the 70th congress

ORCA 2023 meets EFCD

Organisation for Caries Research &
European Federation for Conservative Dentistry,
Egmond aan Zee, the Netherlands, 5-8 July

Abstracts
70th ORCA meeting

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Dear colleagues and attendees, my dear friends! It is a great pleasure to welcome you to the 70h ORCA Congress in Egmond aan Zee The Netherlands. This year ORCA collaborates with the EFCD to get more professionals involved and meet along the border between Cariology and Operative Dentistry fields. The ORCA program with poster discussions from the wide scope of cariology has been expanded by sessions on Education, Behavioural Sciences, Public Health and Restorative. New are the symposia and workshops hosted each day of the congress, i.e., a symposium on Dental Public Health interventions and symposia to address the for the dentist relevant issues on Cariology and Operative Dentistry: when and how to restore and how to deal with dilemmas in daily dentistry. Furthermore, there will be opportunities for teachers in Cariology and Operative Dentistry to meet and exchange ideas during a special teacher's conference. The congress programme features more than 180 original research presentations from over 30 countries. With warm thanks to all the authors and to the scientific committee members Carolina Ganss (Editor in Chief) and Margherita Fontana (Vice-President of ORCA), who helped to review the presentations, I am extremely happy and proud to present you the ORCA 2023 scientific overview.

Monique van der Veen,
Congress Chair and Co-President of the 70th ORCA Congress, Egmond aan Zee

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Organisation for Caries Research &
European Federation for Conservative Dentistry,
Egmond aan Zee, the Netherlands, 5-8 July

Abstracts

Session 1
Epidemiology

Thursday, July 6 2023, Afternoon

1 Global prevalence of early childhood caries. Systematic review and meta-analysis.

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Introduction: Although preventable, Early Childhood Caries (ECC) remains a global health problem leading to negative impacts on child's development and growth patterns as well as causing oral health–related quality of life issues, such as inadequate nutrition. Despite recent efforts in lowering caries prevalence through various caries prevention programs, the overall trend is still high.

Aim: To systematically review papers on early childhood caries (ECC) at global level published from 2011 to 2022 and its association with socioeconomic indicators (geographical area, unemployment rate, gross national income and income inequalities index).

Methods: Meta-analyses models, using a random effects model with STATA 17® software, were run for both ECC prevalence and experience, stratified by country of publication as well as measures of socioeconomic indicators: geographical area, gross national income (GNI), wealth inequality within a nation index (Gini), unemployment rate. Results: One hundred publications reporting ECC data from 49 countries were included and summarized by meta-analysis. The lowest prevalence was reported in Japan (20.6%) and Greece (19.3%). The global estimated random-effect pooled prevalence of ECC was 59.05%, while the estimated overall pooled caries experience (mean dmft) was 3.41±2.40, ECC prevalence was 22.11%, 14.14%, 15.37%, 20.27% and 28.10% for countries with GNI ≥5.000 USD, ≥5.000≤10.000 USD, ≥10.000≤20.000 USD, ≥20.000≤40.000 USD and ≥40.000 USD respectively. For the four different categories of life expectancy (53-70, ≥70-75, ≥75-80, ≥80), the highest pooled prevalence of ECC was in the age category ≥75-80 (39.41%) and for the unemployment rate, it was in the category of medium unemployment rate (60.38%).

Conclusion: Results from 49 different countries reported a wide range of ECC prevalence. Both ECC prevalence and experience were associated with geographical areas and GNI.

The authors received no specific funding for this work.

2 Caries status in 12-year-old children, health care systems and socio-economic conditions across European Countries. A systematic review and meta-analysis

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A better understanding of socio-economic context might enable more efficient evidence based preventive strategies in oral health. The present study aimed to assess the influence of socio-economic macro-factors on caries status in 12-year-olds. This systematic review involved epidemiological surveys on caries status of 12-year-olds over the past 10 years, in English and other languages. DMFT was calculated and analysed in relation to type of health system, gross national income, unemployment rate and Human Development Index. One-way analysis of variance, Fisher's exact test, and ordinal logistic regression analysis were run (SPSS 26). A meta-analysis was performed for countries that reported data on DMFT, stratified by GNI and health care systems, using a random-effects model (REM) with 95% confidence interval. Total sample involved 23,320 children from 21 countries of the extended European region. The analysis confirmed a strong negative correlation between income and caries experience ($p \leq 0.01$). Children living in an Eastern European country showed a two times higher risk of poor oral health. All Eastern European countries had a higher mean DMFT than the overall mean DMFT=1.18. Country economic indicators and type of health care system strongly affect children's oral health. Therefore favouring upstream approaches in preventive oral health strategies in countries with difficulties in financing oral health systems might be beneficial.

Funded by University of Bern, Bern, Switzerland.

3 Adjustment for school type related selection bias in 12-yr-olds in German National Oral Health Survey

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Objective: To adjust the mean DMFTs in 12-yr-olds for each federal state due to school type related selection bias (known to be correlating with socio-economic status) within the German National Oral Health Survey in Children (GNOHSC) 2016.

Methods: The diverse school types in the 16 German federal states were grouped into Grammar Schools (GS), Other Secondary Schools (OS) and Special Needs Schools (NS). The relative sample sizes of children examined in GS, OS and NS during GNOHSC 2016 did not exactly match the true distribution of schoolchildren attending these school types in the federal states. Therefore, the "raw" total DMFT in each federal state was adjusted by weighing DMFTs in GS, OS and NS with the true regional percentages of pupils attending these school types as published by the Federal statistical office.

Results: In all federal states the DMFT in GS was lower than in OS (~ twofold on mean) and in 14 states the DMFT in NS was higher than in OS (~ twofold on mean). This confirms the strong gradient of oral health according to different socio-economic status in the scholar system in Germany. By weighing raw DMFTs with the true distribution of school types in the federal states, the DMFTs augmented or decreased on a scale of +7.5% to -12.8%. The adjusted national DMFT (0.447) differed only marginally from the raw national DMFT (0.444).

Conclusion: The adjustment method shows that school type related selection bias in GNOHSC 2016 was negligible on the national level, but noticeable in some federal states. In order to provide reliable DMFT estimates in future GNOHSC for all federal states, school type related representative sample sizes should be attained.

The authors are grateful to the regional public health offices (Gesundheitsämter) and thank the Deutsche Arbeitsgemeinschaft für Jugendzahnpflege e.V. (DAJ) for the excellent cooperation in generating the report of the GNOHSC in 2017.

4 Association between tooth brushing frequency and the increment of dental caries and tooth loss in adolescents

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This cohort study assessed the association between tooth brushing frequency and the increment of dental caries and tooth loss in a population-based sample of South Brazilian adolescents in order to investigate whether there is an additional benefit in a third daily brushing. At baseline, a representative sample of 1,528 12-year-old schoolchildren attending 42 schools in Porto Alegre, southern Brazil, were examined for gingivitis and dental caries and answered a questionnaire. At follow-up, 801 schoolchildren were re-examined after a mean period of 2.5 years (standard deviation=0.3), representing 52.4% of the sample initially examined. The primary outcomes of this study were caries increment and tooth loss increment, modelled as count outcomes. The main predictor variable was tooth brushing frequency (≥ 3 times/day vs. 2 times/day or ≤ 1 time/day). Poisson regression models were used to estimate the risk for caries and tooth loss increment. Incidence risk ratios (IRR) and 95% confidence intervals (CI) were estimated. After adjustment for sociodemographic (sex, socioeconomic status, and school type), behavioural (soft drinks consumption) and clinical (gingivitis) variables, brushing teeth twice/day gave 40% greater risk (IRR=1.40; 95%CI=1.02-1.92) for caries increment than ≥3 times/day. Regarding tooth loss increment, adolescents who brushed their teeth twice/day had a 4-fold greater risk (IRR=3.92; 95%CI=1.23-12.49) than those who brushed ≥3 times/day. Sex, school type, and gingivitis was found to act as effect modifiers, with a third daily brushing being advantageous in terms of tooth loss only for girls, for public school attendees, and for those with ≥50% of bleeding sites. In conclusion, this study suggests that adolescents benefit from a third daily tooth brushing. Increasing brushing frequency to 3 times/day may be a suitable strategy to control tooth loss among high-risk adolescents.

Supported by the National Coordination of Post-graduate Education (CAPES), Ministry of Education, Brazil (finance code 001).

5 Early childhood predictors for dental caries in primary teeth: a machine learning approach

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Due to dental caries' complex nature, combining several variables for predicting caries development would be valuable. Machine learning (ML) is a versatile and effective technique that permits to capture nonlinear interactions in data sets. Therefore, we aimed to develop ML algorithms for predicting caries in primary teeth using early childhood predictors collected in a 2-year follow-up cohort study. Children aged 1 to 5 years were examined in 2010, and reassessed in 2012 regarding caries in primary teeth. Demographic, socioeconomic, psychosocial, behavioural, and clinical factors were collected. ML algorithms decision tree, random forest, and extreme gradient boosting (XGBoost) were employed, along with logistic regression. The discrimination and calibration of models were verified in independent sets. From 639 children included at the baseline, we reassessed 467 (73.3%) children in 2012. For all models, the Area Under ROC Curves (AUC) at training and testing was above 0.70 for predicting caries in primary teeth after 2 years of follow-up, with the XGBoost reaching the best performance. The XGBoost model based on SHAP algorithm showed the caries experience as the strongest predictor for caries incidence, with a marginal contribution of other variables (high frequency of sugar consumption and poor parents' perception of their children's oral health). This model reached AUC, accuracy, sensitivity, and specificity values of 0.804, 0.764, 0.721, and 0.795, respectively in the training set (n=326). For the test set (n=141), the same parameters were 0.749, 0.759, 0.678, and 0.817, respectively. In conclusion, the implementation of ML shows potential for predicting caries development in primary teeth after 2 years with a reasonable performance using easy-to-collect predictors from early childhood.

Funded by Union Global Partnership Network (UGPN), FAPESP (grants # 2011/17068-1 and 2019/27593-8) and CNPq.

6 Caries experience of 7-year-old children living in Uzbekistan: an epidemiological study

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The aim of the study was to determine caries prevalence rate, caries experience and significant caries index (SiC) of 7-year-old children in Uzbekistan. Methods. The schools were randomly selected in rural, periurban and urban areas in all 14 regions of Uzbekistan. In total, 6014 children aged 7 years old were examined. Prior to the start of the research project in 2021, seven dentists were trained how to apply the criteria of the World Health Organization (WHO 2013) by a dentist with much experience in caries epidemiology. The examinations of the children took place in the selected schools by using artificial light, dental mirrors and blunt probes. The data were entered into an electronic file and after exclusion of errors, caries prevalence rate, mean dmft and DMFT values and SiC index were calculated by using MS-excel software. Results. The overall prevalence of dental caries was 95.3% (95% CI: 94.5%-96.2%) for deciduous teeth and 17% for permanent teeth (95% CI: 14.9%-20.1%). The mean dmft and DMFT values were 6.51 (SD 3.60) and 0.29 (SD 0.73). The values for dmft-SiC and DMFT-SiC were 10.4 and 0.85. The mean number of carious, missing and filled teeth was as follows: 5.63 (dt), 0.28 (DT), 0.80 (mt), 0.00 (MT), 0.07 (ft) and 0.01 (FT). Conclusion. It can be concluded that prevalence of caries among 7- year-old children living in Uzbekistan according to WHO criteria is «moderate». It is recommended to improve preventive and restorative dental care and implement national dental caries preventive strategies in schools that could decrease dental caries experience in children of Uzbekistan.

The research was funded by unrestricted grant of Borrow Foundation (UK) and supported by the Ministry of Innovative Development of Uzbekistan, Ministry of Healthcare of Uzbekistan.

7 First oral health survey among schoolchildren in Burundi

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Introduction: Oral health is a crucial indicator of overall health, wellbeing, and quality of life. To our knowledge, data on oral health in Burundi are non-existent. The present survey aimed to assess dental health status in Burundian schoolchildren using the DMFT index.

Methods: This cross-sectional study was conducted in the regions of Kayanza, Muyinga, and Kirundo. Data were collected in March 2022 by four calibrated examiners (ICC 0.88, p≤0.01) from 1102 individuals, stratified by age: 551 of 5-6 years (261 males/290 females) and 551 of 12 years (263 males/288 females). Schoolchildren were examined and caries were registered using the dmft/DMFT index. Descriptive statistics, the Cochran-Mantel-Haenszel method and One-way Anova were used to analyse the data.

Results: The overall caries prevalence at 5-6 years was 41.8% and 41.3% at 12 years. Mean dmft score was 1.8±2.9 and mean DMFT score was 1.2±1.9. The missing component contributed 5.5% to the dmft and 0.23% to the DMFT. No statistical difference was found between gender groups for dmft and DMFT (F=0.9, p= 0.56; F=0.89, p= 0.55). Compared to Kayanza area, the subjects living in Muyinga and Kirundo had a lower dmft (OR 0.71, CI 0.52-0.94; OR 0.9, CI 0.63-1.24), whereas DMFT at 12 years was higher in Kirundo (OR 1.12, CI 0.81-1.54) and almost the half in Muyinga (OR 0.51, 95% CI 0.38-1.69).

Conclusions: In Burundi caries affects more than forty percent of schoolchildren. The study showed a complete absence of dental treatments experience. A wide variation was found across national geographical areas. Areas for future research to developing oral disease prevention and management strategies are needed.

The authors received no specific funding for this work.

8 defs/DMFS improvements in the Public Dental Health Service for Children/ Adolescents in Denmark during 1972-2022

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Background: The Danish Parliament decided by law, in 1971, that the municipalities should introduce free of charge and outreaching dental care service for schoolchildren in Denmark (PDHSD). From 1972, the PDHSD gradually included 1st grades pupils all over the country, eventually all 7-16-yr olds were part of PDHSD in 1982. During the 1980's pre-school children and 16-18-yr-olds were also gradually included into the service.

Aim: To illustrate the improvements in defs/DMFS in children/adolescents achieved from 1972-2022, and to indicate which initiatives are most likely to have had an impact on the development.

Material and Methods: On optical character recognition forms (OCR) the dentists recorded d3efs/D3MFS and other dental diseases/conditions. The OCR-forms, were read into the computers, and data was transferred back to the municipalities, each year.

Results: Greatly speaking national defs/DMFS figures were provided annually of 7-and 15-yrs-olds. Mean defs/DMFS on 7-yr-olds in 1972/73 was 12.5/2.8, dropping to 4.5/0.17 in 1992, and to 1.8/0.08 in 2022. On 15-yr-olds the mean DMFS in 1981/82 was 13.7, dropping to 4.4 in 1992 and to 1.0 in 2022. Establishment of the PDHSD, use of fluorides vehicles, fissure sealants, changed views on when filling therapy should be carried out, caries research progress showing that active lesions can be arrested by mechanical plaque disturbances and caries-risk related programs according to individual needs, e.g. the Nexö-method, each and in combination has had an marked effect on the caries reduction achieved. These statements can be documented by clinical studies done with the use of samples from PDHSD.

Conclusion: PDHSD has during 50 years managed to reduce the defs/DMFS of children and adolescents from being extremely high to extremely low.

The authors received no specific funding for this work.

9 Validation of the Turkish child oral health impact profile-short form (COHIP-SF 19) in children with molar-incisor hypomineralisation

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This study aimed to cross-culturally adapt Child Oral Health Impact Profile-Short Form 19 (COHIP-SF 19) to Turkish and to test its validity and reliability in children with Molar Incisor Hypomineralisation (MIH). The Turkish version of the COHIP-SF 19 was developed with a forward-backward translation method. Psychometric properties of the scale were evaluated through the floor and ceiling effects, construct validity (convergent and discriminant validity), internal consistency, and test-retest reliability among 8-15 aged 295 children with MIH.

Results from construct validity analyses showed that lower COHIP-SF 19 scores were found for children with self-perceived poor (or fair) general health and oral health ($p \leq 0.0001$) and dental treatment need ($p \leq 0.0001$) and positive rank correlations between COHIP-SF 19 overall and sub-dimensions scores and children's satisfaction with their oral health and appearance related to oral cavity ($p \leq 0.0001$). The internal consistency was good for the overall COHIP-SF 19 score with a Cronbach's alpha of 0.823. The test-retest reliability was excellent with the 0.959 ICC. In conclusion, the Turkish version of COHIP-SF 19 is a valid and reliable measurement tool to evaluate children with MIH's oral health-related quality of life.

The authors received no specific funding for this work.

10 Progression of dental caries to severe stages in the primary dentition: a 7-year cohort study

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The aim of this study was to evaluate the risk of sound surfaces and initial/moderate dental caries lesions progressing to severe stages (cavitated dentine lesions, restorations, and loss due to dental caries) during a 7-year follow-up. This prospective cohort with 7 years of follow-up was conducted in southern Brazil. In 2010, 639 pre-schoolers were randomly selected and evaluated. In 2017, 449 schoolchildren were reassessed (70.3% cohort retention rate). Dental caries was collected using the International Caries Detection and Assessment System (ICDAS) index in both assessments. Clinical factors related to dental surfaces and subjects' demographic variables were collected at baseline. Multilevel Poisson regression analysis was used to estimate the risk of progression of surfaces scores 0-4 at baseline for cavitated dentine lesions (scores 5-6), restorations, or losses due to dental caries. Relative Risks (RR) and their respective 95% confidence intervals (95%CI) were calculated. In total, 8.9% of the re-evaluated surfaces presented progression to cavitated dentine lesions. It was observed that the progression was greater ($p \leq 0.05$) among lesions scores 3 (RR 5.0; 95%CI 3.5–7.1) and 4 (RR 4.9; 95%CI 3.4–7.1) when compared to lesions scores 1 (RR 3.1; 95%CI 2.3–4.2) and 2 (RR 2.8; 95%CI 2.3–3.4). Sound surfaces (RR 6.1; 95%CI 3.8–10.1) and initial carious lesions (RR 2.8; 95%CI 1.9–4.2) in children with a prior history of moderate or severe lesions had a significantly higher risk of progression ($p \leq 0.001$). In conclusion, sound surfaces and initial carious lesions showed a slower progression to dentinal cavitation, restoration, or tooth loss due to dental caries when compared to moderate lesions. However, this risk becomes higher when the individual had at least one moderate or severe lesion at baseline.

Funded by The Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq – process 160258/2020-0) and Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP (grant No. 2019/27593-8).

11 Caries experience of second permanent molars among 11-15-year-old children in Greifswald: a cross-sectional analysis

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Aim: To determine the prevalence of caries experience of second permanent molars (SPM) and analyse potential risk factors among 11-15 years-old children attending schools in the city of Greifswald, Germany.

Materials and Methods: caries experience (DMFT) and initial caries (IDMFT) of the SPM were collected during compulsory school examinations in the school year 2020/2022. Besides descriptive statistics and bivariate correlation analyses, the association of caries experience of SPM and adjacent first permanent molar (FPM) was analysed in multilevel (tooth, child, school, examination wave) regression models while adjusting for age, sex, and school type. Ethical approval (Reg. No.: BB48/10a/Greifswald University).

Results: In total, 2184 children (mean age: 13.3±1.3 years; 49% female) with 7583 SPM were included in this study. Regarding DMFT in SPM, a prevalence of 2.3% (n=172) was observed. When initial lesions were included, caries prevalence increased to 13.8% (IDMFT; n=1043). DMFT and IDMFT for SPM were both significantly correlated with age ($p \leq 0.05$), but not with sex. Regarding school type, children from special schools exhibited higher DMFT and IDMFT for the SPM compared with children from other schools (DMFT: 6.2% vs. 1.9%; IDMFT: 26.8% vs. 12.5%; $p \leq 0.001$). Interestingly, DMFT or IDMFT on a FPM was strongly associated with DMFT or IDMFT on the adjacent SPM, independent of age, sex and school type (ORDMFT=12.0, 95% CI: 7.1-20.4; ORIDMFT=10.6, 95% CI: 7.4-15.2).

