to recall risk factors for oral cancer and required the internet to supplement their understanding of the disease. To reduce the anxiety associated with newly diagnosed oral dysplasia, further investigation into communicating lesion and risk habit information to patients is required at the initial referral level.

11. Metal Artifact in CBCTs and the Impact on Implant Planning

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Objectives: Cone beam computed tomography (CBCT) imaging is commonly used for pre-surgical treatment planning for dental implant placement. Image quality is known to be affected by several factors, including artifacts due to metal restorations. Metal artifacts produce image deterioration via bright streaks radiating from the metallic object and loss of gray values in the vicinity of the metallic structure. The aim of the study is to determine the impact of progressively increasing metal artifacts on the measurement accuracy of commonly evaluated points in implant treatment planning.

Methods: Holes (1 mm in diameter) were drilled into porcine mandibles located 3, 6, and 9 mm from the alveolar crest on the buccal and lingual surfaces and filled with gutta percha. Repeated CBCT images were taken, with progressively increasing amalgam restorations and stainless-steel crowns (up to a total of 8 restorations per jaw) using 3 different fields of view, with a total of 81 images for the amalgams and 162 for the stainless-steel crowns. The measurement between these two points (buccal to lingual) on the mandible was performed using a digital caliper to establish "truth" and compared to the same measurements taken digitally on the CBCT images to estimate the accuracy of the image with increasing numbers of metallic restorations.

Results: Comparison between "truth" (digital caliper) and baseline CBCT with no metal artifact demonstrated differences ranging from 0-1.7 mm. This range of variation appears to be consistent even with increasing metal artifact, with no clear detectable pattern of change.

Conclusions: There appears to be a variation of up to 1.7 mm between measured anatomical points and imaging under commonly used settings. While this result may be clinically relevant, it does not appear to be affected by increasing metal artifact due to amalgam restorations or stainless steel crowns.

12. Physician-Led Oral Health Promotion: Impacts on Children's Perceptions and Behaviours

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Objectives: Children in northern British Columbia generally experience poorer oral health compared to children in urban areas. A school-based oral health promotion program was implemented in collaboration with a physician and 2 elementary schools (S1, S2) in Houston, B.C. The purpose of this project was to assess changes in the children's oral health perceptions and behaviours, and the program's perceived impact on the schools.

Methods: A survey was administered to children in grades 4-7, after the program, to assess perceived oral health changes and behaviours. Interviews with 12 school staff were conducted to explore the program's perceived impact on the school and their students. Survey data was de-identified to ensure participant confidentiality and univariate analysis was conducted.

Results: Fifty-three children from S1 and 45 children from S2 completed the post-program surveys. The survey revealed that 69% of children from each school reported improved oral health compared to before program implementation. Some children from S1 and S2 still experienced oral pain (18 and 14%, respectively) and difficulty eating (27 and 16%, respectively), while children from S2 had fewer issues regarding appearance than children from S1. Cariogenic snacks remain prevalent in both schools; however, 29% of S1 children and 40% of S2 children reported decreased frequency of consuming sugar sweetened beverages. The majority of children from both schools (66% from S1 and 69% from S2) brush their teeth twice or more daily. Interviews with school staff revealed that both schools recognize a need for the program and reinforcement, and believed the program provided access to oral health education and hygiene aides that some students previously did not have.

Conclusions: In Houston, BC where access to dental services is limited, physician-led oral health promotion activities can increase access to oral health education and can contribute to improved perceptions of oral health and related behaviours.

13. Assessing Dental Hygiene Students' Readiness for Interprofessional Learning

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Objectives: The need for Interprofessional Education (IPE) has been well documented and communicated by many prominent governmental bodies and health organizations. However, more longitudinal outcomes are needed to demonstrate the impact of IPE on students' attitudes and behaviours. This study assessed dental hygiene students' readiness for IPE and collaborative practice at the University of British Columbia.

Methods: Ethics approval was received by the university's behavioural research ethics board (H18-02026). This study employed a mixed-methods approach. A modified Readiness for Interprofessional Learning Scale (RIPLS) survey was conducted on 23 (96% response rate) second-year dental hygiene students prior to commencing the university's newly integrated 4-week IPE curriculum and immediately following its completion approximately 1 month later. A focus group comprising 5 students then explored learning experiences and impact on attitudes about collaborative practice in greater depth. Curriculum content included professionalism, ethical practice, Indigenous cultural safety, and resiliency.