Conclusion: Caries experience of SPM significantly increases with age. The outstanding association between caries experience on the first and second permanent molar highlights the shared aetiology, proximity, and a comprehensive, persisting set of common risk factors. Therefore, prevention strategies should also be considered essential during teenage years after complete eruption of SPM.

This study has been supported by the Department of Preventive and Pediatric Dentistry, University Medicine Greifswald, Greifswald, Germany.

12 Caries Prevalence on young first and second permanent molars: a cross-sectional study in Greifswald

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Introduction: Poor oral hygiene in children and adolescents may lead to a rapid increase of caries experience, especially on young permanent teeth during the first 4 to 5 years after eruption, when they are not on the same occlusal level as the adjacent teeth.

Aim: To analyse the prevalence of caries experience (DMFT) of first and second permanent molars (FPM/SPM) in different age strata starting from eruption (6-year-olds for FPM and 11-year-olds for SPM) up to 4 years afterwards (10-year-olds for FPM and 15-year-olds for SPM).

Methods: Cross-sectional data was collected as part of the compulsory dental school examinations in the area of Greifswald, Germany (ethical approval: reg. no.BB48/10a/Greifswald University). For analysis, proportions of erupted FPM with DMFT (DMFTFPM) were calculated for 6-/7-/8-/9-/10-year-olds and analogously proportions of erupted SPM with DMFT (DMFTSPM) for 11-/12-/13-/14-/15-year-olds. The association of DMFT and age was evaluated via Chi2-tests.

Results: Between 2019 and 2022, 6-10-year-olds (n=2691, 48.2% females, 10001 FPMs) and 11-15-year-olds (n=2700, 48% females, 7596 SPMs) were examined. Observed prevalence of DMFTFPM was 1.4% for 6y, 2.0% for 7y, 2.4% for 8y, 3.6% for 9y and 3.1% for 10y. Similarly, prevalence of DMFTSPM was 1.5% for 11y, 1.4% for 12y, 1.9% for 13y, 2.8% for 14y and 2.9% for 15y. Both, DMFTFPM and DMFTSPM were significantly correlated with age ($p \leq 0.05$) and exhibited a parallel increase of prevalence over the first 5 years after eruption.

Conclusion: While classical prevention strategies for permanent teeth mainly focus on FPM, our results show a similar caries experience for SPM during the first years after eruption. Therefore, comprehensive prevention strategies should also be considered essential during teenage years after eruption of SPM.

This study has been supported by the Paediatric Dentistry Department of Greifswald University, Germany.

13 Fissure sealing and caries experience in German Special Olympics Athletes between the years 2008-2018

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Aim: In a cross-sectional study on a small cohort of young adults with intellectual disabilities in Germany, it was observed that persons with a fissure sealing (FS) had a significantly lower caries experience than those without an FS (Schmidt et al. 2021). This association between FS and caries experience was to be examined in a larger cohort of young adults with intellectual disability, consisting of athletes who participated in the Special Olympics Germany (SOG) Games between 2008-2018.

Methods: During four National SOG Summer Games (2008, 2012, 2016, 2018), athletes were examined by trained dentists on a voluntary basis as part of the Special Smiles® program. By using artificial light and a dental mirror, the DMFT-index was determined according to the WHO-recommendations as well as the presence of FS on the premolars and permanent molars. It made no difference whether the FS were complete or not. These data were analysed subsequently by using MS Excel 2016 and SPSS 26 (Mann-Whitney-U-Test).

Results: Overall, 1517 SOG-Athletes aged between 18 and 34 years received dental examinations. Their mean age was 24.9 years (SD±4.9). Out of them, 37.6% (n=570) had at least one FS (SOG-A_FS≥0). The mean DMFT-value for group SOG-A_FS≥0 was 2.85 (95%CI: [2.57-3.14]) and for athletes without fissure sealants (SOG-A_FS=0) it was 6.40 (95%CI: [6.02-6.78]). This difference was statistically significant ($p \leq 0.001$). In addition, the corresponding caries prevalence rate in the group "SOG-A_FS≥0" (65.6%) was lower than in the group "SOG-A_FS=0" (81.9%).

Conclusion: The present study confirms the finding that fissure sealing is not only an important tool for caries prevention among children and adolescents in the general population, but also in young adults with intellectual disabilities from Germany.

Funded by the Department of Special Care Dentistry of Witten/Herdecke University and by Special Olympics Germany.

14 Dental caries and tooth wear: observational study among an adult population in France

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The present observational study (Resto Data) aimed to: 1) investigate the prevalence of dental caries (DC) and tooth wear (TW) among an adult population in France and 2) assess the relationship with commonly described risk factors/indicators. 76 investigators included 822 patients from hospital dental clinics and private practices (422 and 400, respectively). DC and TW prevalence were calculated from data coming from standardized clinical examinations. A questionnaire was administrated to collect information about patient's lifestyle (diet, oral health behaviour), medication and diseases. Data analysis was performed to assess the relationships between DC/TW and risk factors/indicators using Python with Jupyter notebook environment; forest of trees was used to prioritize the importance of all features. 48% of the patients had at least one carious lesion (ICDAS 1-6); 38% presented ICDAS 4-6 lesions; DC prevalence decreases with age. 38% had at least one wear lesion (BEWE 1-3); 28% presented BEWE 2 and 3 lesions. TW prevalence increases with age. 85% reported brushing at least twice a day; nevertheless 34% had a plaque index ≥2. In all age groups (18-29 vs 30-59 vs ≥60), patients were more likely to present DC when having dental plaque and being a new patient or at irregular dental attendances. In the same manner, sweet or energy drinks consumption was also an important risk factor/indicator, especially in patients ≤60. Patients aged 30-59 were more likely to present TW when presenting dental malpositions and using an electric toothbrushing. Despite the potential bias of representativeness of the study population, the present survey describing DC and TW prevalence and highlighting the relationship with risk factors/indicators is the first of its kind in France.

The authors received no specific funding for this work.

15 Self-reported oral health in a population of pregnant Portuguese women.

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Aim: Pregnancy is a particularly vulnerable period regarding oral health. The oral hygiene habits of Portuguese pregnant women have been described as ineffective, regardless of the frequency of toothbrushing [Antunes et al. (2001)]. Therefore, this investigation aimed to assess self-reported oral health and hygiene habits in a pregnant population from Portugal and to evaluate maternal risk factors for the caries status of their older children.

Methods: An epidemiological study was performed with a convenience sample of 175 pregnant women in the 3rd trimester of pregnancy. A structured questionnaire was applied to collect self-reported data regarding systemic and oral health, oral hygiene habits, and demographics. Data were analysed using chi-square tests and odds ratios (minimum level of significance of 5%).

Results: Regarding the self-assessment of their oral health before pregnancy, 64.9% (n=103) of women considered their oral health as good or very good and a total of 87.9% (n=152) participants reported brushing their teeth at least twice a day. Despite this, 36.2% (n=63) of the participants reported an extracted tooth due to caries. Although 92.5% (n=160) visited the dentist at least once in the last two years, 19.4% (n=34) of the participants reported only going to the dentist if there was a problem and 55.8% (n=91) had caries during the same period. Mothers with overweight or obesity constituted a risk factor for their older children to develop caries (n=37; OR=4.8 [1.0; 21.8]; p=0.04).

Conclusions: Although the oral hygiene habits of the participants were acceptable, the number of dental visits per year was still inadequate. The recent history of caries was high in our population. Maternal metabolic health may represent a risk factor for dental caries in children.

Maria João Azevedo's PhD fellowship was supported by an FCT scholarship (SFRH/BD/144982/2019). Ana Filipa Ferreira's PhD fellowship was supported by an FCT scholarship (SFRH/BD/138925/2018).

16 Factors associated with missing teeth in the general population of Bialystok, Poland- preliminary report

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Dental caries is one of the main causes of tooth loss, which is a serious public health problem. The aim of this study was to assess factors associated with missing teeth in the Polish population based on the results of the Bialystok Plus study. A total of 1,138 subjects aged 20-79 years (mean 48.8±15.4) were included in the study. Socio-economic variables, medical history, smoking history, dental habits and health and dental status were collected by questionnaire and physical and dental examination. Data were statistically analysed using chi2 and Mann-Whitney U tests, p≤0.05. The subjects were divided into groups with complete dentition and at least one missing tooth; third molars were excluded from the analysis; 760 (66.8%) subjects had at least one missing tooth. The mean number of missing teeth was 5.9±7.8. Age (p≤0.001), education level (p≤0.001), frequency of tooth brushing (p=0.034), BMI (≤0.001), smoking (p=0.011), prevalence of cardiovascular disease (p≤0.001), diabetes (p≤0.001) and cancer (p=0.001) were associated with the risk of missing teeth in the population assessed. Half of the participants (49.2%) with complete dentition had never smoked cigarettes. University degree appeared to be a protective factor against tooth loss, with 74.7% of those with full dentition having a university degree vs. 48.5% of those with missing teeth. One-third (31.6%) of those with full dentition reported having cardiovascular diseases; in the group with missing teeth, cardiovascular diseases were reported by more than two-thirds of participants (69.7%). For diabetes, the percentage was 1.7% vs. 16.4%. Gender and low frequency of dental visits were not risk factors of tooth loss. This study showed that, in the general Polish population, having missing teeth is associated with several socio-demographic, medical and behavioural factors.

Funded by Medical University of Bialystok, Poland

17 Dental caries and periodontal problems among refugees: a scoping review

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Background: The oral health of refugees is among the most neglected aspects of their health. Therefore, this scoping review aimed to comprehensively evaluate currently available prevalence data on oral health diseases, namely dental caries and periodontitis, among refugees and asylum seekers worldwide.

Method: In accordance with PRISMA criteria, the authors searched Scopus, Embase, and PubMed for publications on dental caries and periodontal diseases among refugees published after 2011. Twenty-six studies were included in the review from 1225 records. The risk of bias was evaluated using JBI SUMARI.

Results: Dental caries and tooth loss due to caries were high in refugee populations regardless of their age, gender, or nationality. For the adult population, the overall DMFT means (±SD) obtained in our systematic search was 9.2 (± 2.3); for children, it was 3.1 (±1.1) for deciduous (dmft) and 2.5 (± 1.1) for permanent teeth (DMFT). Dt and dt accounted for the highest proportion of caries in the children and adult populations. Caries prevalence among refugees ranged from 4.6%-98.7%, and gingivitis from 5.7%-100%, indicating a high heterogeneity in refugees' oral health. Regarding oral health accessibility, the percentage of refugees who have never been to a dentist ranged from 17%-72%, showing a very low level of accessibility to dental health services.

Conclusion: Refugees and asylum seekers worldwide face a heavy burden of oral health diseases and limited access to dental services. Interventions and strategies must be developed to reduce inequities in oral health in this population. Further research is required to better comprehend, plan, and implement preventative actions.

The authors received no specific funding for this work.

18 Evaluation of dental caries and oral health behavior in middle-aged and elderly persons living in the community: A pilot study

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The aim of the study was to evaluate oral health of persons aged 45 years and over living in the community. After obtaining informed consent from the participants, who were chosen at random, a clinical examination was performed and data was collected on the presence of dental caries using the International Caries Detection and Assessment System (ICDAS) and on oral hygiene using the Approximal Plaque Index (API). The participants filled out questionnaires on socio-economic status, medical history and oral health behaviour. Logistic regression and multinomial regression models were carried out to investigate the association between dental caries and other factors. One hundred subjects (63% males; mean age: 73 years) were included in the study. 83% brushed their teeth twice daily, 65% visited the dentist and dental hygienist yearly. One-third of the participants had API ≥ 50%. Twenty- five participants presented with coronal carious lesions; sixteen participants with ICDAS 1-3 lesions, nine participants with ICDAS 4-6 lesions. Six participants had root caries classified as ICDAS 2. The mean number of decayed (corresponding to ICDAS 4-6), missing and filled teeth was 0.30, 4.20, and 8.75, respectively; mean DMFT score was 13.35. Dental caries prevalence was 15%. The mean number of root caries lesions was 0.20. Persons who never visited a dental hygienist had higher odds of dental caries (OR 41.99, 95%CI 0.01 - 0.38). The presence of dental caries was statistically significantly associated with rheumatoid arthritis (RR 12.80, 95%CI 1.47 – 111.20). Even though oral hygiene measures are performed and access to dental care is good, high plaque scores and untreated dental caries are still prevalent in the Swiss population.

Funded by the Lütz-Zurrer Stiftung, the Swiss Society of Periodontology, the Sana Foundation and the Nakao Foundation.

19 Characteristic of factors associated with dental caries in Polish adult population- preliminary study

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Untreated dental caries a multifactorial disease affects people around the world and is one of the reasons of tooth loss. The aim of the study was to describe factors associated with untreated dental caries (D) and DMFT index in the population-based study carried out in Bialystok, Poland (Bialystok Plus Study). In this cross-sectional study 1,112 randomly selected respondents aged 20-79 took part. Their mean age was 48.72. Study included questionnaire: age (below/above 65), gender, place of residence, education, professional status, medical history like diabetes mellitus, BMI, hypertension, myocardial infraction and dental examination.

Mann–Whitney U and Kruskal–Wallis test were used to compare dental caries in relation to socio-economic and medical variables, $p \leq 0.05$. Gender ($p<0.001$), age ($p=0.049$), dental treatment needs ($p<0.001$), edentulousness ($p=0.002$), education ($p<0.001$), professional status ($p=0.036$), number of meals ($p=0.033$), smoking ($p<0.001$) were associated with untreated dental caries (D). Gender ($p<0.001$), age ($p<0.001$), mouth dryness ($p<0.001$), edentulousness ($p<0.001$), education ($p<0.001$), professional status ($p<0.001$), diabetes mellitus ($p<0.001$), hypertension ($p<0.001$), myocardial infraction ($p=0.006$), number of teeth ($p<0.001$) were associated with DMFT index.

Our study shows that maintaining good oral health is crucial for general health. Although untreated dental caries was associated only with socioeconomic variables, but DMFT showed association with severe medical conditions like diabetes mellitus, hypertension, and myocardial infraction.

Funded by Medical University of Bialystok, Poland

20 Caries experience among 65-year-olds in Oslo

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There are few epidemiological studies on the caries status of young-elderly. Therefore, the aim of this study was to investigate the caries experience among 65-year-olds in Oslo, Norway. A random sample of 65-year-olds (response rate=58%) answered a questionnaire and underwent clinical and radiographic examinations (n=457, 52% men and 48% women). Coronal primary- and secondary caries lesions, root remnants, and root caries lesions as well as missing and restored teeth were recorded. Decayed teeth (DT) were defined as teeth with coronal- and root caries lesions that had progressed into dentine and root remnants, and DMFT/S scores were calculated. Overall, the mean number of teeth was 25 (SD: 4), the mean number of exposed root surfaces was 25 (SD: 18), and the mean DMFT was 19.4 (SD: 4.7). Thirty-seven percent of the individuals had at least one decayed tooth (DT≥0), and the mean number of filled teeth (FT) was 16.1 (SD: 5.4). The prevalence of coronal enamel and dentine caries was 56% (i.e., individuals with at least one coronal caries lesion), and of root caries 20%. The prevalence of enamel caries was 35%, and the prevalence of the other caries classifications were as follows: primary coronal dentine caries 12%, secondary coronal caries in dentine 33%, root caries without cavitation 17%, and root caries with cavitation 7%. In conclusion, the present findings indicate that the majority of 65-year-old Oslo residents have almost complete dentitions, however few sound teeth due to high treatment experience. Coronal enamel and secondary dentine caries lesions comprised the largest proportion of the total caries burden. Based on the present results, it will be important to increase the emphasis on caries preventive measures and to ensure maintenance of restored teeth in this age group.

We acknowledge funding from the Faculty of Dentistry, UiO.

21 Exploring caries risk indicators among 65-year-olds in Oslo

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As part of an epidemiological study about oral health of the young elderly in Oslo we explored possible associations between dental caries and sociodemographic, behavioural, and biological factors in this population.

A random sample of 65-year-olds in Oslo (n=457, 52% males) answered a questionnaire and underwent clinical and radiographic examinations. All coronal and root caries lesions, root remnants, missing teeth and dental restorations were recorded. Decayed teeth (DT) were defined as teeth with coronal- and root caries lesions that had progressed into dentine and root remnants. The explanatory variables were gender, country of birth, level of education attained, financial capacity, smoking habits, dental visiting pattern, toothbrushing habits, sugar intake, and salivary secretion status.

Thirty-seven percent of the individuals had at least one decayed tooth (DT≥0). Multivariable logistic regression analysis showed that males (OR: 1.8, 95% CI: 1.2-2.8), basic education (OR: 1.9, 95% CI: 1.2-2.9), irregular dental visits (OR: 2.2, 95% CI: 1.0-4.8) and hyposalivation (OR: 2.1, 95% CI: 1.0-4.4), were significant risk indicators for having decayed teeth ($p \leq 0.05$).

Bivariate analyses of individuals with both coronal and root caries lesions (n=58) showed that male gender, non-western country of birth, basic education, limited financial capacity, irregular dental visits, and toothbrushing less than twice daily were associated with the dental caries (Chi-square test, $p \leq 0.05$). In individuals with coronal but not root caries lesions (n=114), the caries was associated with male gender and toothbrushing less than twice daily, while in individuals with only root caries lesions (n=35) this was associated with a higher level of education.

These findings indicated that several sociodemographic, behavioural, and biological factors are risk indicators for having decayed teeth in this young elderly population.

We acknowledge funding from the Faculty of Dentistry, UiO, Oslo.

Session 2
Clinical studies part 1 & Restorative

Thursday, July 6 2023, Afternoon

22 Dental practitioner's treatment choices for replacement of defective restorations

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Non- or minimally-invasive treatment strategies for dental caries are well established for primary lesions. For caries adjoining to sealants and restorations (CARS), no clear guidelines are available, although non-invasive strategies may be applied in clinical practice by means of 'clinical judgement'. In the present study, treatment options for CARS and marginal defects by general dental practitioners (GDP) were compared to the choice of a clinical reference standard in a series of 'paper cases'.

Methods: a senior clinician selected 22 cases, clinical and simulated in extracted teeth, documented with photographs and radiographs, encompassing sound restored teeth, restorations presenting marginal defects and recurrent caries. Via an online survey, the cases were presented to 38 GDP (19 mainly younger Dutch-speaking and 19 somewhat older French-speaking) and 9 4th year students. They could choose from six options in order of increasing invasiveness: 1-no action, 2- follow-up, 3- follow-up with targeted preventive measures, 4- refurbish/reseal, 5- repair and 6- replacement of the whole restoration.

Inter-rater agreement and difference with respect to the senior clinician's opinion were calculated and further graphed and analysed statistically (ICC, kappa, Bland-Altman Plots).

Treatment choices varied widely per case with the exception of cases with clear dentinal involvement. ICC varied between 0.092 (students) and 0.144 (older GDP). Agreement was poor between all participants and senior clinician (kappa 0.134 in the student group, 0.219 and 0.272 in both GDP groups). There was no difference between the groups of practitioners and/or students (Kruskal-Wallis test, $p \geq 0.05$) regarding difference between decision and reference.

Conclusion: Practitioners disagree about treatment choices for caries or defects on the tooth-restoration interface. Students were not less invasive in their decisions than practitioners, showing that guidelines lack in clinical teaching and practice.

The authors received no specific funding for this work.

23 Attitude towards the deep treatment of caries. Survey on a clinical case

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The Aim was to study the criteria of action against the treatment of deep caries of Spanish dentists and analyze if there are significant differences depending on the years of professional practice (YPP). This work has the approval of the Ethics Committee. An anonymous survey has been carried out, sent through a link. The first five questions focus on the data of the respondents and the remaining five ask about the attitude towards a clinical case of a 25-year-old patient with deep cavitated caries in 4.7. Statistical analysis with chi-squared test was done; 347 valid answers have been obtained. 9.5% have ≤5 YPP, 23% have 5-10 YPP, 40.6% have 15-30 YPP and 26.8% have ≥30 YPP. 93.9% of the respondents state that they apply concepts of minimal intervention and 90.4%, performing conservative dentistry treatments on a daily basis. 66.8% indicate the treatment based on clinical symptoms (p=0.18). 54.1% would perform definitive filling with specific pulp protection, p=0.19; 66.2% used contra-angle rotary material with a round bur for dentine removal with refrigeration and a manual excavator (p=0.160), using chemical methods for caries detection in 48.1% compared to 48.7% who did not use them (p=0.363). Using 38.9% Biodentine as a pulp protector ($p < 0.0001$). About the adhesive technique 61.6% use self-etching adhesive with selective etching (p=0.246) and 56.4% performing the final filling with conventional composite (p=0.870). With the limitations of this study, we conclude that up to 30 YPP the material of choice as a pulp protector is Biodentine, but after 30 YPP calcium hydroxide is preferred, with significant differences. The adhesive technique is self-etching with selective etching, although a decreasing trend is observed as the YPP increases.

The authors received no specific funding for this work.

24 Can marginal defects predict restorations' failure? A nested cohort study

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The aim of this cohort study nested in an RCT was to investigate marginal defects as predictable variables in dental restorations' failure. The restorations were randomly allocated to one of two visual criteria for restorations' assessment: a) FDI criteria – International Dental Federation (marginal adaptation, marginal staining, and recurrence of caries) and b) CARS criteria - Caries Associated with Restorations or Sealants). All restorations were examined by both criteria, but the final treatment decision followed the randomized criteria indication. Descriptive analysis and cox regression were performed. A total of 727 restorations were included from 185 patients. After the follow-up varying from 6 to 71 months (mean of 41.3 months), 502 (69.1%) restorations were reassessed, and 62 (12.3%) failed. Univariate cox regression showed higher CARS codes (HR 1.25, CI 1.094-1.449, p<0.001), FDI adaptation (HR 1.84, CI 1.451-2.349, p<0.001), and caries recurrence (HR 1.32, CI 1.103-1.596, p=0.002) scores as risk factors for restoration failure. FDI staining was not a risk factor for composite restoration failures (HR 0.95, CI 0.838-1.095, p=0.53). In the multivariate analysis considering just composites, only FDI marginal adaptation (HR 1.72, CI 1.293-2.292, p<0,001) was a risk factor for restoration failures. The same was observed for all restorations, with FDI marginal adaptation (HR 1.72, CI 1.294-2.295, p=0.001) presented as a risk factor. In conclusion, marginal staining is not a predictor of restoration failure in the long term, while major marginal adaptation defects are strongly associated as a risk factor. Dentists should consider plaque retention factors, such as large marginal defects and caries lesions in dentine, rather than staining or minor marginal adaptation problems.

Funded in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001 (Proc. # 88882.346909/2019-01), and by the CNPq (National Council for Scientific and Technological Development) (productivity scholarship: Proc. # 310340/2017-9).

25 Prospective randomised split-mouth study investigating class-II-restorations with novel self-adhesive-bulk-fill and conventional bulk-fill-composites: 4-year results

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AIM: Clinical performance evaluation of a novel, tooth-coloured, self-adhesive bulk-fill material (SABF, 3M) in comparison with a conventional bulk-fill composite (Filtek One, 3M; FOBF) for class-II-restorations. The null-hypothesis was that both materials perform equally in terms of survival and FDI-criteria. METHODS: In this prospective, randomized split-mouth study, 30 patients received one SABF and one FOBF posterior restoration. Before FOBF-application, a universal adhesive (Scotchbond Universal, 3M) was applied (self-etch-mode). SABF was applied without adhesive. The restorations were evaluated by two calibrated, blinded examiners using FDI-criteria at baseline (BL) and 48 months. Nonparametric statistical analyses, $\chi 2$-tests ($\alpha=0.05$), error rates method, and survival-analyses were performed. RESULTS: Twenty-six from initially 30 patients were available with at least one restoration under risk at 48-months. Survival was 96% for SABF (one restoration: secondary caries) and 92% for FOBF (one restoration: secondary caries, one restoration: fracture). All other restorations showed clinically acceptable (1-excellent, 2-good, 3-satisfactory) FDI-ratings for all criteria and time points. Error rates method revealed significantly better aesthetic properties for FOBF compared to SABF, but no significant differences in functional and biological properties. FOBF performed significantly better regarding surface lustre (A1, $p<0.001$), surface staining (A2a, $p<0.01$), and colour match/translucency (A3, $p<0.001$). Over time, surface lustre (A1, $p<0.01$), surface staining (A2a, $p<0.05$), marginal discoloration (A2b, $p<0.001$), and marginal adaptation (B6, $p\leq0.001$) deteriorated significantly for both materials. CONCLUSION: The null-hypothesis could not be rejected. Both materials performed similarly regarding survival-rate and FDI-criteria within 48 months of clinical use. SABF exhibited significantly less favourable but clinically acceptable aesthetic properties compared with FOBF. After 4 years, the new self-adhesive bulk-fill restorative material showed clinically satisfactory results and can be recommended for clinical use.

The study was supported by 3M Oral Care.

26 Evaluation of MTA in direct pulp capping treatment of immature permanent teeth: retrospective study

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The aim of this retrospective study was to evaluate the outcome of pulp capping of immature teeth using MTA (Mineral Trioxide Aggregate). Twenty-seven patients aged 6-13 years (15 females and 12 males) with 27 immature permanent teeth were included in the study. Radiographically, root development of all teeth was recorded according to the Cvek root development scale and periapical status according to the Periapical Index (PAI). The pulp capping protocol was performed with MTA and the teeth were restored with the required definitive restorations. These teeth were followed from 12 to 24 months. Direct capping treatment was applied in 20 of the teeth because of caries, in 7 of them because of complicated crown fractures due to trauma. No statistically significant difference was found between baseline and 24 months for PAI scores and external root resorption of the treated teeth ($p=0.266$, $p=0.294$). Cvek root development scores of the teeth were examined on radiographs taken at the start of treatment; Score 3 was found in 5 (18.5%) teeth, Score 4 in 14 (51.9%) teeth, Score 5 in 8 (29.6%) teeth, score 1 and 2 cases were not found. One (4.3%) tooth was found to have a Cvek root development score of 3, 5 (21.7%) were found to have a score of 4 and 17 (72.9%) were found to have a score of 5 on the 24-month radiographs. There was a statistically significant difference between baseline and 24-month follow-up in Cvek root development score from direct pulp capping treatment ($p<0.001$). Direct pulp capping treatment with MTA is used to maintain continuity of apex formation and pulp vitality, and MTA was found to have a high success rate as a direct pulp capping material. MTA appears to be suitable material in immature permanent teeth.

The authors received no specific funding for this work.

27 Shear bond strength of 4 dental adhesives placed following selective fluorescence caries removal in vitro

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Red-fluorescing dentine indicates bacterial infection [Lennon et al.: Caries Res 2002;36:315-319]. Aim was to investigate the effect of selective removal of red-fluorescent dentine-caries on shear-bond-strength and fracture-mode of 4 adhesives. 65 extracted carious permanent teeth and 50 non-carious controls were distributed into 4 groups: ClearfilTM SE (CSE), OptibondTM FL (OFL), ScotchbondTM Universal with (SB+) and without (SB-) etching. Teeth were ground (320 grit) exposing strongly red-fluorescing dentine (StrongFD), on which a composite-cylinder was placed, using one of 4 adhesives. After 22 hours in water at 37°C shear-bond-strength testing and fracture-mode analysis were performed. Then, StrongFD was selectively removed, leaving weakly-fluorescing dentine (WeakFD). Composite-cylinders were placed and tested as described above. Finally, all red-fluorescing dentine was removed, composite-cylinders were placed and tested again. Differences were tested using the Mann–Whitney U test ($p \leq 0.05$). Median (Q1, Q3) shear-bond-strength on StrongFD was: SB- 14.4 (9.2, 18.2) MPa ≥CSE 10.2 (6.4, 17.3) MPa ≥ SB+ 9.1 (6.9, 11.2) MPa ≥OFL 6.8 (4.0, 10.8) MPa. Shear-bond-strength increased statistically significantly for all adhesives on WeakFD ($p \leq 0.001$-$p=0.039$): SB- 19.8(13.6, 24.3) Mpa ≥SB+ 19.5 (12.7, 23.1) MPa ≥CSE 17.5 (12.0, 22.5) MPa ≥OFL 15.8 (11.9, 20.9) MPa. Only SB+ 25.7 (22.4, 29.1) MPa was significantly different ($p \leq 0.001$) on non-fluorescent dentine compared to WeakFD. Caries-free controls were tested at 3 corresponding dentine depths, superficial shear-bond-strength was: OFL 18.7 (16.0, 22.2) MPa ≥SB+ 18.4 (12.0,25.9) MPa ≥CSE 18.1 (12.7,20.7) MPa ≥SB- 13.0 (9.6,17.8) MPa. This was significantly higher ($p \leq 0.001$-$p=0.04$) compared to StrongFD except for SB-. Central shear-bond-strength was not significantly different to WeakFD, deep shear-bond-strength was significantly lower for SB- ($p=0.002$) and CSE ($p=0.013$) but higher for OFL ($p=0.023$) compared to corresponding carious. Adhesive failure was most frequent fracture-mode for CSE and OFL (all depths), for SB+ on StrongFD or WeakFD, for SB- on non-fluorescing dentine and all controls. Superficial StrongFD should be removed for higher shear-bond-strength. The adhesives tested do not require complete caries removal to achieve higher bond strength.

The authors received no specific funding for this work.

28 Effectiveness of polywave LED curing units for postcuring of 3D-printed crown and bridge resin

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This study aimed to evaluate the efficacy of polywave light-emitting diode (LED) curing units for postcuring of 3D-printed crown and bridge resin. A total of 216 disc-shaped specimens were designed and 3D-printed with crown and bridge resin (NextDent©;B MFH). The specimens were postcured using two polywave LED light-curing units with different modes: Group NC, negative control, no postcuring; Group PC, positive control, LC-3D Print Box (30 min); Group V1, VALO Cordless (3200 mW/cm2, 6 s); Group V2, VALO Cordless (1000 mW/cm2, 40 s); Group B1, Bluephase NG4 (2000 mW/cm2, 10 s); Group B2, Bluephase NG4 (1200 mW/cm2, 40 s). The Vickers microhardness was measured on the specimens. The L*a*b* colour and translucency parameters were evaluated before and after 10,000 thermocycles. The MTT assay was performed using the eluents from the postcured resin specimens to evaluate cell viability. Data were statistically analysed using ANOVA and Kruskal Wallis tests (α=0.05). The microhardness values in all LED curing groups ranged from 20.0 (95% CI: [18.5 - 22.3]) to 23.8 (95% CI: [21.7 - 25.4]) Hv and were lower than that in Group PC (26.5 (95% CI: [25.7 - 27.2], $p \leq 0.05$). The L*a*b* colour coordinates in all LED curing groups except Group V1 were different than those in Group PC before thermocycling ($p \leq 0.05$). Translucency parameters did not significantly differ between Group PC and all LED curing groups. Group B2 showed significantly lower cell viability (81%) compared to Group PC and other LED curing groups (83~90%, $p \leq 0.05$). Two polywave LED curing units in two curing modes exhibited dissimilar efficacy in postcuring of 3D crown and bridge resin when compared to a conventional postucuring device in surface hardness, colour parameters, and biocompatibility.

Supported by Grant No-08-2020-0005 from the Seoul National University Dental Hospital; the Korea Medical Device Development Fund Grant funded by the Korean Government (the Ministry of Science and ICT, the Ministry of Trade, Industry and Energy, the Ministry of Health & Welfare, and the Ministry of Food and Drug Safety) (Project Number: 9991006717, KMDF_PR_20200901_0044).

29 Systematic review and network meta-analysis of restorative therapy and adhesive strategies in root caries lesions

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This systematic review and network meta-analysis aimed to identify a clinically relevant performance hierarchy of the different adhesive approaches to restore cavitated root caries lesions. A systematic search was conducted in Medline, Web of Science, Embase, Cochrane Library, Scopus and grey literature. Randomized controlled trials investigating restorative strategies (restorative/adhesive materials) for root caries lesions in adult patients were included (publication year not restricted). The primary outcome was restoration retention at different follow-up times (6-/12-/18-/24-months), while the risk of bias was assessed using the Cochrane_RoB-2 tool. A network meta-analysis was conducted using a random effects model stratified by four follow-up periods. I2-statistics assessed heterogeneity. All available combinations of adhesives (1-SE: one-step self-etch; 2-3ER: two-/three-step etch-and-rinse) and restorative materials (CC: conventional composite) as well as conventional and resin-modified glass ionomer cements (GIC, RMGIC) were included.

547 studies were identified and nine were eligible for the meta-analysis. In total, 1263 root caries lesions have been restored in 473 patients in the included clinical trials. Patients involved were either healthy (n=6 trials), needed care (n=2 trials) or received head-and-neck radiotherapy (n=2 trials). No material or material combination showed significantly higher retention rate than any others (p≥0.05). Only a tendency for a higher risk of restoration loss (24-months) was observed for GIC compared to 1-SE/CC (67.9; 95% CI:[-8.5/144.2]), 2-3ER/CC (66.4; 95% CI:[21.6/111.3]) and RMGIC (49.5; 95% CI:[6.0/93.0]).

According to the network meta-analysis, an evidence-based choice of restorative strategy for managing cavitated root caries lesions is impossible. A tendency towards superiority of RMGIC and adhesively bonded composite compared to GIC could be observed. Yet, there is still a clear need for more standardized and well-designed RCTs evaluating the retention rate of root caries restoration approaches.

We would like to acknowledge the technical support from Ms. Ines Badertscher and Ms. Bernadette Rawyler, co-workers of the Dental Faculty of the University of Bern, for their assistance in preparing the schemas and graphical images of this study.

30 Success rate of Hall Technique for restoring carious primary molars-systematic review and meta-analysis

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This systematic review evaluated the success rate of preformed metal crowns using the Hall Technique (HT) to restore carious primary molars. A systematic search (Medline/PubMed, Embase, Scopus, Web of Science, LIVIVO and ProQuest) was carried out up to January 2023 for studies meeting the eligibility criteria: Randomized Clinical Trials (RCTs) and Non-Randomized Studies of Interventions (NRSIs); children with decayed primary molars treated using the HT; and reporting success for at least 1-month post-treatment. A single-arm meta-analysis assessed the pooled proportion (95% CI) of HT survival rates. Subgroup meta-analysis for risk of bias was also performed using the RStudio Team software. Risk of bias was assessed using RoB 2 for RCTs and ROBINS-I for NRSIs, and certainty of evidence was assessed using the GRADE approach. Searching identified 598 studies, with 24 (13 RCTs and 11 NRSIs) meeting the eligibility criteria and undergoing quantitative analysis. In meta-analyses of RCTs, the pooled proportion of success rate of HT was 99% (95CI: 98-100) in 12 months of follow-up. Low heterogeneity with no statistical significance was verified (I2:25%, p=0.19). For NRSIs, the pooled proportion of success rate for HT was 95% (95CI: 91-100) up to 89 months of follow-up. There was high heterogeneity with statistical significance (I2:97%, p≤0.001). There was no evidence of a difference for risk of bias in the subgroup meta-analyses (RCTs: p=0.186; NRSIs: p=0.210). The overall risk of bias for RCTs ranged from low to concerning, while most NRSIs were low to moderate quality. The certainty of evidence was considered low for RCTs and moderate for NRSIs. Hall Technique has high success rates and is a suitable treatment option for restoring primary molars.

Funded by CNPq and CAPES.

31 Micro-tensile bond strength between 3D printing resin and acrylic provisional resin and fracture toughness of combined with different thickness

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Objectives: The objectives of this study were to compare the micro-tensile bond strength between 3D printing resin with different surface treatments and conventional provisional resin and to compare the fracture toughness when both resins are combined with different thickness.

Materials and Methods: 3D printing resin blocks (RAYDENT©;B) with different surface treatments (Group NT: no surface treatment, Group ML: monomer liquid application for 60 seconds, Group CB: bond of Clearfil SE Bond application) were combined with conventional provisional resin (Tokuso Curefast); 20 beams (1 mm x 1 mm x 10 mm) per group were made and subjected to the micro-tensile bond strength test.

15 specimens (25 mm x 2 mm x 1.5 mm) per group with different composition (Group 1: 1.5 mm thick conventional provisional resin, Group 2: 0.5 mm thick 3D printing resin with 1.0 mm thick conventional provisional resin, Group 3: 1.0 mm thick 3D printing resin with 0.5 mm thick conventional provisional resin, Group 4: 1.5 mm thick 3D printing resin) were made. The 3 point bending test was performed for fracture toughness. The data was analysed using one-way ANOVA, followed by Bonferroni correction test with the significance level of 0.05.

Results: For the mean micro-tensile bond strength, Group ML had significantly higher value than Group NT and Group CB ($p \leq 0.05$). For the mean fracture toughness, Group 3 and Group 4 showed significantly higher values than Group 1 and Group 2 ($p \leq 0.05$).

Conclusion: When provisional crowns made with 3D printing resin are relined by conventional provisional resin, pretreating the inside surface of the crowns with monomer liquid and ensuring the 1 mm thickness of 3D printing resin would be recommended clinically.

Ray supported the experimental specimens of the 3D printing resin.

32 Withdrawn

33 The influence of food pigments on the colour of composite materials

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The aim of the study was visual and spectrophotometric evaluation of the colour change of composite materials exposed to food colouring agents. Three composite materials in A3 colour were used - microhybrid: Arkon (Arkona) and Els (Saremco Dental AG) and nanohybrid: CeramX mono (Dentsply DeTrey). Experimental liquids were: coffee, tea, red wine, orange juice, red beet juice, chlorhexidine and distilled water as control. Samples were tested in solutions for 1 h, 3 h, 24 h and 168 h. The colour was measured with an EasyShade spectrophotometer (VITA) before and after placing them in liquids. The results of the colour analysis were presented in CIE L*a*b* system. Spectrophotometric analysis revealed the following values of L factor: for CeramX mono from 70.7 to 64.0; Arkon from 72.0 to 63.6, Els from 72.7 to 63.6. The analysis of the results with Tukey's test showed significant changes between all samples tested in red wine. The Levene's test revealed that after 1 h and 3 h of incubation results are insignificant, while after 24 h and 168 h statistically significant results appeared ($p=0.018$ and $p=0.008$, respectively.) Mann-Whitney U test showed statistically significant changes of samples tested in red wine ($p<0.001$). For CeramX the mean for coffee was 71.5, tea 69.3, red wine 67.4, orange juice 69.9, red beet juice 70.5. For Els the mean for coffee was 72.4, tea 71.0, red wine 68.3, orange juice 71.8, red beet juice 71.6. For Arkon the mean for coffee was 71.8, tea 70.6, red wine 67.8, orange juice 71.7, red beet juice 71.3. In conclusion, analysis of tested materials and liquids showed that the brightness of samples of all tested composites treated with experimental fluids decreases with the duration of the experiment. The most significant changes are observed after incubating composites in red wine.