Results: Attitudinal shifts were observed in three of the RIPLS measures suggesting that students found greater clarity regarding their professional roles and became more receptive to learning clinical problem-solving skills with other disciplines. No statistically significant differences surfaced between the pre-attitudinal and post-attitudinal RIPLS measures. The focus group revealed three prominent themes: greater role clarification, recognition of similarities in knowledge and practice with other professions, and cultivation of professional identity, collegiality, and respect.

Conclusion: Dental hygiene students gained greater clarity about professional roles and developed an enhanced appreciation for working with other health professions after completing the university's month-long integrated IPE curriculum.

14. Comparative Ontogeny of the Tongue, Mandible, and Hyoid Cartilage

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Objectives: Craniofacial growth characteristics during human fetal development are challenging to explore, mainly due to lack of large numbers of samples. The main objective of this research was to investigate the growth of the human fetal tongue, mandible and hyoid cartilage. These structures arise from different pharyngeal arches but may share a common developmental trait. We hypothesized that the growth of the tongue has a positive correlation to the growth of the mandible and the hyoid cartilage during the fetal stage of prenatal human life.

Methods: Human fetal heads were obtained from abortions between 9 and 19 gestational weeks (n=16). They were contrast-enhanced with Phosphotungstic acid (PTA) and imaged with high-resolution μCT (micro-computed tomography). Using 3D Slicer software, segmentation of the tongue muscles, mandible, and the hyoid cartilage was performed, and their volumes were calculated. Landmarking of the interior mandibular surface was done to compare its growth trajectory to the tongue. Multiple regression analyses were performed to assess the relationship between variables.

Results: PTA contrast enhancement provides excellent visualization of hard and soft tissue of the craniofacial regions of developing fetal heads. Volumetric measurements from segmented tongue and hyoid cartilages showed a two-fold increase in size between the ninth and tenth gestational weeks and enlarged to double the size in the twelfth week. The lesser horns of the hyoid cartilage in this age group sample is not noticeable. The mandibular bone showed a similar growth trajectory as the tongue and hyoid cartilages.

Conclusions: These data indicate a strong correlation between the growth of soft and hard tissue components of the craniofacial structures, namely the mandible, tongue, and hyoid cartilage during the second trimester of human fetal growth. This supports the functional matrix theory proposed by Moss and is in line with previous data investigating late fetal and postnatal growth integration.

15. Impact of Platelet Rich Fibrin (PRF) on Post-Cancer Extraction Healing

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Objectives: The present study evaluated the role of platelet rich fibrin (PRF) in healing of extraction sites in cancer patients. PRF is a new method used to concentrate platelets and utilize them for expedited wound healing in the surgery site. PRF is also considered a living tissue graft due to its cellular content and constant release of growth factors. Our null hypothesis was that PRF does not affect post-cancer extraction healing.

Methods: This retrospective chart review included 19 cancer survivors who needed extractions and had previously recorded history of developing oral complications, either due to Medication Related Osteonecrosis of the Jaw (MRONJ), spontaneous Osteoradionecrosis (ORN), or osteomyelitis. In addition to debridement following the extraction, these patients had PRF placed in the extraction sites. These cases were compared to published data about healing without PRF.

Results: The study included 11 females and 8 males, age ranged from 48 years old to 88 years old. Of the 19 patients, only 1 patient was lost to follow-up before healing completion. Healing time varied between 7 and 497 days, with a mean of 101.2 days and median of 56 days. 6 patients healed within 1 month, 5 within 2 months, 3 within 3 months, and 4 patients needed more than 3 months to fully heal. Complications encountered during healing affected 7 patients, and included: sinusitis, pain to the gingiva or jaw, refractory osteomyelitis, numbness, recurrent infection, dehiscence, and bone spicules.

Conclusions: Within the limits of this study, all patients eventually healed after their extraction and placement of PRF. Thus, it was shown that PRF did not adversely affect the healing process. These results can be used to pave the way for a future clinical trial.