The authors received no specific funding for this work.

34 Curing light beam's inhomogeneity affects resin composite's microhardness: effect of thicknesses and shades

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The aim of this study was to evaluate how the light-curing unit (LCU) beam's inhomogeneity affected the microhardness of resin-based composites (RBC) with different thicknesses and shades. Four body shades (A1B, A2B, A3B, A4B), one dentine shade (A3D), and one enamel shade (A3E) of RBC (Filtek Z350) were selected. RBCs were filled into 10-mm Teflon holes of four thicknesses (1, 2, 3, and 4 mm) and irradiated in bulk using LCU for 40 seconds. Microhardness in the center and its 3 mm left, and right points were measured using a Vickers hardness tester. The beam profile of LCU was measured using a Laser Beam Profiler and a CCTV. The irradiance of LCU passing through RBCs was measured with a cosine corrector and spectrometer. 1-way analysis of variance (ANOVA) and Tukey tests (p=.05) were used to analyse the effects of RBC's shades and thicknesses on irradiance and the effect of thicknesses and shades on the RBC's microhardness. Repeated measured 1-way ANOVA with Least Significant Difference (LSD) test was used to analyse the effect of measuring points on the RBC's microhardness (p=.05). Pearson's correlation was used to correlate the irradiance and microhardness at each measuring position (p=.05). The irradiance decreased with increased RBC's thicknesses, shades intensity (p≤.05). The microhardness decreased as RBC's thickness increased (p≤.05). The microhardness decreased from the centre to the periphery. This tendency was more evident in the thick (3- and 4-mm), dark (A3B and A4B), and an opaque shade (A3D) (p≤.05). There was a positive correlation between the irradiance and microhardness in left (r=0.60, p≤.001), center (r=0.54, pP≤.001) and right (r=0.60, p≤.001) measurement point. In conclusion, LCU using inhomogeneous light output have different effects on the RBC depending on the thicknesses and shades.

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government(MSIT) (No. 2022R1F1A1063262).

35 The effect of Er, Cr- YSGG laser caries removal on the bond strength of a universal adhesive to dentine

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AIM: Aim of this study was to evaluate the effect of Er,Cr-YSGG caries removal on the microtensile bond strength (µTBS) of a universal adhesive to dentine.

MATERIAL AND METHOD: In present study 8 extracted human molars (6 with occlusal dentine caries and 2 without caries) were used. Coronal caries lesions in teeth were removed conventionally with burs or using the Er,Cr-YSGG laser (Waterlase MD, Biolase Technology Inc, Irvine, CA, USA) until a hard dentine layer was reached. A universal adhesive system (G-Premio Bond,GC Europe N.V., Leuven, Belgium) was applied to the entire tooth surface. Resin composite (Charisma Smart) was built up to the adhesive treated dentine surface. For µtbs analyses, sticks with a thickness of 1x1 mm (± 0.2 mm) were obtained from the samples. Three teeth were used for each caries removal method. Sticks (n=10) of caries-affected dentine were obtained just above the discoloured affected dentine. Sticks from caries-free extracted teeth were used to evaluate the µTBS of sound dentine. Prepared sticks were subjected to tension at a head speed of 1 mm/min in a universal test device for µTBS test. Data were analysed with One-way ANOVA and Tukey HSD post-hoc tests.

RESULTS: Sound dentine had significantly higher bond strength results (36.7±5.9 MPa) than the other groups (24.3±6.5 MPa for Er,Cr-YSGG group, 22.6±6.0 MPa for bur rounded group) ($p \leq 0.05$). There was no statistical difference between rounded burs and Er,Cr:YSGG groups ($p \geq 0.05$).

CONCLUSION: The Er,Cr:YSGG laser caries removal did not effect on the bonding performance of the tested universal adhesive to dentine affected by caries, and could be used as an alternative to burs for caries removal.

The authors received no specific funding for this work.

36 Comparison of surface roughness of glass ionomer based restorative materials after brushing with different toothpastes

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This study aims to compare the surface roughness (Ra) of reinforced glass ionomer-containing restorative materials and a composite resin before and after brushing with four different kinds of toothpaste (Colgate Total 12, R.O.C.S. Sensation Whitening; ginger, and honey-containing toothpaste/Gumgumix; experimental toothpaste containing moringa/expM). 2 mm x 8 mm sized disc-shaped samples (n = 200) were prepared from three different reinforced glass ionomers (Equia Forte HT Fil GC, Japan; Equia Forte Coat applied Equia Forte HT Fil, GC, Japan; ChemFil Rock, Dentsply Sirona, Germany; DeltaFil, DMG, Germany) and a micro-hybrid composite resin (Filtek Z250, 3M ESPE, USA). After 10.000 cycles (5-55°C) with 20 s dwell time of thermal aging, samples were divided randomly into 4 subgroups (n=10) according to toothpaste types and then a brushing procedure was performed by brushing simulator for 10.000 strokes. The Ra of all samples was measured with a mechanical profilometer (Mitutoyo SJ.201P, Japan) before and after brushing. The data were analysed with IBM SPSS V23. The Wilcoxon, Kruskall Wallis H, and Dunn tests were used for statistical evaluation. A statistically significant difference was found between the Ra of the tested materials before and after brushing ($p \leq 0.05$). Filtek-Z250 showed the lowest Ra before (0.24±0.14µm) and after (0.41±0.19µm) brushing regardless of toothpaste type, followed by the uncoated Equia Forte HT Fil (0.25±0.24µm, 0.55±0,1µm respectively). ExpM toothpaste brushing showed the lowest Ra (0.38±0.2µm) on Filtek-Z250 sample surfaces. In conclusion, The Ra values before/after brushing the uncoated Equia Forte HT Fil material were similar to the Filtek-Z250. Toothpaste containing moringa has not affected the Ra of all tested materials except the coated Equia Forte HT Fil group.

The authors received no specific funding for this work.

37 Assessment of surface properties of glass ionomers by SEM/EDX after brushing with different toothpastes

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This study aimed to evaluate the surface properties of reinforced glass ionomer-containing restorative materials and a composite resin by SEM/EDX before and after brushing with different toothpastes. 200 samples from three different reinforced glass ionomers (Equia Forte HT-with and without Equia Forte Coat, GC, Japan; ChemFil Rock, Dentsply, Germany; DeltaFil, DMG, Germany) and one microhybrid composite resin (Filtek-Z250, 3M-ESPE, USA) were prepared according to the manufacturer's instructions. Following thermal cycling (5°C/55°C, 20 s dwell-time, 10,000 cycles) samples were divided into 4 subgroups (n=10) and brushed with 4 different toothpastes (Colgate Total 12, R.O.C.S. Sensation Whitening, ginger and honey containing toothpaste/Gumgumix, experimental toothpaste containing moringa/ExpM) in a brushing simulator (10,000 strokes, r=10 mm, 40 mm/s). SEM and EDX analysis were performed to assess the surface properties. SEM images of the coated Equia Forte HT and Filtek-250 groups prior to brushing were similar. After brushing, scratches were observed only on the surface of the coated Equia Forte HT group. However, the filler particles were detached from the surface and the areas around the particles were eroded in all other groups regardless of the toothpaste used. In the initial EDX analysis, fluoride was only observed on the surface of the uncoated Equia Forte HT group (3.34 wt%), while it was observed on the surface of all glass ionomer groups except coated Equia Forte HT after brushing (Equia Forte HT: 5.99 wt%, ChemFil : 2.46 wt%, DeltaFil: 3.37wt%). Zinc was observed only in the ChemFil Rock group (initial 7.93 wt%, after brushing 9.6 wt%). In conclusion, within the limits of this study, it was shown that Equia Forte Coat protects the glass ionomer-based restorative materials against abrasion. The surface properties of reinforced glass ionomer-based restorative materials after brushing were similar to composite resin.

The authors received no specific funding for this work.

38 Investigation of the effect of different beverages on the hardness and roughness of restorative materials

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The aim of this study was to determine the changes in hardness and surface roughness of four different restorative dental materials kept in different beverages. One conventional composite resin (Filtek Z250, 3M Espe, USA), two bulkfill composites (Xtrafil, Voco, Germany and Tetric-N-Ceram, Ivoclar, Germany) and one glassionomer cement (Ketac Molar Easymix, 3M Espe, USA) were prepared using round teflon molds with a height of 4 mm and a diameter of 8 mm (n=10). After each specimen was polished with abrasive discs (Sof-lex, 3M ESPE), the initial roughness and Vickers hardness values were measured. Then, each material group was kept in coke, tea and distilled water for 30 d period, 3 times a day, for 15 min each time. After 30 d, the roughness and hardness values were remeasured. The initial hardness of Tetric-N-Ceram, Z250, Xtrafil and Ketac Molar Easymix was 60.9±4.5, 93.3±6.2, 101.1±5.9 and 56.1±5.9, respectively. Also, the initial roughness of Tetric-N-Ceram, Z250, Xtrafil and Ketac Molar Easymix was 0.17±0.07, 0.14±0.05, 0.30±0.07, 0.60±0.15. Two-way ANOVA test showed that the roughness and hardness values of the materials changed after the materials were kept in beverages ($p \leq 0.05$). While Z250-distilled water (89.5±3.9) and Xtrafil-distilled water (90.1±7.0) showed statistically similar and highest final hardness, Ketac Molar Easymix kept in tea had the lowest final hardness (23.8±6.3). While conventional and bulkfill composites kept in distilled water, coke and tea showed statistically similar final roughness (between 0.15±0.05 and 0.43±0.14), glass ionomer kept in tea (1.53±0.57) and in coke (1.35±0.46) had the highest final roughness. When considering both hardness and roughness, dentists may prefer Z250 as conventional and Xtrafil as bulkfill composites for the restorations of patients who consume tea and coke regularly. Glassionomer may be used as temporary restoration.

This study was supported by Karadeniz Technical University Research Project Unit Number TDH-2021-9382.

Session 3
Diagnosis & Microbiology

Thursday, July 6 2023, Afternoon

39 Diagnosing exposed dentine by multiple raters allows new insights into diagnostic decision making of dentists

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Assessing whether dentine is exposed or not without aids is not necessarily part of everyday dental practice and is anything but trivial. The decision process of dentists in making such a decision is unknown.

Sixty-one examiners were asked to diagnose 49 tooth areas with different grades of tissue loss (minor, moderate, and advanced) to decide whether dentine was exposed (positive status) or not (negative status). The true status was determined by histology.

For each tooth the rate of correct decisions reflecting the difficulty to diagnose this tooth and the positive rate reflecting the perception of the tooth by the raters was computed. Meta-analytical techniques were used to assess the inter-tooth variation and the influence of tooth-specific factors on difficulty or perception, respectively. To facilitate interpretation of the variation, mean and standard deviation are transformed into a 95% range.

A huge variation in diagnostic difficulty (95%-range: 0.18-0.96) and perception (95%-range: 0.09-0.96) could be observed. Advanced tissue loss made diagnoses more difficult. The background colour of the tooth area (additional explained variation (aev): 23.7%; $p \leq 0.001$), the tissue loss (aev: 4.5%; $p=0.017$) and the true status (aev: 37.8%; $p \leq 0.001$) were associated with perception and may hint to cues used by the raters. No association between the colour index and the true status (mean value in areas with “dentine exposed”: 0.66 and in areas with “dentine not exposed”: 0.63) was found. As the existing literature suggests only a very weak relationship between background colour and exposure status of the dentine, our results suggest room for improvement in decision making.

This example illustrates the power of diagnostic accuracy studies with multiple raters to contribute to a better understanding of diagnostic decision processes.

The authors received no specific funding for this work.

40 Accuracy of photographs taken with a smartphone to detect active caries lesions in orthodontic patients

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The aim of this observational cross-sectional study was to evaluate the diagnostic accuracy of photographs taken with a smartphone to detect active caries lesions associated with the use of fixed orthodontic appliances. A convenience sample of 100 individuals with fixed orthodontic appliance in both arches was selected. After tooth cleaning and drying, caries lesions were classified according to surface integrity into non-cavitated or cavitated and according to surface roughness and light reflection into inactive or active. Then, photographs were taken by a trained researcher with an iPhone 7 Plus and a Selfie Ring Light illuminator in five views (frontal, left lateral, right lateral, lower occlusal, upper occlusal). The diagnostic parameters of sensitivity (SE), specificity (SP), positive predictive value (PV+), negative predictive value (PV-), and accuracy were calculated for the photographic method considering the clinical examination as the gold standard. The sample was predominantly composed of young adults (mean ± standard deviation [sd] age of 27 ± 16 years) and females (66%). The prevalence of caries activity was 74% (n=74 patients). These individuals had, on average (±sd), 3.5 (±3.6) active lesions, ranging from 0 to 16 (median 2, interquartile range 0, 6). Photographs were able to correctly identify 66 out of 74 individuals with active caries according to the gold standard. On the other hand, only 4 out of 26 healthy patients were correctly identified by this method. These findings are expressed in the following diagnostic parameters: 89% SE, 15% SP, 75% PV+, 33% PV-, and 70% accuracy. In conclusion, photographs taken with a smartphone after tooth cleaning can be used to screen patients for referral to dental caries assessment due to its high SE.

We acknowledge the support of the National Coordination of Post-graduate Education (CAPES), Ministry of Education, Brazil (finance code 001).

41 Development of a vision transformer model for caries detection and localisation on dental photographs

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Caries is among the most prevalent diseases across the globe and needs to be reliably diagnosed. Here, the visual examination (VE) is the method of choice due to its simplicity and documented validity. Aiming at objectifying VE the use of dental photographs and methods of artificial intelligence (AI) may potentially contribute to an accurate diagnostic evaluation in the future. Therefore, the present study aimed at developing an AI-powered algorithm that can detect, classify and localize caries. For this purpose an image set comprised of 18,179 anonymous dental photographs (aspect ratio of 1:1, resolution 1,200 x 1,200 pixels with no compression, jpeg format and RGB colour space) was used. All images were pixelwise labelled with the computer vision annotation tool by a group of trained annotators and independently checked and corrected by an experienced dentist. The detection and classification of caries followed the WHO, ICDAS and UniViSS methods. The AI-powered algorithm was trained using a pipeline of methods, mainly image augmentation and adapting a transformer network (SegFormer B5, Nvidia, Santa Clara, USA). The entire image set of single tooth photographs (n= 18,179 images) was divided into a training (n=17,179) and test set (n=1,000). After 250 training epochs and fine-tuning of the model intersection over union (IoU), accuracy (ACC) and average precision (AP) for non-cavitated caries (0.630, 0.989, 0.813), greyish translucencies (0.599, 0.999, 0.764), enamel breakdown (0.352, 0.999, 0.581), dentine cavities (0.691, 0.997, 0.895), and fully destructed teeth (0.796, 0.999, 0.895) were determined. It can be concluded that it was possible to achieve an excellent agreement for caries detection, classification and localisation using standardised, single-tooth photographs and a vision transformer model. Nevertheless, the current model needs be further improved and evaluated under clinical conditions.

The authors received no specific funding for this work.

42 Fluorescence-based detection of secondary caries lesions around amalgam restorations

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Secondary caries (SC) is the most common reason for replacing dental restorations. SC typically occurs along the tooth–restoration interface, and it is difficult to visually observe the difference between the dark colour of the metal restoration itself and the discoloration associated with the caries lesion. This study aimed to determine the diagnostic performance of fluorescence-based (QLF) technology in distinguishing between amalgam restorations and SC as well as quantifying the severity of SC. Images of 85 extracted human premolars and molars filled with amalgam restorations were taken with QLF-D (Inspektor Research Systems BV, The Netherlands). On QLF images, the levels of mineral content and bacterial metabolic activity of SC relative to sound enamel were calculated as the difference in fluorescence brightness (|ΔFmax|) and red fluorescence intensity (ΔRmax), respectively. Statistical analyses were performed using Mann-Whitney and Kruskal-Wallis tests with Bonferroni post hoc correction and receiver operating characteristic analysis. Using histology as a gold standard, 71 teeth were included in the final analysis, which revealed that 14 teeth (19.7%) were sound, while 36 (50.7%) and 21 teeth (29.6%) had enamel and dentine SC, respectively. Both |ΔFmax| and ΔRmax increased significantly with the SC severity ($p \leq 0.001$), and ΔRmax showed a strong positive correlation with the histology findings ($\rho = 0.804$, $p \leq 0.001$). For distinguishing enamel and dentine SC, ΔRmax showed high sensitivity (0.93 and 1.00, respectively) and specificity (0.86 and 0.78, respectively), while the corresponding values for |ΔFmax| were generally lower (0.61, 0.76, 0.86, and 0.72, respectively). These findings indicate that the QLF technology, and especially the red fluorescence parameter, has an excellent diagnostic ability in distinguishing between amalgam restorations and SC as well as in quantifying the severity of SC with high validity.

Supported by a grant of the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health & Welfare, Republic of Korea (grant number: HI20C2114).

43 Comparison of visual and online digital images using merged International Caries Detection and Assessment System (ICDAS) codes in dental undergraduate students

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The aim of this study was to evaluate and compare dental undergraduate students' reliability and consistency in detecting caries on extracted teeth and online digital images using merged International Caries Detection and Assessment System (ICDAS) and ICDAS codes. A total of 70 UITM dental undergraduates participated in a series of calibrations using conventional visual and digital images of the same extracted teeth. ICDAS and merged ICDAS caries code were used to evaluate caries on 52 tooth surfaces with varying degrees of severity. The inter- and intra-examiner reliability was calculated using Cohen kappa values for both methods. Paired T-test was determined to compare the two groups using SPSS 26 software. Conventional visual examination showed excellent inter- and intra-examiner agreement (kappa scores ≥0.61) using both ICDAS and merge codes. Students performed slightly less in the online digital assessment method with inter-examiner agreement kappa scores between 0.41-0.80 and with a mean kappa value of 0.56 compared to 0.64 for the conventional visual way. Students reached a very good intra-examiner agreement for both methods. However, a paired t-test showed no statistically significant differences ($p \leq 0.05$) for both assessment methods. Conclusion: Online digital images can be an alternative method for ICDAS calibration as they showed good intra-examiner agreement reproducibility. However, the quality of the photos and the labelling of the caries lesion plays an essential role to ensure that good agreement is achieved.

The authors received no specific funding for this work.

44 Remote caries lesion assessment using CariesCare International criteria: perspectives for teledentistry

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Background: recording dental caries outside of a clinical setting and for field studies involves difficult logistics and demands large investments of resources.

Aim: to assess the precision of caries lesion detection via photographs taken from cellphone and professional cameras using the CariesCare International (CCI) criteria.

Materials and methods: 30 children ages 5 to 10 were clinically evaluated by a previously trained examiner using CCI criteria (0=sound; 1=initial-lesion; 2=moderate-lesion; 3=extensive-lesion). Then, photographs of each child's oral cavity were taken using a professional camera (PC) Canon EOS Rebel with macro lens (100 mm) with a Ring Flash, and an iPhone 11 Pro-Max with a LED Ring Light. Frontal, right and left lateral, and upper and lower occlusal photographs were taken. A blind examiner assessed the occlusal and buccal surfaces of the photographs from both cameras on a computer. Weighted kappa (Kw) analyses were performed to calculate the agreement between the CCI scores from the photographs and the gold standard clinical assessments (CA), as well as for inter-examiner agreement.

Results: the participants' mean age was 6.7 years (SD=1.5). A total of 873 surfaces were evaluated, of which 61.4% (CA), 65.4% (PC), and 66.9% (iPhone) were considered sound (CCI=0). There was an excellent agreement between the iPhone CCI scores and the CA scores (Kw=0.85), and an even higher agreement between the PC and CA scores (Kw=0.95). Inter-examiner agreement was also excellent for each of the different methods of caries lesion detection (Kw≥0.93).

Conclusion: the possibility of performing caries lesions assessment through photographs seems to be a promising tool for a remote diagnosis of dental caries. These options can be used to reduce costs and logistics in epidemiological studies and for teledentistry.

Universidad Iberoamericana, UNICA - Caries Research Unit and the International Association for Dental Research-Regional Development Program Latin American Region (IADR RDP LAR).

45 In-vitro performance of BlueCheck liquid for detection of initial lesions on occlusal surfaces

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Objectives: Clinical detection of caries lesions is routinely performed visually. However, visual caries detection is often subjective and adjunct methods can provide additional benefit in objectifying and documenting demineralisation and further approach, e.g. remineralisation of lesions. A new tool named BlueCheck (BC, Incisive Technologies, Australia) was developed for detection of caries lesions via reversible staining of porous bioapatite. This study aimed to evaluate the ability of BC to stain initial caries lesions on occlusal surfaces. Material and Methods: The occlusal surfaces of 54 extracted permanent human teeth were cleaned and classified visually (ICDAS). On each surface BC was applied and rinsed with water after three minutes. The surfaces were checked for presence of blue colored areas (yes/no) independently by two examiners. Teeth were cut for histological evaluation. Correlation of methods was calculated using Spearman´s rank correlation coefficient (rs). ROC curves were created for ICDAS and BC based on histology as reference and AUC were compared (α=0.05). Results: The distribution of ICDAS codes was: code 0=12, code 1=22, and code 2=20. Percentage agreement was 94.4% for BC assessment between both examiners and 92.6% between ICDAS and BC. Significant correlation was found between all methods: ICDAS/BC=0.665, ICDAS/histology=0.832, BC/histology=0.737 ($p \leq 0.0001$). Sensitivity/specificity values (%) were: ICDAS=100/91.7 and BC=90.5/100. The AUC (95% CI) were: ICDAS=0.978 (0.896; 0.999) and BC=0.952 (0.857; 0.992). No significant differences were observed between the AUC (p=0.489). Conclusion: BC showed high agreement with visual criteria. While the overall diagnostic accuracy was comparable, specificity of BC was higher than ICDAS, whereas sensitivity was slightly lower. In the light of the results of this in-vitro study, the use of BC presents an interesting perspective for possible confirmation in future clinical research.

BlueCheck liquid was provided by Incisive Technologies Pty Ltd, Australia.

46 Ultrasound device, antimicrobial photodynamic therapy and bioactive glasses for the treatment of dentine caries lesions

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The mechanical, antibacterial and chemical effects for combining ultrasound, aPDT (antimicrobial photodynamic therapy), and bioactive glass to remove, decontaminate and remineralise caries-like dentine were evaluated. Bovine specimens (n=125, 4 mm x 4 mm x 2 mm) were selected by means of superficial KHN (Knoop hardness number) and then randomized according to the caries removal techniques: bur (BUR) or ultrasound (ULT), decontamination (with or without aPDT) and remineralisation methods (45S5 or F-18 bioactive glasses) in different groups as follow: caries lesion (control); sound dentine (control); BUR; BUR+aPDT; ULT; ULT+aPDT; BUR+45S5, BUR+F-18; ULT+45S5; ULT+F-18; BUR+aPDT+45S5; BUR+aPDT+F-18; ULT+aPDT+45S5; ULT+aPDT+F-18. Transverse microradiography (TMR), cross-sectional hardness (CSH), Fourier Transform-Raman (FT-Raman) and confocal microscopy (CLSM) were performed. Two-way ANOVA and Tukey's test was used ($\alpha = 0.05$). The mean value of the superficial KHN of the specimens included in this study was 40.8 ± 8.7 KHN. TMR revealed lesion depth of 213.9 ± 49.5 µm, and mineral loss of 4929.3% vol.µm. CSH increases as function of depth, regardless of the investigated group ($p \leq 0.05$). Removal with BUR (24.40 - 63.03 KHN – Knoop hardness number) showed greater CSH than ULT (20.01 - 47.53 KHN; $p \leq 0.05$). aPDT did not affect the CSH ($p \geq 0.05$). No difference was observed between 45S5 or F-18 ($p \geq 0.05$), except for ULT ($p \geq 0.05$). FT-Raman showed no differences for phosphate ($p \geq 0.05$), but for carbonate and C-H bonds. CLSM images showed that aPDT effectively inactivate residual bacteria. ULT, aPDT and bioactive glasses is a promising minimally invasive treatment.

CAPES - Coordination for the Improvement of Higher Education Personnel (Process Number: 001/1776257, Finance Code 001) and Sao Paulo Research Foundation - FAPESP (Grant number 2013/07276-1)

47 A combined microscopy-based analysis of biofilm pH and biofilm matrix carbohydrates

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Carbohydrate components of the dental biofilm matrix may play a role in creating and maintaining localized acidic microenvironments that promote dental caries. This study combined pH measurements with the ratiometric dye C-SNARF-4 and fluorescence lectin binding analysis (FLBA) to simultaneously map the distribution of carbohydrate matrix components and biofilm pH at the microscale. Biofilms were grown from salivary inocula in the presence (SUC) or absence (NOSUC) of 1% sucrose. Biofilm pH was monitored in five fields of view (FOV) after 5 and 15 min of exposure to sucrose. Thereafter, fucose- and galactose-containing matrix components were visualized in the same FOVs with the fluorescently labelled lectins Aleuria aurantia lectin (AAL) and Morniga agglutinin-G (MNA-G). Experiments were performed in biological triplicates. Differences in pH and in lectin-stained biovolumes were assessed using paired t-tests or One-way ANOVA followed by Tukey´s test. The relationship between biofilm pH and lectin-stained biovolumes was assessed using Spearman correlations (α=0.05). Biofilm pH was lower in SUC biofilms at both time points (p≤0.05). Both lectins visualized higher biovolumes in SUC than in NOSUC biofilms (p≤0.05). MNA-G-targeted carbohydrate components were distributed evenly across the biofilms, whereas AAL stained increasing biovolumes towards the top of SUC biofilms (p≤0.05). MNA-G targeted larger total biovolumes than AAL in SUC (453.2±56.0 SD vs. 206.1±82.0 SD; p=0.02), but not in NOSUC biofilms (149.9±111.5 SD vs. 78.0±44.8 SD; p=0.40). Correlations between biofilm pH and the abundance of both lectins did not reach the level of statistical significance (rho=-0.71; p=0.14). Combining pH ratiometry and FLBA is a well-suited approach to simultaneously characterize the microscale architecture and pH profile of dental biofilms. Sucrose increased the production of fucose- and galactose-containing matrix components, but their abundance was not significantly correlated to local biofilm pH.

The authors received no specific funding for this work.

48 Modulation of mutans streptococci cariogenic biofilm represent a promising targeted preventive therapy for dental caries.

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Streptococcus mutans (Sm) and Streptococcus sobrinus (Ss) are implicated as the primary pathogen in caries due to its unique virulence factors. Previous metagenomics and metatranscriptomics analyses among 300 biofilm samples from preschool-age children identified a negative correlation between DNA of Sm and logratio (RNA/DNA) of Streptococcus oligofermentans (So). This study aimed to evaluate the biofilm properties of Sm (NCTC 10449 and H066 – virulent clinical sample) and Ss 6715 in the presence of So, in a discovery-validation pipeline involving in vitro approaches in cariogenic challenging conditions, testing if it represents a contemporary treatment strategy to target cariogenic microbiota. Biofilms were developed on saliva-coated hydroxyapatite discs with mono-cultures or co-cultures of Sm, Ss and So in TSB, with or without 1% sucrose, at 37°C at 5% CO2. Biofilm metabolic profiles were measured by Isothermal Microcalorimetry using calScreener™ (SymCel Sverige AB, Sweden). Acidogenic/aciduric properties were measured in single- and dual-species biofilm grown in pH 5.5 or 7.1. The results were expressed as mean + standard deviation, and subjected to Student's t test (significance levels set at 0.05). When So was the biofilm primary colonizer, it significantly inhibited biofilm attachment, growth (2-log reduction in mean CFU/ml), and metabolic activity of all strains of Sm and Ss, minimizing the cariogenic challenge on hydroxyapatite discs. Acidogenicity of Sm H066 and Ss 6715 was impaired when So was the primary colonizer, with biofilm pH never reaching below 6.3, while NCTC 10449 decreased the pH to 5.0. The metabolism (total heat, J) of Sm and Ss was reduced when co-cultured with So (from 1.3+0.5J to 0.9+0.3J, $p \leq 0.05$; and from 1.3+0.6J to 1.1+0.4J, NS). In conclusion, S. oligofermentans might represent a promising strategy to target cariogenic microbiota since it disrupts important virulence properties associated with caries development.

Funding: NIH/NIDCR U01-DE025046 and R03-DE02898

49 The antimicrobial effect of two vitamin D compounds on Streptococcus mutans and their impact on virulence gene expression

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Aim: The aim of this laboratory-based study was to investigate the antimicrobial effects of two Vitamin D compounds, Cholecalciferol (D3) and Doxercalciferol (D2), against Streptococcus Mutans and to assess any possibility of downregulating its virulence factors.

Method: The minimum inhibitory concentration MIC) and minimum bactericidal concentration (MBC) of Cholecalciferol and Doxercalciferol for S mutans were determined according to the Clinical Laboratory Standards Institute (CLSI) guidelines for micro-dilutions. The effect of both compounds on the inhibition of the environmental pH drop was assessed 24 h after exposure by using a pH indicator at baseline and endpoint in a 1% and 5% sucrose broth. The effects of both agents, at different concentrations, on gene expression of glycosyltransferases (GtfB, GtfC, and GtFD), in a 5% sucrose medium were investigated via qRT-PCR.

Results: The MIC interval of Cholecalciferol and Doxercalciferol were 20-41 µg/ml and 41-83 µg/ml, respectively. The MBC of Cholecalciferol and Doxercalciferol were 83 µg/ml and 160 µg/ml, respectively. The pH assay showed that vitamin D compounds are not effective in inhibiting the pH change at lower concentrations. However, both D3 and D2 inhibited the lowering of the pH under 5.5 at concentrations of 160 µg/ml on the 5% sucrose essay and solutions displayed a pH≥6 at 333 µg/ml. In addition, there was an increase in the expression of GtfD ($p \leq 0.05$) and a decrease in GtfB and GtfC for D2.

Conclusion: Within the limitations of this laboratory-based study, Vitamin D compounds might be a promising agent for dental caries prevention, as these compounds demonstrated evidence of antimicrobial activity against S mutans. However, further research is required to investigate the effect on the expression of virulence factors: GtfC and GtfB.

This research project was part of MSc in Minimally Invasive Dentistry programme.

50 Association of Helicobacter pylori in oral cavity with dental caries

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Helicobacter pylori infection is thought to most commonly occur via the oral cavity. Using a caries-induced rat model, we previously showed that the presence of dental caries may be a risk factor for H. pylori colonization in the oral cavity. The present study was conducted to analyse the association of H. pylori colonization in human oral cavities affected by dental caries. The study protocol was approved by the Ethics Committee of Osaka University Graduate School of Dentistry (no. H30-E32). Saliva specimens and extracted teeth were obtained from 54 patients referred to the Department of Oral and Maxillofacial Surgery II of Osaka University Dental Hospital from 2019 to 2021 due to conditions requiring tooth extraction. H. pylori distribution in each specimen was analysed using a polymerase chain reaction method. Dental caries status of all extracted teeth was evaluated by the same dentist. Additionally, medical history and lifestyle habits, as well as prior incidence of H. pylori infection in gastric tissue were noted. Dental caries frequency in teeth extracted from H. pylori-positive and -negative subjects was 76.5% and 45.9%, respectively ($p \leq 0.05$, Fisher's exact test), while the frequency of pulp invasion by dental caries in those groups was 23.5% and 10.8%, respectively. H. pylori organisms were detected in oral specimens of some subjects who had received H. pylori eradication therapy and each of their extracted teeth showed dental caries invasion of the pulp. It was concluded that colonization of H. pylori in the oral cavity may be associated with dental caries, while the presence of the bacterium in individuals affected by severe dental caries is considered to be a risk factor for H. pylori reinfection.

This study was supported by a JSPS KAKENHI grant (21K21037).

51 Antibiofilm activity of a Curcuma xanthorrhiza oil nanoemulsion on dental microcosm biofilms

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Curcuma xanthorrhiza oil (CXO) is a natural essential oil with significant antibacterial activity against oral bacteria. However, its hydrophobicity makes it difficult to solubilize, which restricts its use as an intraoral antimicrobial agent. This study aimed to formulate a novel CXO nanoemulsion (CXO-NE) using a nanoemulsification method, and to evaluate its antimicrobial activity on dental microcosm biofilms compared with Listerine (positive control) and distilled water (DW, negative control). Stimulated saliva from a healthy adult was inoculated with a Hydroxyapatite disc and incubated in an anaerobic condition for 4 days with applying CXO-NE to the biofilm for 1 minute three times daily over the last 2 days. After 4 days of maturation, the biofilm properties were assessed using quantitative light-induced fluorescence (QLF), bacterial viability, dry weight, and confocal laser scanning microscopy. Kruskal-Wallis test and Mann-Whitney U test were used for statistical analysis. The intensity of biofilm red fluorescence detected by QLF was 42% lower in the CXO-NE group than in the DW group, and its area was 37% smaller (both $p \leq 0.001$). In addition, total and aciduric bacterial counts were significantly lower for the CXO-NE-treated biofilm than for the biofilm treated with DW ($p \leq 0.001$ and $p = 0.01$, respectively). Dry-weight analysis showed that CXO-NE treatment resulted in significantly lower biomass than in the positive and negative controls (both $p \leq 0.001$). The biofilm thickness and biovolume were 76% and 75% lower, respectively, for CXO-NE than for the DW-treated biofilm, which was 69% lower than for the Listerine-treated biofilm. The novel CXO-NE showed a significantly higher antibiofilm activity than did Listerine, which has been widely used as an intraoral antimicrobial. Therefore, CXO-NE can be used as a new antimicrobial agent based on natural agents to prevent biofilm-mediated oral diseases.

This research was supported by the Bio & Medical Technology Development Program of the National Research Foundation (NRF)& funded by the Korean government (MSIT) (No. 2022M3A9F3016364.)

52 Multiple-enzyme treatment reduces biofilm formation in a highly acidogenic in vitro model

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Background: Biofilm matrix-degrading enzymes are a promising approach to caries control, as they target determinants of biofilm virulence without compromising the microbial balance of the oral cavity. This study aimed to test the effect of treatment with a multiple-enzyme combination on the prevention and removal of a highly acidogenic in vitro-grown biofilm model dominated by Streptococcus spp.

Materials and methods: Biofilms were grown in 96-well plates under aerobic conditions at 37°C for 24 hours using pooled saliva as inoculum and brain-heart infusion broth supplied with 5% sucrose and sterile saliva as growth medium. The effect of treatment with a combination of mutanase, glucanase and DNase on biofilm prevention and removal was investigated. Treatment was performed either during (prevention) or after biofilm growth (removal) and the remaining biofilm was quantified by crystal violet staining. Additionally, the treatment effect on biofilm matrix compounds was analyzed using confocal microscopy. Extracellular DNA was stained with TOTO-1, microbial cells with SYTO41 and matrix polysaccharides were visualized by including fluorescently labelled dextran in the growth medium. Treatment effects were analysed using unpaired t-tests ($p \leq 0.05$ was considered statistically significant).

Results: Enzyme treatment reduced mean biofilm formation with 94%±1% (SD) ($p \leq 0.001$) and 69%±2% ($p \leq 0.0001$) when performed during and after growth, respectively. Extracellular polysaccharides were on average reduced by 28%±6% compared to control treatment ($p=0.02$), but the mean ratio between polysaccharides and microbial cells remained unchanged (0.70±0.37 vs. 0.77±0.22; $p=0.74$). No significant reduction in the amount of eDNA ($p=0.74$) was observed.

Conclusion: Multiple-enzyme treatment is a promising non-biocidal approach to biofilm control.

The study was supported by Novozymes A/S and the Innovation Fund Denmark (grant number 9065-00244B).

53 Rothia species in caries-free and caries-affected toddlers

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Several Rothia species have beneficial general health effects due to their nitrate-reducing activity. However, little is known about their role in oral health and disease in young children. Therefore, we aimed to analyze the relative abundance of Rothia species in toddlers with different dental statuses. This research is part of the “Predicting Caries Risk in Underserved Toddlers in Primary Healthcare Settings” study. Children (n=215, 4 years old) were assigned to the following groups: 1) healthy (n=50, ICDAS=0); 2) dysbiotic microbiome but caries-free (n=38, ICDAS=0 at 4 years, but ICDAS≥1 at 6.5 years); 3) early caries (n=75, ICDAS=1-2 at 4 years) and 4) advanced caries (n=52, ICDAS≥3 at 4 years). The microbial composition of saliva and pooled plaque were assessed using sequencing (V4 region of 16S rRNA gene). The reads were denoised, mapped to zero-radius operational taxonomic units (zOTUs), and a taxonomy was assigned using the RDP classifier with HOMD as well as NCBI BLAST using “16S ribosomal RNA sequences”. Kruskal-Wallis test followed by Mann-Whitney test was performed. From the 2368 zOTUs, 28 zOTUs were classified into three Rothia species: R. aeria, R. dentocariosa and R. mucilaginosa. The relative abundance of R. aeria in dental plaque, or R. dentocariosa in saliva, differed significantly in the study groups, while that of R. mucilaginosa did not. Plaque of the advanced caries group had a lower relative abundance of R. aeria (median: 0.5%;range: 0-8%) than the early caries (0.9%;0-14%) and healthy groups (1.3%;0-20%), while saliva of the advanced caries group had higher R. dentocariosa (0.6%; 0-4%) than the early caries (0.2%;0-4%) and healthy groups (0.1%;0-3%). In 4-year-old toddlers, Rothia aeria and Rothia dentocariosa are associated with a healthy oral ecosystem and caries, respectively, suggesting Rothia interspecies competition with changing oral environment.

Supported by NIH Grant Number 5U01DE021412, NIH CTSA grants [UL1-TR000442 (University of Iowa), 2UL1-TR000433 (University of Michigan), and UL1-TR000006 (Indiana University)], Colgate, the University of Michigan School of Dentistry, and a Consortium of Delta Dental Plans [Delta Dental of Iowa, Delta Dental of Wisconsin, the Renaissance Health Service Corporation for Delta Dental of Michigan]. DK was supported by Stichting Bevordering Tandheelkundige Kennis with NTvT Onderzoeksbeurs 2017 and by the ACTA Research Institute. Disclosure: Dr. Fontana serves on the Delta Dental National Scientific Advisory Committee.

54 Antimicrobial activity of probiotic strains against caries-associated oral bacterial species – an in vitro study

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Aim: The present experimental in-vitro study was performed to determine the antimicrobial effect of Streptococcus salivarius K12 and M18, both produce bacteriocin-like inhibitory substance (BLIS) which acts against caries-associated S. mutans.

Methods: Antimicrobial activity of S. salivarius K12 resp. M18 extracted from lozenges, against S. mutans OMZ 175 and eleven clinical isolates of S. mutans was determined applying the simultaneous and deferred antagonism method. Streptococcus salivarius MU (BLIS non-producer) acted as the positive control and Bacteroides fragilis as the negative control. Experiments were repeated three times and zones of inhibition (mm) were used to assess the antagonistic effect the bacteria had on pathogen growth.