16. University of British Columbia Children's Dental Program: A Retrospective Study

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Objectives: Many dental schools contribute to public health through free or reduced fee treatment for underserved pediatric populations. The University of British Columbia (UBC) Faculty of Dentistry's students provide dental care to pediatric patients through a bussing program known as the Children's Dental Program (CDP), which transports children from areas outside of Vancouver city limits to UBC for free care. The purpose of this study was to quantify the scope of the CDP by reviewing the populations served and dental treatment provided over the past 21 years.

Methods: De-identified data was retrieved from UBC's axiUm database, including demographic information and treatment procedures performed. The first three digits of the patients' postal codes were used to create choropleth maps using QGIS Software. The 21-year period was divided into four periods, and analyzed using SPSS Software.

Results: A total of 5,203 patients were treated between April 1997 and March 2018. The patients were from various British Columbia cities, and a majority were from the Vancouver suburbs of Surrey, Abbotsford, and Burnaby. From Period 1 to 4, the number of patients increased from 1,279 to 1,641; the provision of diagnostic procedures increased from 3,237 to 4,373; restorative procedures decreased from 5,211 to 4,009; and preventive procedures decreased from 5,152 to 4,322.

Conclusions: Since the inception of the UBC CDP the number of patients seen has increased, but the number of treatment procedures has decreased – excluding diagnostic procedures. The preventive component in patient care has decreased over these periods. This research will allow us to suggest valuable and timely improvements for the CDP.

17. The Malignant Risk of Lichenoid Dysplasia: A Systematic Literature Review

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Objectives: Oral epithelial dysplasia (OED) is recognized as potentially malignant. However, in the presence of intense lichenoid changes, dysplasia is often discounted as reactive. To elucidate the risk of malignant progression of OED with striking lichenoid features (lichenoid dysplasia, LD), we aimed to systematically review and summarize the primary literature reporting the malignant transformation of LD.

Methods: A systematic search of electronic databases was conducted using Web of Science, PubMed, and MEDLINE EBSCO. The following keywords were used: ["oral lichen planus" OR "lichenoid dysplasia" OR "lichenoid mucositis"] AND ["carcinogenesis" OR "malignant progression" OR "oral cancer" OR "malignant potential" OR "mouth neoplasm"]. The references and bibliographies of included studies and papers were also scrutinized. English-language, full-text, primary, peer-reviewed publications were included in this literature review. Review articles and papers that did not answer the primary research question were excluded.

Results: 250 records were identified through database searches, and 3 additional records identified through other sources. 222 articles remained after duplicates were removed, 4 of which met the inclusion and exclusion criteria. The 4 studies were retrospective, and reported the proportion of malignant transformation of LD. An analysis of study quality revealed a high risk of bias in most studies due to convenience sampling, small sample sizes, and failure to report the diagnostic criteria used or the length of follow-up.

Conclusions: There is a pressing need for well-designed, prospective studies to further investigate the malignant potential of LD. However, given that malignant transformation was still found in these lesions, biopsy and careful follow-up is warranted.

18. 3D Stereophotogrammetric Evaluation of Facial Taping Outcomes for Cleft Lip

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Objectives: Prior to surgical correction of a cleft lip (CL) deformity, presurgical orthodontics (PSO) is used in order to improve soft tissue alignment and facilitate surgical repair. A common component of PSO is the daily use of a soft-tissue adherent tape across the defect. The aim of this study was to evaluate two commercially available cleft lip taping devices, 3M[TM] and Dynacleft, for their ability to improve nasolabial shape and symmetry post-surgery.

Methods: A retrospective cohort study of 70 CL patients who had received either Dynacleft or 3M[TM] facial taping for PSO was conducted. 3D stereophotogrammetry images were obtained at three time-points: prior to treatment, post-taping, and after surgical repair. 3D images were annotated with 31 landmarks on the nasal and upper lip region using 3DMD Vultus software (Atlanta, GA). The landmarks were then used in conventional morphometric analysis with previously validated facial measurements (linear distances, ratios, and angles) to compare the two cohorts at each stage. Geometric morphometrics using Procrustes ANOVA analysis was also conducted to compare the nasolabial region between the two taping groups.

Results: Both devices demonstrated progressive improvement in multiple facial metrics after taping and surgery. Although variability in the degree of improvement was noted after PSO, no differences were found after surgery between the two taping groups. ANOVA comparison of the nasolabial region after Procrustes analysis confirmed no significant difference between facial shape for the two taping cohorts after surgical CL repair (p-value = 0.80).

Conclusions: PSO with facial taping reduces the severity of facial deformity prior to surgical CL correction across multiple facial measurements. However, both 3M and Dynacleft taping devices result in similar facial alignment post-surgery. Given that there is a large difference in cost between the two systems, our data suggests that either can be successfully utilized for PSO prior to CL surgery.

19. Preventive Dental Education for Improving Toothbrushing Skills in Children

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Objectives: This study assessed the effectiveness of one-to-one dental education delivered by dental students for improving toothbrushing skills in elementary school-aged children.

Methods: The sample consisted of 125 children between the ages of 5 to 12 (Kindergarten to Grade 7). Each child was first asked to perform his/her best toothbrushing, and then to brush following a customized tooth-brushing video demonstrating appropriate toothbrushing techniques. Then, a dental student commented on areas for improvement. The tooth-brushing observation form included assessments of the following aspects: brushing time; brushing all buccal, lingual, and occlusal surfaces; brushing slowly or not; brushing reaching the gum line; and brushing the tongue. The effectiveness of the dental education was evaluated by measuring the changes before dental education and 2 or more weeks later.

Results: Toothbrushing skills in elementary school-aged children significantly improved after one education session. The mean (sd) brushing time increased from 67 (49) seconds to 83 (49) seconds ($p<0.001$), with the older children (grades 6 & 7) improving the most. The proportions of children brushing all buccal surfaces improved from 73% to 83% ($p=0.047$), all lingual surfaces from 41% to 55% ($p=0.011$), all occlusal surfaces from 65% to 72% ($p=0.203$), brushing teeth slowly from 38% to 65% ($p<0.001$), brushing including the gum line from 42% to 61% ($p=0.002$), and brushing the tongue from 19% to 44% ($p<0.001$).

Conclusions: One-to-one preventive dental education delivered by dental students was an efficient short-term approach for improving dental brushing in elementary school-aged children.

20. Application of Macromolecular Crowding for Human Gingival Fibroblast Cultures

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Objectives: Fibroblast-derived extracellular matrix (ECM) regulates cell phenotype and behaviour relevant for wound healing and pathological conditions. Better understanding of cell-ECM interactions requires culture models that mimic ECM found *in vivo*. Unlike *in vivo*, cultured cells reside in aqueous media with low concentration of macromolecules. To overcome this deficiency, inert macromolecular crowders (MCs) have been introduced to mimic *in vivo*-like conditions *in vitro*. We hypothesized that MCs will modulate human gingival fibroblast function and gene expression distinctly from traditional non-crowded culture conditions. The objective was to compare fibroblast function and ECM deposition treated with or without MCs over time.

Methods: Primary human gingival fibroblasts were seeded at high density and cultured for up to 14 days in three conditions: A) traditional, non-macromolecular crowded culture in DMEM containing 10% FBS and 50 mg/mL of ascorbic acid; B) as in A, but the medium was supplemented with MCs (Ficoll 70/400); and C) as in B, but medium was supplemented with 2% FBS. To study cell phenotype and function, we assessed cell morphology (brightfield microscopy), cell proliferation (image analysis and total RNA quantification), protein accumulation (Bradford assay), localization (immunofluorescence staining), and gene expression (RT-qPCR). Experiments were repeated a minimum of three times and statistical testing was performed using one-way ANOVA.

Results: MCs induced changes in cell morphology, reduced proliferation, and cell and matrix protein abundance significantly over time. MCs also modulated organization of type I collagen in the ECM and significantly altered the expression of 4 out of 26 wound healing-related genes studied.

Conclusions: MCs modulate gingival fibroblast functions and ECM deposition *in vitro*, suggesting that they can be used to generate improved *in vivo*-like three-dimensional fibroblast cultures. These could be used to study the regulation of fibroblast phenotype and function by the ECM niche in contexts relevant to human development, wound healing, and diseases.

21. Space Maintenance Treatment Planning for Pediatric Patients

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Objectives: The purpose of this study was to examine and explore differences in treatment planning for space maintenance between pediatric and general dentists. It also examines factors that are associated with treatment planning made by general dentists.