Results: Within the simultaneous antagonism method S. salivarius K12 resp. M18 showed an antimicrobial activity against S. mutans OMZ 175 with -3.8 (95%CI: [-5.6 to -2.1]), ($p \leq 0.0001$) resp. -2.3 (95%CI: [-4.2 to -0.3]), ($p \leq 0.05$) using multiple comparisons test. The eleven clinical S. mutans strains were inhibited with -3.3 (95%CI: [-4.6 to -1.9]), ($p \leq 0.0001$) by K12 and -3 (95%CI:[-4.4 to -1.6]), ($p \leq 0.0001$) by M18. The sensitivity against inhibitory activity of K12 resp. M18 between the single strains was different but not significant. Among the deferred antagonistic test, both K12 and M18 did not show any antibacterial activity against the S. mutans strains. Data were performed by one- or a two-way analysis of variance (ANOVA) with multiple comparison test (GraphPad Prism, 9.3.1 for Windows, GraphPad Software, San Diego California, USA).

Conclusions: Both, S. salivarius K12 and M18 were able to directly inhibit the growth of the tested S. mutans strains as determined by the direct antagonism assay. Thus, the use of S. salivarius K12 and M18 could be an efficient prophylactic measure to reduce or prevent the carious processes in patients.

The authors received no specific funding for this work.

55 Effect of a solution containing Malva sylvestris on microcosm biofilm formed on tooth

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This study evaluated the antimicrobial and anti-caries effects of solutions containing Malva sylvestris, with or without fluoride and xylitol, on microcosm biofilm produced on enamel and dentine. One hundred and eight bovine enamel and 108 bovine dentine samples were submitted to the formation of microcosm biofilm with 0.2% sucrose, for 5 days, at 37°C. From the second day to the end, the experimental solutions were applied (1 mL/min/d): 1) 12.5% Malva sylvestris; 2) Sodium Fluoride (225 ppm F); 3) 5% Xylitol; 4) Malva sylvestris + F; 5) Malva sylvestris + Xylitol; 6) Malva sylvestris + F + Xylitol; 7) Malva sylvestris (Malvatricin Plus® - positive control); 8) 0.12% chlorhexidine (PerioGard®, positive control) and 9) PBS (negative control) (n=12, biological triplicate). The colony forming units (CFU) were counted for Lactobacillus spp. and Streptococcus mutans/S. sobrinus. Demineralisation was quantified by transverse microradiography (TMR). Data were compared using ANOVA/Tukey or Kruskal-Wallis/Dunn ($p \leq 0.05$). None of the treatments was able to reduce CFU (Log10/mL) for Lactobacillus spp. and S. mutans/S. sobrinus (ANOVA/Tukey, $p \geq 0.05$). With respect to enamel demineralisation, the integrated mineral loss (ΔZ) was reduced for samples treated with chlorhexidine (reduction of 33%), while the average mineral loss (R) was reduced with chlorhexidine (42%), fluoride (30%) and Malva sylvestris + fluoride (42%) compared to negative control (Mean 58.4 I.C 7.8 %vol) (ANOVA/Tukey, $p \leq 0.0001$). ΔZ (%vol.µm), lesion depth (LD-µm) and R (%vol) for dentine were reduced with chlorhexidine (20-32%) and Malvatricin Plus® (20-29%) compared to negative control (ΔZ mean 29.9 I.C 5.4%vol.µm - ANOVA/Tukey, $p=0.0031$, and LD mean 176.4 I.C 31.1 µm, $p=0.006$; Kruskal-Wallis/ Dunn's for R $p \leq 0.0001$). The experimental solution containing Malva sylvestris + F showed the anti-caries effect on enamel under this model.

The São Paulo Research Foundation supported this work (FAPESP 2021/13664-0, 2021/13602-5, 2021/03053-4).

56 Synergistic effect of α-(1→3) glucanase and DNAse on the removal of S. mutans biofilm

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Extracellular polysaccharides (EPS) provide mechanical stability for cariogenic biofilm, which can be increased by the presence of extracellular DNA (eDNA). Therefore, we evaluated the effect of α-(1→3) glucanase and DNAse I on Streptococcus mutans biofilm removal. First, α-(1→3) glucanase from Prevotella melaninogenica was cloned, expressed heterologously and purified. Early S. mutans UA159 biofilms were formed for 24 h in 96-well-plates using UTEYB medium supplemented with 1% sucrose. The biofilms were submitted to an enzymatic treatment (0.5 mg/ml in PBS for each enzyme) at 37 ºC for 1 h according to the following groups (n=3): DNAse, Mutanase, DNAse + Mutanase and PBS (negative control). Then, biomass was stained with 0.05% crystal violet, water washed, and the remaining dye was recovered with 30% acetic acid, being measured in a microplate reader at 570 nm. EPS was extracted with 1 M NaOH under microplate agitation for 15 min, transferred to microtubes, centrifuged, and the supernatant was precipitated with ethanol (1:3, v/v). EPS were quantified colourimetrically by the phenol-sulfuric method, using glucose as standard, being measured at 490 nm. The degree of synergism (DS) was calculated, and data were analysed by one-way Anova, Tukey's Test (α=5%). The results (mean ± SD; different letters represent statistically significant differences, p≤0.05) for PBS, DNAse, Mutanase, and DNAse + Mutanase for biomass (absorbance) were: 1.26 ± 0.02A, 1.12 ± 0.09A, 0.84 ± 0.26B, 0.24 ± 0.05C resp. and for EPS (μg): 19.7 ± 0.8A, 13.8 ± 0.3B, 2.0 ± 1.1C, 0.6 ± 0.3C resp. The DS was 1.8 and 0.8 for biomass and EPS, resp. In conclusion, the data supports that α-(1→3) glucanase and DNAse combined have a synergistic effect on the removal of S. mutans biofilm.

CAPES nº 001 and FAPESP (2020/15092-1)

57 Biofilm formation on dentine influenced by toothpastes in situ

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Few studies are available investigating the effect of toothpastes on the biofilm formation. Aim of this study was to investigate the influence of toothpastes with different active ingredients on the biofilm formation on dentine in situ.

Starting from (I) a base paste without active ingredients, (II) one active ingredient: 1.48 ppm fluoride, 0.05% chlorhexidine, 0.8% aluminum lactate, 0.04% Curcuma xanthorrhiza root extract or; (III) combinations of active ingredients were added: 3% Zinc Gluconate/0.04% Curcuma xanthorrhiza/fluoride, 0.8% aluminum lactate/0.05% chlorhexidine/fluoride. Water served as control.

Six volunteers wore bovine dentine slabs three times, which were attached to acrylic splints. Within an exposure time of 48 h, dentine specimens positioned in the 1st quadrant were brushed after 30 min, 12 h, 24 h and 36 h for 30 s each. Specimens of the 2nd quadrant were not brushed, but were left in the oral cavity and exposed to the foam of the toothpastes for 2 min. Biofilm coverage was analysed by fluorescence microscopy using a scoring system and compared by Mann-Whitney-U-Test ($p \leq 0.05$, *compared to water), 0: no bacteria, 1: scattered bacteria, 2: small colonies less than 100 bacteria, 3: larger colonies, 4: ≤50%, 5: ≥50% of surface covered by biofilm.

Brushed specimens showed score 1 up to score 4 (q1/median/q3), water: 2/2/3, (I): 1/2/2, (II): 1/1/2*, (III): 0.5/1/2*. On unbrushed specimens scores between 1 and 5 were found with median scores for water: 4/5/5, (I): 4/5/5, (II): 4/4/4* (chlorhexidine, aluminum lactate) - 4/5/5 (Curcuma xanthorrhiza), (III): 3.5/4/5 (Zinc Gluconate/Curcuma xanthorrhiza/fluoride) - 4/4/5 (0.8% aluminum lactate/0.05% chlorhexidine/fluoride).

No inhibition but a delay of biofilm formation on unbrushed dentine is possible by toothpastes for 48 h. Further studies should evaluate which combinations of active ingredients are appropriate to prevent the formation of dysbiotic biofilms and to support the establishment of healthy conditions of the microbiome.

Supported by Dr. Theiss Naturwaren, providing of toothpastes.

58 Evaluation of optimal pH and temperature of α-(1→3) glucanase from Prevotella melaninogenica

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Extracellular polysaccharides present in the cariogenic biofilm matrix may be degraded by α-(1→3) glucanase enzymes. However, the enzymatic activity depends on pH and temperature conditions, which were evaluated in this study. The enzyme α-(1→3)-glucanase from Prevotella melaninogenica was cloned, expressed heterologously and purified. Streptococcus mutans UA159 culture were grown in Tryptone-Yeast Extract (TYEB) medium supplemented with 29.2 mM sucrose. The culture was centrifuge and the pellet was sonicated and washed with PIPES buffer pH 7,0. The final pellet was lyophilized and was used as substrate for α-(1→3) glucanase enzymatic activity assay. Mixtures of 10 µg of bacterial pellet and 0.5 mg of α-(1→3) glucanase were assessed. Samples were kept in a ThermoMixer at 1000 rpm for 1 h, boiled at 95°C for 10 min, filtered and analyzed by an anion exchange chromatography system coupled with HPAEC pulsed amperometric detection, equipped with a CarboPAC1 250 mm × 2 mm analytical column. Glucose and nigerosis were used as standards for the identification and quantification of α-(1→3) glucanase hydrolysis products. The optimum pH was determined using McIlvaine buffer, varying the pH from 2.5 to 8.0, at a fixed temperature of 40 ºC. The optimum temperature was determined with MES buffer at the determined optimal pH, varying the temperature from 30 to 60 ºC. The α-(1→3) glucanase showed the highest activity at pH 5.5 and maintained more than 90% of activity at pH 6.5. The optimal activity temperature was 40 ºC, however the enzyme maintained more than 90% of activity between 35-45ºC. In conclusion, α-(1→3) glucanase has high enzymatic activity under pH and temperature conditions present in the oral cavity and could be a strategy for cariogenic biofilm control.

Funded by FAPESP (2020/15092-1).

Session 4
ORCA Nathan Cochrane Junior Scientist Award part 1

Friday, July 7 2023, Morning

59 Caries-inhibiting activity of silver diammine fluoride: effects of potassium iodide

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Silver diammine fluoride (SDF) is used to manage caries lesions, especially in young patients. It promotes remineralisation of enamel lesions and arrests dentine caries by inhibiting matrix metalloproteinases (MMPs). Potassium iodide (KI) is applied after SDF to reduce the undesirable consequence of tooth darkening. The aim of this in-vitro study was to determine the effect of KI on the caries-inhibiting properties of SDF in primary teeth. Caries was diagnosed and categorised in-vivo using ICDAS prior to tooth extraction. For enamel lesions, surface microhardness (Vickers hardness) was measured on 20 enamel surfaces with ICDAS scores of 2, before and after the application of SDF and with or without the additional application of KI. For dentine lesions, 15 carious dentine blocks were obtained from teeth diagnosed with ICDAS scores of 5 and 6 and randomly assigned to one of four groups: baseline, SDF, SDF+KI and control. Total MMP activity was assessed using an MMP colourimetric assay. Data were analysed using two-way ANOVA with Tukey's multiple comparison test ($p \leq 0.05$). Our results showed that the surface microhardness of enamel caries lesions increased by 66.8% ($p \leq 0.0001$) following the application of SDF and by 71.5% ($p \leq 0.0001$) following the application of SDF+KI. However, for dentine caries lesions while SDF inhibited total MMP activity by 93% ($p \leq 0.001$), the application of SDF+KI resulted in a decrease in MMP activity of only 55.5% ($p = 0.07$). In conclusion, the addition of KI after SDF did not significantly affect the remineralisation of enamel lesions. However, treatment with SDF+KI is less effective in arresting dentine caries lesions as demonstrated by the continued, significant level of MMP activity.

Funded by the minister of Higher Education, Libya.

60 Effect of Ca-coacervates and its components on enamel lesions in de- and remineralising environments in vitro

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Calcium-coacervates (CC) might be used as remineralising agents for dental hard tissues and inhibit further demineralising processes. The aim of this study was to evaluate the effect of infiltration of artificial bovine enamel lesions with a CC emulsion as well as its single components compared to a self-assembling peptide P11-4 in a pH-cycling (pHC) model. Enamel specimens were prepared from bovine incisors, partly varnished, and stored in demineralising solution (DS; pH 4.95; 17 d) to create two enamel lesions per sample. Specimens were randomly allocated to 6 groups (n=15-18). While one lesion per specimen served as no-treatment-control (NTC), the other lesions were etched (H3PO4, 5s), air-dried and subsequently infiltrated (Inf) for 10 min with either CC [10 mg/ml polyacrylic acid (PAA), 50 mM CaCl2 (Ca) and 1 M K2HPO4 (PO4)] or its components PAA, Ca and PO4. Additionally, a self-assembling peptide P11-4 (CurodontTM Repair, Credentis, Switzerland) was tested. Specimens were cut perpendicularly to the lesions, providing one half serving as baseline while the other half was exposed to pHC for 28 d (pH 4.95 3 h/ pH 7 21 h). The difference in integrated mineral loss between lesions at baseline and after pHC was analyzed using microradiography (ΔΔZ=ΔZpHC-ΔZbaseline). Compared to NTCs mineral gain [median (Q25/75] was significantly higher in CC [ΔΔZtreatment:-3372 (-4380/-371) vol%×µm; ΔΔZcontrol:-1171 (-3722/-209) vol%×µm; p≤0.05, Wilcoxon] and PAA [ΔΔZtreatment:-2370 (-3780/1248) vol%×µm; ΔΔZcontrol:-1020 (-1588/-216) vol%×µm; p≤0.05, Wilcoxon]. In the other groups, no significant differences between treated and untreated lesions were detected (p≥0.05). CC and PAA seem to promote remineralisation of artificial caries lesions in the tested pHC model.

The authors received no specific funding for this work.

61 Effect of polyacrylic acid on mineralisation processes in artificial enamel lesions

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Infiltration of initial caries lesions with polyacrylic acid (PAA) has been shown to affect mineralisation processes. The aim of this study was to evaluate the effect of PAA concentration on the remineralisation of artificial enamel lesions in a pH cycling (pHC) model in vitro. Enamel specimens were obtained from bovine incisors and artificial caries lesions were created with a demineralisation solution (pH 4.95; 28 d) resulting in two enamel windows separated with varnish. Specimens were randomly allocated to three groups (n=20). One lesion of each specimen was etched (37% H3PO4, 5 s) and infiltrated with PAA (0.1, 1 or 10 mg/ml) while the other lesion served as a non-treated-control (NTC). To obtain a baseline control, specimens were cut perpendicularly to the lesions. The remaining halves were exposed to pHC (21 h/d: pH=7; 3 h/d: pH=4.95) for 28 d. The difference in integrated mineral loss between lesions at baseline and after pHC was analysed using transverse microradiography (ΔΔZ = ΔZpHC - ΔZbaseline). In untreated controls, pHC resulted in moderate mineral gain [median (Q25/Q75); ΔΔZ: 2513 (3718/602) vol%×µm]. Mineral gain was significantly higher in lesions infiltrated with 0.1 mg/ml [ΔΔZ: 4393 (6644/3290) vol%×µm] and 1 mg/ml PAA [ΔΔZ: 2779 (4195/1396) vol%×µm] ($p \leq 0.05$, Wilcoxon), while infiltration with 10 mg/ml [ΔΔZ: 2762 (4275/672) vol%×µm] did not result in significant mineral gain compared to NTC ($p \geq 0.05$). Lower concentrations of PAA seem to have higher remineralising potential in artificial bovine enamel caries lesions.

The authors received no specific funding for this work.

62 Assessment of enamel remineralisation after treatment with different varnishes

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This study aims to compare the different varnishes in the remineralisation of artificial enamel caries lesion in permanent molars. The extracted molars were kept in a 0.1% thymol solution until the experimental procedure was initiated. Forty enamel samples were used in our study. Samples were randomized into 4 groups (n=10) according to their surface hardness: Group 1 (G1): 5% NaF varnish, Group 2 (G2): 1% Rennou (theobromine calcium and phosphate (Ca/P) containing varnish, Group 3 (G3): 3% Rennou varnish, Group 4 (G4): Ca/P containing fluoride varnish (MI Varnish-GC). Each group was subjected to a pH cycling model for 6 d. The Vickers hardness test determined surface microhardness under a load of 200 g for 15 s. Three areas on the midline surface of each specimen were subjected to impressions at each of the three separate times (before treatment, after demineralisation, and after remineralisation) and the percentage of surface microhardness recovery (%SMHR) calculated. In addition, scanning electron microscope (SEM) images were investigated to compare morphological changes on the surfaces and images were obtained at x1000 and x2500 magnification. The collected data was analysed using statistical software (SPSS) and the results were analysed using ANOVA. Multiple comparisons between groups were performed using paired t-tests and post-hoc Tukey tests.

All varnishes exhibited significant remineralisation ($p \leq 0.05$). SMHR% values of G1, G2, G3 and G4 were 377±156, 278±62, 285± 80 and 206±45, respectively. Significant differences in SMHR% were found between the varnishes ($p \leq 0.05$). There was no significant difference between 1% Rennou and 3% Rennou varnish ($p=0.100$). SEM images have also supported the microhardness values. In conclusion, under remineralising in vitro conditions, all varnishes treated artificial enamel caries lesions at different degrees. Theobromine and F with Ca/P varnishes were as effective as NaF varnish in remineralising initial caries lesion.

The authors received no specific funding for this work.

63 A new approach for EDX fluoresence methodology and SEM observations combined with light microscopic analysis

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The principal purpose of this study was to investigate the efficacy of different active ingredients as biomimetic mineralisation on the chemical composition and crystallinity of demineralised dentine samples in vitro.

Thirty-two sound human molars were used. The prepared samples were immersed in a demineralisation solution maintained for 72 h and these samples were randomly divided into 4 groups: surfaces treated with potassium nitrate containing toothpaste (Concentrate Smile, USA) (Group 1), surfaces treated with arginine containing toothpaste (Colgate Pro, Poland) (Group 2), surfaces treated with calciumsodiumphosphosilicate containing toothpaste (Sensodyne Repair and Protect, USA) (Group 3) and control surfaces with no pretreatment (Group 4). Data was statistically analysed using by one way ANOVA (analysis of variance) test and LSD (least significant difference) test for comparison between means at a significance level of 0.05.

SEM-EDX elemental mapping was used to evaluate the degradation from depth profiles of fluoride (F), Calcium (Ca), and phosphate (P) leaching. Micromorphological and elemental analyses were done using SEM and EDX. Light microscope analysis was also performed. SEM EDX analysis on enamel and dentine showed a significant difference between the groups except the control group ($p \leq 0.05$). EDS analysis demonstrated Calcium content within dentine for Group 1 and 3 were with calciumsodiumphosphosilicate and potassium nitrate 36.8±2.3 and 21.9±3.3 respectively ($p=0.083$). In addition, also carbon ($p=0.121$) and oxygen ($p=0.041$) were detected within the precipitates. Elemental analysis showed significant differences in calcium weight percentage among the second and third observation levels in all groups ($p \leq 0.05$).

In conclusion, all tested toothpastes showed some ability to resist demineralisation at the margins.

The authors received no specific funding for this work.

64 Impact of SDF + KI topical application on the remineralisation of deciduous teeth.

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The application of KI following SDF decreases the black staining of silver metal. Previous studies have shown that a multilayer barrier that inhibits demineralisation is formed on the tooth surface by application of SDF. However, it is unclear how the application of KI affects the multilayer barrier and if it interferes with the remineralisation process.