Methods: Two online self-administered electronic questionnaires were developed and administered by the UBC Qualtrics Survey software. One was a 32-item questionnaire that was administered to 1640 general dentists, and the other was a 31-item questionnaire that was administered to 41 pediatric dentists registered with the College of Dental Surgeons of British Columbia. The questionnaires consisted of three case scenarios regarding space management in pediatric patients. The assessments on space maintenance treatment planning were based on the following cases: 1) extraction of tooth #7.4 in primary dentition; 2) extraction of tooth #7.5 in primary dentition; and 3) premature loss of tooth #7.3 in mixed dentition. The survey assessed the practitioners' demographic information, knowledge, attitudes, and practices towards space maintenance for each of the specific cases.

Results: The response rate from general dentists was 20.3% (n=320), while from the pediatric dentists it was 56.1% (n=23). A majority of general dentists (76.7%, n=244), and all the pediatric dentists (100%, n=23) chose to place a Band-and-Loop appliance after extraction of tooth #7.4. A majority in both groups selected to place a Distal Shoe appliance after extraction of tooth #7.5 (59.2%, n=189 for general dentists and 78.3%, n=18 for pediatric dentists), and both general (59.6%, n= 189) and pediatric (69.6%, n=16) dentists selected that they would consider an orthodontic consultation for the case regarding premature loss of tooth #7.3. Attitudes were the strongest factor associated with differences in treatment planning.

Conclusions: Space maintenance treatment planning is multifactorial in nature. Attitudes towards space management and practice experience were more strongly associated with decision-making.

22. Self-Esteem and the Self-Perception of Malocclusion

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Objectives: This study examined whether relationships exist among self-esteem, self-perception of malocclusion, and motivation to seek orthodontic treatment.

Methods: 49 patients were recruited through the Graduate Orthodontics Clinic at UBC's Faculty of Dentistry. An online survey inquired about their self-esteem, motivation to seek orthodontic treatment, and self-perceived esthetics of the malocclusion. Objective severity of the malocclusion was assessed by a calibrated examiner. Subjectively and objectively measured malocclusion were compared and subsequently related to patient self-esteem and their motivation to seek orthodontic treatment. Self-esteem was measured by the Rosenberg Self-Esteem Scale; self-perception of malocclusion through the aesthetic component of the Index of Orthodontic Treatment need (IOTN-AC); and the objective malocclusion severity by the IOTN-AC, IOTN-DHC (Dental Health Component), and Index of Complexity and Orthodontic Need (ICON). Patients indicated their motivation for treatment on a scale of 1-100%.

Results: Self-esteem did not differ significantly with age or gender. Motivation to seek treatment did not differ significantly between males or among different age groups, but a non-significant trend of increased motivation in the older participants was observed. There were no significant differences between the subjectively and objectively measured IOTN-AC scores. Lower and higher self-esteem was not significantly associated with different severities of self-perceived or objectively determined malocclusions (IOTN-AC objective and subjective, IOTN-DHC, ICON). Self-esteem was not significantly different among participants with different motivations to seek orthodontic treatment. Findings using three different objective measures of malocclusion (IOTN-AC, ICON, IOTN-DHC) were significantly associated. Higher and lower self-esteem were not related to underestimation or overestimation of malocclusion severity.

Conclusions: Self-esteem was not related to a bias in self-perception of malocclusion severity. The ability to match the self-perception of malocclusion severity to the objectively determined severity of malocclusion did not vary predictably with self-esteem. Motivation to seek treatment was not related to self-esteem or the severity of the malocclusion.

23. Periodontitis Associated with Sugar Consumption in a Representative Canadian Population

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Objectives: The objective of this study was to evaluate the association between sugar consumption and periodontal disease among a representative sample from the Canadian Health Measures Survey (CHMS). The study hypothesis was that those individuals with high consumption of sugary beverages would be more likely to have periodontal disease.

Methods: Data from a subsample of the CHMS cycle 1, 2007-09, was used by including those between the ages of 20 and 79. Means and standard deviations via descriptive statistics were used. Parameters for simple regression modelling were: blood pressure, weight, oral health status, and interviews that revealed dietary habits, habits related to smoking and alcohol consumption, current health status, lifestyle and physical activity, and socioeconomic variables. Statistical significance was set at $p < 0.05$, using Stata® statistical software.