Aim: To understand the effect of SDF+KI application on remineralisation.

A sound-exfoliated deciduous first molar was sectioned into 2 mm x 2 mm enamel blocks. These blocks were demineralised for two hours in 50 ml 0.1 M acetic acid (pH 4.0). After demineralising, one block was treated with 0.25 µl SDF (silver capsule, Riva Star, SDI, Australia). Other block was treated with 0.25 µl SDF (silver capsule) followed by application of KI (green capsule, Riva Star, SDI, Australia). These blocks were separately immersed in 50 ml remineralising solution pH 7.0 (0.222 g CaCl2, 0.163 g KH2PO4, 8.7 g NaCl) at 37^{o}C. Real-time ISE was used to measure the concentration of $Ca2^{+}$ and F^{-} every 2 min for 120 h and plotted against time. Both enamel blocks were 3D-imaged before and after the remineralisation cycle using X-ray microtomography (XMT) to measure the change in mineral density on the surface.

ISE showed that the uptake of $Ca2^{+}$ with SDF after 120 h was 0.69 mM whereas with SDF+KI it was reduced to 0.49 mM. Relative to treatment with SDF alone, samples treated with SDF+KI showed a reduced amount of free-fluoride concentration in solution.

XMT with SDF show radiopacity with mineral density of 2.8 gcm-3 whereas with application of SDF+KI the mineral density is 2 gcm-3.

Although the application of KI following the application of SDF decreases the black staining of carious lesions, it also impacts the multilayer barrier and inhibits the remineralisation process.

The authors received no specific funding for this work.

65 The performance of SoproLIFE for detection of root caries

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Aim: The aim of this study was to evaluate the performance of Light-Induced Fluorescence Evaluator (SoproLIFE) for detection of root caries.

Method: A total of 35 teeth with root carious lesions (RCLs) were included; 62 regions of interest were identified. Visual-tactile assessments and SoproLIFE images were used to classify each region of interest according to clinical criteria used to detect severity index(SI) for RCLs. SI was scored as SI0 for hard lesions, leathery-approaching 'hard' and easily cleansable was SI1, whilst SI2 presented with leathery, shallow cavitated with easily maintained plaque free and SI3 was cavitated where pulpal integrity was judged to be at-risk. The specificity and sensitivity for SoproLIFE diagnosis mode were evaluated.

Results: In visual-tactile assessments, 12 regions were diagnosed as SI0, 31 regions were SI1 whilst 16 were SI2, and three regions were SI3. Inter and intra reproducibility of SI for RCLs were 0.862 and 0.854 respectively ($p \leq 0.001$). The results showed a high reliability in SI for RCLs (Intraclass correlation coefficient=0.949; 95%CI=0.918-0.966, $p \leq 0.001$). A high reliability in SI between two examiners were reported (interclass correlation coefficient=0.85; $p \leq 0.001$). The intra reproducibility of SoproLIFE for RCLs was 0.918 ($p \leq 0.001$). According to the descriptions of SoproLIFE fluorescence codes, the sensitivity was 67% with a specificity at 86% for the SI0 level. The sensitivity and specificity were 64% and 81% respectively at SI1, whilst sensitivity (56%) and specificity (100%) was recorded at SI2. However, at SI3, the low sensitivity was 29% and specificity was 67%.

Conclusion: The performance of SoproLIFE was promising in distinguishing different clinical stages of RCLs. This SoproLIFE could be useful in conjunction with clinical criteria to detect the SI for early root caries in clinical decision-making process however further evidence is required.

The authors received no specific funding for this work.

66 Validity and reliability of OCT in the diagnosis of approximal carious lesions

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The purpose of this in vitro study was to evaluate the validity and reliability of an optical coherence tomography (OCT) intraoral probe for the detection of approximal carious lesions.

Forty extracted human premolars and molars with fifty-six unrestored approximal surfaces were mounted in a patient-equivalent simulator (PK-6, Frasaco) and scanned by digital radiography (DR) and the prototype of an intraoral OCT probe (Medical Laser Center Lübeck/Thorlabs/University of Leipzig: SD-OCT, Telesto-II-SP21, λc=1550 nm). The caries status of the tooth surfaces was validated (sound: 0, caries: enamel, 1-4; dentine, 5) with x-ray microtomography (µCT, reference, Bruker Skyscan 1172), and these findings were additionally compared with histology (Zeiss, Stemi-2000-C). Five calibrated raters with low to high experience analyzed the DR and OCT images at intervals of 2 to 4 weeks each. Intra- and interrater agreement (weighted Cohen's kappa κ, Fleiss' kappa) and sensitivity as well as specificity were calculated.

Intrarater agreements with OCT were moderate to substantial (κ: 0.53-0.77; p≤0.001) and fair to substantial for DR (κ: 0.36-0.78; p≤0.05). The DR interpersonal agreement ranged from slight to substantial for the first and second assessments (κ: 0.1-0.74, Fleiss'-κ: 0.23/0.24; p≤0.001), whereas with OCT agreement was pairwise fair to substantial (κ: 0.27-0.62; Fleiss'-κ: 0.23/0.18; p≤0.001). Agreement between µCT and histology was almost perfect (κ: 0.82; p≤0.001). For all raters, sensitivity was higher for OCT (0.66-0.91) than for DR (0.46-0.82), as were the values for specificity (OCT: 0.67-0.92; DR: 0.33-0.58).

The additional lesions identified by intraoral OCT imaging suggest that radiological approximal caries detection would profit from supplementation with OCT. Training of OCT examiners will improve the quality of the findings.

Funded by EFRE-Grant (100175024) and AIF Project GmbH (ZF4148701CR5).

67 Efficacy of herbal toothpastes containing Moringa Oleifera and hemp on dentine tubule occlusion

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The study aimed to evaluate the occluding/remineralisation performance of herbal toothpastes containing Moringa Oleifera and hemp.

Eighty dentine samples were immersed in 6% citric acid solution for 2 min to expose the dentine tubules. Samples were randomly divided into 8 groups (n=10). Control group (deionized water), (M) experimental toothpaste with Moringa Oleifera (SPC Kozmetik, Turkey), (MF) experimental toothpaste with Moringa Oleifera and fluoride (SPC Kozmetik), (H) experimental toothpaste with hemp (SPC Kozmetik), (MO) Moringa Oleifera oil, (HO) Hemp oil, (S) Sensodyne Repair and Protect (GSK, Ireland), (R) R.O.C.S. Sensitive, Repair and Whitening (R.O.C.S., Russia). Agents were applied to the dentine surfaces using an electric toothbrush (Oral B, Cross Action, Procter&Gamble) for 1 min 3 times a day for 1 week using an erosive cycle model.

Dentine samples were evaluated at baseline, after citric acid exposure, and after treatment stages using microhardness, FluoreCam, DIAGNOdent Pen, ultrasound, optical profilometer, and scanning electron microscope. Data were statistically analysed using ANOVA, Kruskal Wallis H, and Friedman tests ($p \leq 0.05$).

According to FluoreCam data, lesion size decreased in toothpaste groups and increased in herbal oil groups, all groups demonstrated mineral uptake. Herbal toothpastes showed similar microhardness results to conventional toothpastes. The Vickers hardness number (VHN) was significantly lower in MO and HO groups (49.1±3.5; 49.3±3.7) than in toothpaste groups ($p \leq 0.05$). The highest VHN was recorded in S (76.6±2.9) following MF (74.3±4.3); M (71.9±3.35); R (71.8±2.9) and H (68.9±2.8). According to DIAGNOdent Pen and ultrasound results, all treatment groups except herbal oils showed similar results, which were significantly lower than the other groups ($p \leq 0.05$).

According to the study's results, herbal toothpastes containing Moringa Oleifera and hemp were effective in dentine tubule occlusion and may be used to reduce dentine hypersensitivity.

The authors received no specific funding for this work.

68 The efficacy of some commercial desensitizing toothpastes on dentine tubules occlusion and on dentine hardness

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The aim of this study was to evaluate the efficacy of some commercial desensitizing dentifrices on dentine tubules occlusion and on mineral acquisition. Forty human dentine disks were submersed in 40% citric acid for 30 s and then randomly and equally distributed into four groups. In study groups (1-3), the dentine samples were exposed to tooth brushing for 2 min, twice a day, 14 d using three toothpastes slurries: Dontodent Sensitive- group 1, Dr. Wolff's Biorepair- group 2 and Sensodyne Repair and Protect- group 3. Between the tooth brushing sessions, the samples were stored in artificial saliva (AFNOR NF S90-701). In control group (group 4) no toothpaste was applied. All of the samples were evaluated using scanning electron microscopy (SEM), energy-dispersive X-ray (EDX), and Vickers dentine hardness determination. On SEM images the degree of dentinal tubule occlusion was assessed using a five-grade scale. The mean score values in groups 1-4 were: 3.60±0.69, 2.20±0.91, 2.30±1.16, and 5.00±0.00, respectively. Significant statistical results were obtained when comparing the scores in study groups and control group (Kruskal Wallis test $p < 0.05$). On EDX evaluation statistically significant results were obtained when comparing calcium, phosphate, carbon, and oxygen ion concentrations in study groups and control group (ANOVA and Kruskal-Wallis tests $p < 0.05$). The mean values of Vickers dentine hardness number in groups 1-4 were: 243.0±10.0, 327.4±56.7, 260.3±37.7, and 225.8±29.9, respectively. No statistically significant results were obtained when comparing the hardness mean values in groups (Kruskal-Wallis test, $p = 0.372 > 0.05$). All of the tested toothpastes determined significant occlusion of dentinal tubules, but none of them increased dentine hardness as a result of mineral deposition.

This work was co-funded from the European Social Fund-the Human Capital Operational Programme, Project/ Grant No: POCU/993/6/13/154722

69 Does biofilm formation correlate with the numbers of bacterial cells initially attached to a surface?

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Bacterial adhesion is thought to be the first stage of biofilm formation. Does biofilm formation correlate to the numbers of bacterial cells initially attached to a surface? This study aims to address this question by using various Streptococcus mutans strains that differ in salivary agglutinin (SAG) mediated adherence to a surface. SAG-mediated adherence is a cariogenic trait of S. mutans. To this end, 6 S. mutans strains were inoculated in a Calgary biofilm model coated with SAG or the corresponding diluent sodium carbonate. The adhered S. mutans cells were quantified after 1 h and further cultured in a biofilm medium without sucrose for 40 h. The biofilm formation was also quantified. The quantification was based on the fluorescence intensity (FI) of resazurin solutions. Adhesion and biofilm formation of each strain were compared between SAG-coated (specific binding) and uncoated surfaces (unspecific binding), with one-way ANOVA. The data are presented as mean ± standard deviation. S. mutans V403 was the only strain that showed significantly more adhesion (1,267±201 vs. 318±192) and biofilm formation (4,449±1522 vs. 2,515±635) on SAG-coated surfaces compared to uncoated surfaces. Strains C67-1 and HG723 showed significantly more SAG-mediated adhesion (C67-1: 1,132±328 vs. 357±62; HG723: 587±228 vs. 362±132) but biofilm formation was similar on both surfaces (C67-1: 2,649±985 vs. 3,047±427; HG723: 630±467 vs. 954±648). Strain C180-2 and NG8 also showed significantly more SAG-mediated adhesion (C180-2: 1,439±109 vs. 520±80; NG8: 1,349±202 vs. 518±118), but less biofilm formation on SAG-coated surfaces (C180-2: 1,442±671 vs. 2,717±565; NG8: 2,155±255 vs. 2,590±276). Strains UA159 showed weak adhesion to both surfaces (509±206 vs. 548±302) and no biofilm formation (39±61 vs. 25±65). In conclusion, the initial adhesion of an S. mutans strain, irrespective of specific or unspecific binding, does not predict the biofilm formation of that strain.

This study was funded by Department of Preventive Dentistry, Academic Centre for Dentistry Amsterdam, University of Amsterdam and VU University Amsterdam.

70 Evaluation of the variability of supragingival biofilm clinical isolates

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The purpose of this study was to evaluate the variation between clinical isolates from supragingival biofilm based on their biochemical characteristics. Supragingival biofilm samples from consenting patients consulting the department of conservative odontology at the centre of consultation and dental treatment of Rabat, Morocco, were collected to isolate and characterize the bacterial strains. The isolated bacteria were characterised on the basis of their cultural, morphological, and biochemical characteristics. The biochemical tests were carried out using a qualitative micromethod (RapID™ STR system), containing 14 biochemical tests such as arginine and esculin hydrolysis, and carbohydrates fermentation. The results were qualitatively and quantitatively analyzed. Then, Principal Component Analysis (PCA) and K-means Cluster Method were employed in order to analyse and explore the possible correlated variability. 119 clinical isolates were isolated from 32 supragingival biofilm samples. 76% and 43% of the isolates tested positive for lysine and arginine hydrolysis, respectively. Among clinical isolates, acid was produced in 34% from inulin, 18% from raffinose, 16% from sorbitol, and 12% from mannitol, while 66% of the isolates were positive for hydrolysis of ρ-Nitrophenyl-β,D-glucoside (GLU). Furthermore, the K-means clustering analysis identified two distinct clusters based on biochemical profiles. The metabolic profiles associated with amino acid hydrolysis were predominant in cluster 1 whereas acidogenic bacteria were predominant in cluster 2. In conclusion, supragingival biofilm displays distinct biochemical profiles that may depend on the sampling site and among individuals.

The authors received no specific funding for this work.

71 Withdrawn

72 Ratiometric monitoring of extracellular pH at the microscale in in situ-grown dental biofilms exposed to different saliva flow velocities and film thicknesses

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Confocal microscopy-based pH ratiometry has identified steep pH gradients in simplified models of dental biofilm, as well as highly acidic microenvironments associated with caries progression. Saliva flow has an important impact on biofilm pH, but is typically not included in laboratory setups. The aim of the present study was to investigate the impact of saliva flow on microscale pH developments in complex, in situ-grown dental biofilms (n=54; 48 h and 96-h) from healthy participants (n=9). To mimic the oral conditions as closely as possible, a microfluidic flow-cell was employed that provided saliva flow with film thicknesses matching those in the oral cavity. Biofilm acidogenicity was correlated to microbial composition, as determined by 16S rRNA sequencing. Data were analysed using Wilcoxon signed rank tests and Pearson/Spearman correlations. pH drops in the biofilms upon exposure to sucrose were moderate, and more pronounced in 96-h than in 48-h biofilms ($p=0.012$). Biofilm pH was raised by stimulated (8 mm/min and 30 mm/min), but not unstimulated saliva flow (0.8 mm/min). Both vertical and horizontal pH gradients were observed, with lower pH at the biofilm base, and an accumulation of acids downstream. pH was negatively correlated to biofilm thickness (48-h: $p\leq0.0001$; 96-h: $p=0.002$) and positively correlated to the thickness of the saliva film (48-h: $p=0.0008$; 96-h: $p=0.0002$). In biofilms with low pH, neither the species richness nor the abundance of acidogenic genera were increased. However, several genera commonly associated with biofilm maturity were more abundant.

This work was supported by the Danish Dental Association (053).

73 Aerosol formation and potential infectivity of various dental treatments

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The aim of this study was to evaluate the exposure of dental staff to potentially infectious aerosols during dental treatments by determining the amount and proportion of patient-secreted fluids (PSF) in dental aerosols and droplets during different treatment methods in an in-vitro-model. Dental treatments associated with aerosol generation (dental turbine DT, high-speed contra-angle handpiece HP and, ultrasonic scaling US) were simulated in an oral cavity model on a phantom head. Distilled water served as cooling liquid whereas a tracer fluid (TF) (20% NaCl) was used to simulate intra-oral PSF (flow-rate 1ml/min). The produced aerosol was aspirated close to the oral cavity into three measuring chambers filled with distilled water. The amount of absorbed TF was determined by the increase of conductivity in the measuring chamber (n=9-11/group). Sedimenting droplets were also collected and quantified. To determine the total amount of aerosol and droplets, TF was used as cooling liquid in a second experiment. The amount of total aerosol [mean (SD)] was significantly higher in HP [24,247 (3,367) µg/min] compared to DT [13,707 (2,002) µg/min] and US [2,076 (275) µg/min] ($p<0.05$; Bonferroni, ANOVA). No significant differences were found in the salivary content of aerosol between HP [27.9 (4.5) µg/min], DT [27.2 (3.1) µg/min] and US [27.1 (5.1) µg/min] ($p>0.05$; Bonferroni, ANOVA). The amount of total droplets showed no significant differences in between procedures: HP [17,397 (8,312) µg/min], DT [11,033 (3,423) µg/min] and US [6,443 (2,175) µg/min] ($p>0.05$; Bonferroni, ANOVA). The proportion of saliva sedimenting as droplets showed no significant differences: HP [66.0 (39.9) µg/min], DT [100 (80.7) µg/min], US [105 (40.1) µg/min] ($p>0.05$; Bonferroni, ANOVA). HP produced the highest amount of aerosol but in all procedures, only a small proportion of produced aerosols seems to consist of PSF.

The authors received no specific funding for this work.

74 Comparison of two techniques for analyses of cone beam computed tomography measurements of tertiary dentine

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The aim of the study is to compare between two techniques for analyses of cone beam computed tomography (CBCT) scans used for measuring tertiary dentine volume and density and root length increase after indirect pulp therapy (IPT). CBCT scans of 69 young permanent molars were taken initially (T1) and after one year (T2) of IPT. In the new technique-A, the three-dimensional image analysis procedures were performed using ITK-SNAP and 3D Slicer CMF to standardize and register T1 and T2 scans and obtain accurate measurements of tertiary dentine volume (mm^3), grey level intensity and increase in root length (mm) from the created model of the tooth. Root length increase was measured from T1 and T2 tooth models using 3D Slicer CMF. In the traditional technique-B, analyses were done to calculate tertiary dentine thickness (mm) by subtracting the average of minimum and maximum thicknesses of the distance from the cavity floor to the roof of pulp chamber of T1 from T2 scans. Tertiary dentine radiodensity was measured in HU % by taking measurements at the deepest point and at a standard point at nearly same T1 and T2 scans. Root length increase was measured from nearly the same T1 and T2 scans. Paired t-test was used to compare both techniques. There was no significant difference between the two techniques for measurement of reparative dentine mineral density [Mean (SD): A = 22.4 (15.4); B = 24.4 (15.4); p=0.47]; however, technique-A resulted in higher values for root length increase [A = 1.3 (0.6); B = 1.1 (0.5); p=0.03]. In conclusion, both techniques provided similar findings for mineral density; however, the new technique, although more laborious, also allowed for measurement of dentine volume, and resulted in higher values for root length increase.

The authors received no specific funding for this work.