Results: A total of 2278 individuals had periodontitis and 221 of them were also diabetics. Those with diabetes were more likely to have periodontitis than non-diabetic populations (OR = 1.32, $p = 0.046$). Preliminary analysis has shown an inversed and unlikely correlation between high-sugar beverage consumption and diabetes, and between high-sugar beverage consumption and periodontitis, which disproved the study hypothesis.

Conclusions: The correlation between diabetes and periodontal disease confirms the existing literature. The preliminary analysis of CHMS data suggesting an inverse correlation between high-sugar beverage consumption and diabetes and periodontitis needs further investigation.

24. Effect of Curvature Location on Fatigue Resistance of Reciprocating Files

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Objectives: Nickel-titanium rotary files are susceptible to cyclic fatigue fracture when used in curved canals. The cyclic fatigue resistance (CFR) of new heat-treated reciprocating files has yet to be studied. The aim of this study was to determine whether the CFR of WaveOne (WO), WaveOne Gold (WOG), Reciproc (RE), and Reciproc Blue (REB) is affected by the location of the canal's curvature. The phase transformation behaviour of the files was also assessed.

Methods: The reciprocating files were subjected to CFR testing in five artificial canals with a 60º angle of curvature and 3 mm radius of curvature. The location of curvature was unique for each canal. Each file was inserted 16 mm into the canal and operated until fracture occurred. The time to fracture and the length of the fractured fragment was recorded. The surface of the fractured fragment was evaluated with scanning electron microscopy. Differential scanning calorimetry was used to characterize the file's thermal behaviour.

Results: Reciprocating files have significantly decreased CFR in canals with coronal curvatures compared to those with apical curvatures ($p < 0.05$). Compared to WO and RE, WOG and REB have significantly superior CFR in canals with apically located curvatures ($p < 0.05$). There were no significant differences in CFR between any of the reciprocating files in canals with coronally located curvatures ($p > 0.05$). There were no significant differences in fragment length between the file systems ($p > 0.05$). Surface characterization of the fractured fragments showed typical patterns of cyclic fatigue failure. When heated, WO, WOG, and RE underwent a one-stage phase transformation, while REB underwent a two-stage phase transformation.

Conclusion: The risk of fatigue failure of reciprocating files is higher in coronally located curvatures than apically located curvatures. WOG and REB had superior CFR than WO and RE when the canal curvature was in the apical third.

25. Using Community-Based Participatory Design to Improve Indian Children's Oral Health

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Objectives: Health screenings at Spiti Valley boarding schools, located in a remote high-altitude region of the Indian Himalayas, have shown a high incidence of pediatric dental caries over the past several years. The aim of this year's project was to assess the current oral health status of students, identify barriers to good oral health, and devise community generated, self-sustaining solutions to improve oral health among students.

Methods: Oral health screenings were performed on 561 students (Kindergarten to Grade 10), attending the Spiti Valley boarding schools of Munsel-ling and Rongtong, to assess the incidence of dental caries, dental pain, and oral self-care behaviours among students. Student surveys were conducted to assess students' diet, their perceptions of oral health, and to identify barriers to good oral health.

Results: Oral health screen data showed that 92% of the students had one or more dental caries, 46% had dental pain, and only 10% were brushing their teeth at least once a day. Student surveys revealed that oral hygiene educational programs over the past years have improved students' knowledge. However, behavioural change has been slow due to i) easy access to cariogenic foods, ii) lack of access to toothbrush/paste, and iii) lack of storage system for toothbrushes/paste. Furthermore, the survey results showed that prior years' interventions were difficult to maintain due to inconsistent guardian (parents/school staff) accountability to encourage toothbrushing practice and storage maintenance, especially for younger children, as well as difficulty seeking healthier food alternatives within the school budget.

Conclusion: Dental caries is an irreversible disease process. Long-term improvements in brushing frequency and diet modification are needed to alleviate the high burden of dental caries among students. Identifying the school's own priorities and expectations are useful in deriving relevant oral health goals. These changes will require continual community involvement in establishing and maintaining school-wide policies and programs.

26. Effects of Gingival Fibroblast Secretome on Skin Fibroblast Gene Expression

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Objectives: Oral mucosal wounds heal faster and generate substantially less scarring than in skin. Preliminary data suggests that when gingival fibroblasts (GFBLs) are placed in scar-forming skin wounds, they modulate extracellular matrix composition and skin fibroblast (SFBL) phenotype, leading to augmented healing with diminished scarring. We hypothesized that the GFBL secretome contributes to these responses. The objective of this study was to investigate changes in human SFBL gene expression when stimulated with GFBL secretome-enriched conditioned media (CM).

Methods: Four parallel primary strains of human GFBLs and SFBLs from different donors were allowed to form an *in vivo*-like three-dimensional culture over 6 days, and then incubated in serum-free DMEM for 3 days. The media were then collected and pooled to generate GFBL-CM and SFBL-CM. Next, confluent GFBLs and SFBL were cultured in GFBL-CM (test-CM), SFBL-CM (control-CM), or DMEM only (baseline) for 48 hours before RNA collection. The expression in 18 genes, associated with wound healing, scar formation, and extracellular matrix (ECM) remodelling, was determined using RT-qPCR. The experiment was repeated 3 times and statistical analyses were performed by one-way/two-way ANOVA with multiple comparisons.

Results: Compared to DMEM, GFBL-CM induced significant upregulation in 7 genes in SFBLs ($p < 0.05$; n=4 cell strains), including genes associated with ECM remodelling and wound healing (e.g. MMPs, TNC). Downregulation was observed in 5 genes, including COLA1 and ASMA, both associated with scar formation. Compared to SFBLs treated with their own CM (SFBL-CM), GFBL-CM treatment led to upregulation in 7 genes, including those for TGF-β signaling and MMPs. Levels of ASMA were further reduced.

Conclusions: SFBLs treated with GFBL-CM exhibit gene expression changes consistent with elevated ECM remodelling and diminished scar formation, suggesting that GFBL secretome may favourably modulate skin wound healing. Further experiments are required to identify signalling molecules within the GFBL secretome associated with these responses.

27. Apical Vapor Lock Effect in Conservative NiTi Instrumentation

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Objectives: The presence of apical vapor lock during irrigation has been shown to have a negative impact on debris and smear layer removal. The aim of this study was first, to compare apical vapor lock formation during positive pressure syringe irrigation following conventional, ProTaper Gold and conservative, V-taper nickel titanium instrumentation. The second aim was to evaluate the effectiveness of apical vapor lock elimination by sonic, ultrasonic, and manual dynamic agitation, once established.

Methods: Thirty-six single rooted teeth were instrumented with either ProTaper Gold F2 (25/0.08) or V-taper (25/0.06). In the first part of the study, incidence of apical vapor lock formation was evaluated radiographically following irrigation with sodium hypochlorite and cesium chloride (contrast agent). In the second part, apical vapor lock elimination was evaluated using manual dynamic agitation with 50 strokes of a well-fitting gutta-percha cone. Sonic agitation was performed with the EndoActivator, while ultrasonic agitation was carried out using a piezoelectric unit and a ISO size 15 U-File.

Results: Following positive pressure irrigation, apical vapor lock was detected radiographically in 75.0% of total cases, specifically 72.2% and 77.8% of samples instrumented with V-taper and ProTaper Gold, respectively. Manual dynamic agitation eliminated apical vapor lock in 92% of samples, this was significantly more effective when compared to sonic and ultrasonic agitation.

Conclusion: Incidence of apical vapor lock were equally detected in conservative and conventional instrumentation using V-taper and ProTaper Gold, respectively. Manual dynamic agitation was effective at eliminating apical vapor lock.

28. 3D Facial Morphology and Risk of Sleep-Disordered Breathing in Children

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Objectives: Craniofacial morphology has been recognized as an important factor in OSA pathogenesis and pathophysiology. Stereophotogrammetry eliminates many of the limitations of traditional craniofacial anthropometric methods. The primary aim of this study was to utilize stereophotogrammetry to determine whether associations exist between 3D facial morphometric parameters of children aged 2-17 years, and their risk of sleep-disordered breathing (SDB) as evidenced by their Pediatric Sleep Questionnaire (PSQ) score. The secondary aim was to compare facial morphology of patients at high risk of SDB and those at lower risk.

Methods: 180 patients from the ENT Clinic at BC Children's Hospital were recruited for this cross-sectional study. 3D facial images were acquired using the 3dMD Face system, and linear and angular measurements were calculated. Patients' SDB risk was evaluated using the PSQ. Logistic regression models were used to determine associations between PSQ scores and patient demographic and facial morphometric variables. 3D morphometric analysis was performed to assess for differences in facial morphology in subjects at high risk for SDB (PSQ score ≥0.33) and those at lower risk (PSQ score <0.33).

Results: 33.9% of the patients scored at high risk for SDB. No statistically significant associations were found between PSQ score and any 3D facial morphometric parameter. In addition, PSQ score was not found to be associated with gender, age, or body mass index. 3D morphometric analysis found no difference in facial shape in those at high risk for SDB and those at lower risk.

Conclusions: No linear or angular measurements assessed in this study were found to have a strong correlation with PSQ score. Similarly, age, gender, and BMI were not found to have an effect on PSQ. 3D morphometric analysis found no difference in facial shape in those at high risk and those at lower risk of SDB as evidenced by PSQ.

29. Malignant Risk of Lichenoid Dysplasia Subtypes

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Objectives: The World Health Organization classifies oral lichen planus (OLP) as potentially malignant. It is believed that the malignant transformation of OLP is from lesions with both lichenoid and dysplastic features (lichenoid dysplasia, LD). Two categories of LD, primary lichenoid and secondary dysplasia (L_1D_2) and primary dysplasia and secondary lichenoid (D_1L_2), have been hypothesized. This study aims to determine whether there are two subtypes of LD and if there is a difference in the malignant transformation between the two.

Methods: Patients with a histologically confirmed diagnosis of LD and a minimum of 5 years of follow-up were selected from the Oral Cancer Prediction Longitudinal study. Demographic, risk habit, and clinical information were collected. Progressors progressed to severe dysplasia, carcinoma *in situ*, or squamous cell carcinoma (n=7); non-progressors did not (n=31). Formalin-fixed paraffin-embedded tissue samples were assessed for basal cell and/or basement membrane (BM) degeneration using haematoxylin immunohistochemistry (collagen IV) and computer assisted software analysis. L_1D_2 was defined as LD tissue presenting with basal cell and/or BM degeneration, and D_1L_2 was defined as LD tissue without basal cell and/or BM degeneration (exposure). Statistical analysis was performed using the Independent Samples t-test, Fisher's exact test, and logistic regression analysis.

Results: There were no significant differences in age, gender, smoking history, risk of lesion site, and grade of dysplasia between non-progressors and progressors. Twenty-eight (24 non-progressors (86%), 4 progressors (14%)) subjects presented with basal cell and/or BM degeneration; 10 (7 non-progressors (70%), 3 progressors (30%)) did not. A greater proportion of progressors had intact basal cell and/or BM, but it was not significant (OR 2.571; 95% CI 0.462–14.324; p=0.281).

Conclusions: Based on preliminary data, there are two subtypes of LD with similar malignant risk. Thus, both subtypes should be regarded as potentially malignant.

30. A Qualitative Inquiry on Students' Choice of "Do Not Know"

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Objectives: In a recent large-scale, competency-based Progress Testing dental assessment program, for each question, students had the option to select "do not know" instead of selecting an answer. The objective of this study was to use a qualitative analysis of students' interviews to understand the reasons why they choose "do not know" in different years/stages. This research will provide an implication for faculty members and dental educators to be aware of the role "do not know" plays in Progress Testing and to discuss the culture of certainty and uncertainty in Dentistry.

Methods: This study utilized in-depth interviews with 28 fourth-year DMD students. Each interview lasts for 30 minutes. The qualitative research used Nvivo software for data coding. Students' attitudes towards using "do not know" were analyzed.

Results: The reasons for the students to use "I don't know" options are very different every year. It may relate to their learning conditions, time, personal development, learning outcomes, study plan or other elements. In the first and second year, students usually have the reason that they really do not know the answer. In the third year, students used this option as a tool for distinguishing what they have learned or what they have not learned. Most of the interviewees used it for the purpose of reviewing their learning outcomes and progresses. In their fourth year, the students tried not to use it. They thought that they should know all these answers since they had learned everything.

Conclusions: Recognition of the limits of a health professional's knowledge is an important critical thinking skill. These findings should provide dental educators additional opportunities to rethink the culture of certainty in Dentistry, and how such a culture may influence students' achievement outcomes.