75 Withdrawn

76 Assessment of microtensile bond strength of different caries removal techniques with ICDAS scores

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This study aimed to evaluate the effect of different caries removal techniques and ICDAS scoring to microtensile bond strength (μTBS). Fourty-eight human molars assessed clinically and having scores of 0, 3, 4 and 5 based on International Caries Detection and Assessment System (ICDAS) criteria were inspected. Group ICDAS 0 taken as control for microtensile test. Each group was divided into 4 groups as 1 complete caries removal (CCR) and 3 selective caries removal (SCR) methods: these are stainless-steel round bur (SSRB), ceramic round bur (CRB), tungsten carbide round bur (TCRB) & bioactive glass powder (BAG), TCRB & 29 μm Al_2O_3, respectively (n=3). Following the restoration, five 1 mm^2 stick-shaped specimens were prepared from each tooth with a slow-speed diamond trim blade (Isomet, Buehler, Lake Bluff, Illinois, USA) (n = 15). Specimens were subjected to μTBS stress at a crosshead speed of 0.5 mm/min (Bisco, Schaumburg, IL, USA). Generalized linear model and Tukey's test were used for statistical analysis ($p \leq 0.05$). Caries removal technique was considered significant between all groups ($p \leq 0.001$). The mean of μTBS ranged from 14.2 megapascal (MPa) (%95CI: [12.1-20.5]) to 26.4 (%95 CI:[11.7- 28.4]). The mean±standard deviation of μTBS were obtained as 19.5±3.9 MPa for SSRB, 16.4±3.3 MPa for CRB, 15.0±3.0 MPa for the TCRB&BAG group and 25.1±2.1 MPa for the TCRB&Al2O3 groups, respectively. ICDAS scores showed statistically significant effect for μTBS values ($p \leq 0.001$). Similar μTBS values were obtained for ICDAS 0 (20.1±4.9) and ICDAS 3 (19.9±4.6) scores, which are higher than ICDAS 4 (17.9±4.4) and ICDAS 5 (18.2±5.6) scores. In conclusion, the μTBS for sound dentine were less affected by the caries removal technique. Within the limitations of this study, it can be concluded that the air-abrasion with 29 μm Al_2O_3 may be preferred to increase μTBS for deep carious lesions.

Funded by the Marmara University Scientific Research Projects Commission with the project number TDH-2022-10353.

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Friday, July 7 2023, Morning

77 Snapsnack: taking photographs for registration of food frequency intake, a pilot study

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Frequent consumption of fermentable sugars can cause caries. Charting the diet could help patients manage caries. However, methods to register food intake often result in underreporting of food intake frequency by patients. An easy method to register food frequency intake could be by taking photographs from food with a timestamp using a smartphone. This study examines whether eating and drinking frequency are registered more accurately by means of photographs than by written registration.

Methods. A crossover study was performed with 49 participants (median age 21 years, IQ 9) divided equally into two groups (A and B). Group A recorded their nutrition on day one by taking pictures and on day two by writing down their drink and food intake, while group B did this in the reverse order. In addition, both groups completed a general questionnaire on day three. This study protocol was approved by the ACTA IRB (2018048).

Results. Participants reported a median of 7 (IQ 3) eating and drinking moments per day in writing and 7 (IQ 4) with photographs (two-sided Chi-square test 91, DF=90, N=49, p= 0.43). Most participants (57%) preferred written nutrition registration over photo (27%) or had no preference (16%). The preference for registration indicated on the general questionnaire resulted in a tendency for higher food frequency registration with the preferred method (Kruskal-Wallis test 3.3, DF=2, p= 0.39).

Conclusion. Both registration methods registered equal moments of food intake. However, both were cumbersome and needed professional interpretation. It is suggested a simpler frequency counter of (fermentable carbohydrate) food intake events could result in more reliable registrations.

The authors received no specific funding for this work.

78 An update of practitioners' thresholds for restorative intervention of carious lesions: systematic review

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Evidence and guidelines support noninvasive/nonrestorative management of "early" carious lesions. However a systematic review evaluating dentists/therapists thresholds for restorative intervention, found high levels of intervention where carious lesions are confined to enamel or reach the enamel-dentine junction (EDJ) [Innes et al. J Dent Res;2017:96(5),501-508]. This review update looks for evidence of practitioners' increasing evidence adoption and less early intervention.

Method: Embase, Medline via PubMed, and Web of Science were searched using the original strategy with date restriction: 01/01/16 to 03/01/23. Peer reviewed empirical studies were eligible for inclusion. Relevant systematic reviews underwent citation screening. Papers were screened, selected, data extracted, and citation chaining performed.

Results: Nine studies from nine countries (data collection: 2016-2022) met the inclusion criteria. Seven studies assessed the restorative thresholds for proximal lesions and five for occlusal lesions. For proximal carious lesions confined to enamel (data from seven studies) practitioners reporting they would intervene restoratively: review papers 2016-2022; 26% (704/2,732) and review papers 1983-2016; 30% (5,956/20,097). For proximal lesions that have reached the EDJ, the proportion intervening (5 studies); 2016-2022; 41% (698/1,719) and 1983-2016; 45% (9,131/20,097). For occlusal lesions confined to enamel (data from four studies) practitioners reporting intervening restoratively; 2018-2022; 9% (146/1,539) and in 1983-2016 18% (1,826/10,093). For occlusal lesions including the EDJ in 2018-2022 this was 52% (797/1,539) and for 1983-2016 this was 72% (7,257/10,093).

Conclusions: There was evidence that practitioners might be changing their behaviour towards less invasive restorative interventions for carious lesions confined to enamel or reaching EDJ in line with evidence-based recommendations in guidelines.

The authors received no specific funding for this work.

79 Development of an evidence-based mobile health application for, and with, parents to improve children's oral health

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Improving public access to health information increases opportunities for individuals to take responsibility for self-care. Digital technology has considerable potential to improve health and well-being using mobile technologies such as Mobile Health Apps (MHA). This study, in collaboration with the FDI (World Dental Federation) aimed to work with end-users (parents of children 6 years-old or younger) at the early development stage to co-design an evidence-based prototype MHA to promote oral health for children. Following the favourable ethical opinion attained from Cardiff School of Dentistry (2210a), a snowballing strategy was used to recruit ten (10) parents/carers. Participants completed a questionnaire on demographics and the eHealth Literacy scale. We recorded and transcribed the interviews, which were carried out using "Think Aloud" methodology and guiding questions to capture parents' expectations of the app, integrating these views into the development process. Analysis was conducted using framework thematic analysis. Parents thought the idea of having "all-in-one" reliable app is convenient and time-saving. They highlighted common aspects that they would look for in an app such as information on toothbrushing in terms of type of toothpaste, toothbrush, technique and duration; teething (teeth numbers, symptoms, symptom-relief), diet, pictures of first signs of problems comparing them to healthy teeth; how to find a dentist and how to deal with dental emergencies. National Health Service (NHS) endorsement was suggested to be key to increase the chance of downloading the app. About the design, MHA should be free, simple, with direct and clear information, short texts, should be updated frequently, have a screen with icons for easy search, and interact with children. The suggestions from parents/carers were helpful for guiding the MHA design and to prioritise the content.

Innovation for All, Health and Care Research Wales through Cardiff University.

80 Perception of care worker's oral-related activities of day and night care centres for elderly

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With the rapid aging of Korea, demand for long-term care services for the elderly are increasing. Accordingly, the day and night care centre provide various care activities for the elderly with dementia, but activities related to oral care closely related to the cognitive health of the elderly are limited. Therefore, this study aims to be a basic data for improving oral health of the elderly by grasping oral-related activities and perceptions of facility workers at the day and night care centre. This study passed the ethics review (SM-202207-033-1). The subjects were 222 workers working at the centre, and the survey was conducted through the Google Form questionnaire for about one month from September 2022. Frequency analysis was performed to understand the oral-related perception of workers, and correlation analysis was performed to understand the relationship between dementia perception and oral care needs. First, 88.7% of the subjects recognized oral health as very important, and 72.5% responded that oral-related activities were being conducted at the centre. However, brushing and denture cleaning account for more than 70%, indicating that management is mainly for maintaining the current state, not recovery or preventive management. In addition, 46.8% responded that they had never received oral education at the centre, and there was a lack of specific manuals. Second, the higher the awareness of dementia, the higher the demand for oral care of the elderly with dementia (r=.171, p=0.011), which is thought to be influenced by the experience of caring for the elderly with dementia at the closest distance. In conclusion, it is necessary to develop evidence-based oral programs and activate oral education to improve oral health including prevention of dental caries in the elderly at centres.

This work was supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIT) (No. 2022R1F1A1063262).

81 Qualitative study of older patients' perceptions of root caries treatment with silver diammine fluoride

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Caries treatment with silver diammine fluoride (SDF) leads to irreversible tooth discoloration. This qualitative study investigated the extent to which these discolorations influence the acceptance of SDF treatment of root caries lesions from the perspective of older patients.

Fifteen interviews were conducted with older patients (mean [min/max]: 83 [71/92] years) who had root caries experience following a semi-structured interview guide based on the domains of the Theoretical Domains Framework (TDF) and including case vignettes of SDF treatments. Interview transcripts were used to conduct deductive and inductive content analysis along the TDF and the Capability-Opportunity-Motivation-Behaviour (COM-B) model.

Data saturation was reached and all TDF domains and behavioural determinants of the COM-B were covered, with 22 barriers, facilitators, and conflicting themes towards SDF treatment identified. The main barriers to accepting SDF treatment were lack of knowledge about root caries and SDF treatment (100% interviewees), patients' awareness of permanently discoloured root caries lesions in visible areas (73%), and prejudice about others people's lesions (53%). The most relevant facilitators were the feasibility of treatment in the presence of immobility or need for care (100%), the awareness that aesthetics is less important in non-visible areas (93%), confidence in the practitioner's competence (87%), and the importance of tooth preservation (73%).

In conclusion, permanent discoloration is an important barrier to the acceptance of SDF treatment for visible root caries lesions. Nevertheless, older patients seem to tolerate SDF treatment under certain conditions.

The authors received no funding for this specific work.

82 Association of dental caries according to the dietary pattern of rice

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This study aims to investigate the relationship between white rice, refined starch, and multi-grain rice, which has the characteristics of whole grains, with dental caries using a large-scale sample of Korea. The study analysed the data from Korean National Health and Nutrition Examination Survey Ⅴ-3 (2012) and KNHANES Ⅵ (2012-2015). A total of 11,149 people between the ages of 19 and 64 who answered both the food intake frequency survey and the dental examination were collected. The consumption of rice was classified into 3 groups according to frequency. Logistic regression analysis was performed using IBM SPSS 26.0. It was found that the high group of people who consume white rice was 18.9% more likely to have dental caries than the low group (Odds ratios [OR] = 1.19, 95% confidence intervals [CI] = 1.04-1.36), and the high group of people who consume multi-grain rice was a 26.3% less likely to have dental caries than the low group ([OR] =0.74, [CI] = 0.64-0.84). In addition, when classified by gender, the high group among women who consumed white rice had a 28.6% higher prevalence of having dental caries than the low group ([OR] =1.29, [CI] = 1.10-1.51), and the high group among women who consumed multi-grain rice had a 23.5% lower prevalence of having dental caries than the low group ([OR] = 0.71, [CI] = 0.59-0.84). In men, the high group of men who consume multi-grain rice was found to have 22.3% less likely to have dental caries than the low group ([OR] = 0.78, [CI] = 0.65-0.94). In conclusion, these results suggest that eating multi-grain rice rather than white rice may decrease dental caries.

This work was carried out with the support of the Cooperative Research Program for Agriculture Science and Technology Development (Project No. PJ017104) Rural Development Administration.

83 Trend analysis between interdental cleaning devices and DMFT among the Korean population

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The aim of this study was to explore trends between interdental cleaning devices and Decayed, Missing, and Filled Teeth (DMFT) in adults (19–64 years) and the elderly (≥65 years) using the Korea National Health and Nutrition Examination Survey data from 2007 to 2019 with 72,107 participants. We measured mean scores of the DMFT index and the number of remaining teeth. Moreover, complex sample frequency analysis were performed according to oral health practice variables such as use of dental floss, use of interdental brushes, toothbrushing and oral examinations within a past year. The use of interdental cleaning devices and the number of remaining teeth increased among all age groups over time. Between 2007 and 2019, the use of dental floss increased from 10.9% to 30.9% in adults, and from 0.9% to 8.8% in elderly; the use of interdental brushes increased from 8.7% to 26.1% in adults, and from 3.5% to 20.5% in elderly. The mean scores of Decayed teeth (DT) tends to decreased, while Filled Teeth (FT) tends to increase from 2007 to 2019 in adults and the elderly (adults DT: 0.611 to 0.315, adults FT: 3.505 to 4.758; elderly DT: 0.854 to 0.414, elderly FT: 1.514 to 3.343). The proportion of those who brushed tooth more than twice a day and had an oral examination within a past year did not change much in adults and the elderly during the whole period from 2007 to 2019. In conclusion, the use rate of the interdental cleaning device in Korean adults and the elderly is increasing and substantially impacts the number of remaining teeth. Future oral health education should address the new directions to increase the use of interdental cleaning devices.

The authors received no specific funding for this work.

84 Do air purifiers reduce viral aerosol spreading during simulated caries-related tooth-preserving operative care?

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Aim: To assess the effect of using air purifiers (AP) on droplets and aerosols dispersion during simulated caries-related tooth-preserving-operative care Aerosol Generating Procedures (AGPs) on natural teeth. Methods: Class II/IV cavities were independently prepared (5.5 min) and filled (8 min) to simulate tooth-preserving operative care (n=12) on mannequins and with/without an AP (n=3/group). The AP was used to mitigate aerosol/virus spreading and was positioned between the dentist and the mannequin. Fluorescein (2.65 mmol L−1) or MS2 bacteriophage (1.8x108 plaque forming Units-PFU/mL) solutions were added independently into instrument irrigation reservoirs and used as dispersion or viral tracers. For samples collection filter papers or Escherichia coli C600 cultures in double-layer TSA agar were placed on plastic bands at different angles and distances (up to 2 m) from the AGP source. Relative-Fluorescent-Units (RFUs) from filter papers were quantified by Image-J. Bacteriophage quantification was conducted by conventional plaque assay (PFUs) and reverse transcription quantitative polymerase chain reaction (RT-qPCR). Differences between groups were assessed (U-Mann-Whitney test). Results: Without AP, AGPs from anterior restorations induced a significantly higher (≥32%) amount of RFUs than posterior-tooth AGPs up to 150 cm ($p \leq 0.05$). Decreasing RFUs were observed when AP was used within 30-60-90-150cm for anterior (43%) and posterior teeth (38%) ($p \leq 0.05$). Moreover, the AP reduced bacteriophage detection (PFUs average), however differences were not significant statistically ($p \geq 0.05$). Surprisingly, MS2 genome amplification was found even in absence of PFUs (23%). Differential sensitivity to detect bacteriophage genome between RT-qPCR and plaque assays indicate that although the viral genome achieved these positions nonviable microorganisms were present. Conclusion: Even though the air purifier reduced the aerosol and droplets' dispersion during AGPs, the effect on viral load was not significantly better than when not using it.

Funded by Universidad El Bosque; Newcastle University

85 Macedonian pregnant women's knowledge and attitudes about oral health

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This cross-sectional study aimed to evaluate attitudes and knowledge regarding oral health and infant oral health among pregnant women. The study involved 130 pregnant women in the Republic of North Macedonia who completed an anonymous online questionnaire (Google forms) from January to June 2022. The questionnaire was divided into three parts. The first part contained questions about the general demographic data of the respondents and their own experience about oral health in pregnancy. The second part was related to the knowledge of the relationship between oral health and pregnancy. The third section consisted of questions related to knowledge about the oral health of children at the earliest age. The results were analysed with descriptive statistics. The study involved 130 pregnant 19 to 42 years old women. The women are most informed about oral health in pregnancy from their dentists (30.8 %), but least from doctor of family medicine (3.1%). In pregnancy, gingival bleeding was observed by 60.8 % of respondents and tooth mobility by 22.3 %. The chi-square test found that there was a difference in attitude regarding the age at which they should stop breastfeeding between respondents who had their first pregnancy and those who already had children (Chi square value =13.216, p= 0.004, $p \leq 0.05$). Only 20.5 % of respondents are aware that breastfeeding can cause tooth decay. The majority of pregnant women who are pregnant for the first time believe that they should stop breastfeeding from the 9th to the 12th month of the child's life, and the largest number of those who already have children believe that breastfeeding should be stopped when the child begins to refused it. Pregnant women in the Republic of North Macedonia do not have sufficient knowledge of oral health.

The authors received no specific funding for this work.

86 Dental caries factors in children aged 18 months in a core city of Japan

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Dental caries is one of the most common chronic diseases worldwide that affects children as well as conditions later in adulthood. Therefore, it is very important to clarify factors related to early childhood caries (ECC). However, few studies regarding ECC have been conducted in developed countries, because the prevalence is low and a large-scale survey is needed to clarify the finding. The present study investigated the prevalence and risk factors of dental caries in children aged 18 months in a core city of Japan. The study protocol was approved by the Ethics Committee of Osaka University Graduate School of Dentistry (number R2-E25). Finding from a total of 7351 children aged 18 months who underwent a physical examination that was offered at public healthcare centres in Toyonaka City from April 2018 to March 2020 were analysed. Anthropometric measurements of height and weight, as well as an oral examination and colorimetric caries-risk test were performed. In addition, a structured self-administered interview sheet was provided directly to the parents or guardians. Finding of dental caries at 18 months of age were evaluated by univariate and multivariate analysis using a logistic regression model. Of the enrolled children, 1.2% had experienced dental caries. Multivariable logistic regression analysis results indicated that birth order ($p \leq 0.05$), number of erupted teeth ($p \leq 0.01$), and colorimetric caries-risk test results ($p \leq 0.001$), as well as eating before bed ($p \leq 0.01$), snacking ($p \leq 0.05$), and breastfeeding ($p \leq 0.001$) were significantly associated with caries experiences at 18 months of age. These results suggested that birth order and the number of erupted teeth, as well as lifestyle issues, can be significant factors for dental caries development at 18 months of age.

This work was supported by KAKENHI research project grants (22K10268) from the Japan Society for the Promotion of Science.

87 Consequences of untreated dental caries in a vulnerable population in the Netherlands

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The basic health insurance in the Netherlands does not cover oral healthcare for adults. Many socio-economically vulnerable adults and those living in poverty forgo routine oral healthcare in the general dental practice, despite experiencing a high oral disease burden. Consequently, information on the oral health status of this particular population is scarce. The aim of this study was therefore to report the prevalence and clinical consequences of untreated caries and associated Oral Health Related Quality of Life (OHRQoL) in a Dutch population of vulnerable adults who forgo routine professional oral healthcare in the general dental practice.

Participants were recruited from four nongovernment organizations (NGOs) in five locations. Data was collected on untreated dental caries and by means of the PUFA index, the Deprivation in primary care questionnaire (DiPCare-Q) and the Oral Health Impact Profile 14 (OHIP-14) to describe the population. The protocol was approved by the ACTA IRB, registration number 2021-14626.

Fifty-nine adult individuals with a mean age of 42.5 years (SD=12.9; range: 21-66; 95%CI [39.0- 45.9]) were analysed. The prevalence of untreated dental caries was 66% of which nearly 60% experienced PUFA conditions. The total PUFA prevalence was 46%. The mean OHIP-14 score of 17.7±13.4 (95%CI [14.1-21.4]) illustrated a high impact on OHRQoL. Individuals who experienced clinical consequences of untreated caries reported a significantly higher OHIP-14 score (21.8±14.8, 95%CI [15.6–27.9] vs. 11.1±7.2, 95%CI: [8.1–14.1], p≤0.05).

In conclusion, serious odontogenic infections were present in most individuals, with distinct effects on their OHRQoL. These results emphasize the urgency to implement primary dental care services for these socio-economically vulnerable adults. Future studies should aim to explore barriers and facilitators in the access to oral healthcare for this population.

The authors received no specific funding for this work.

88 Herbal mouthrinses for prevention of dental caries in children and adolescents – a systematic review

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The primary aim of this study was to evaluate the effectiveness of herbal mouth rinses (HMR) on caries prevention in children and adolescents. In addition, this systematic review assessed its effectiveness in remineralisation of white spot lesions, reduction of halitosis, and improving gingival and periodontal health in orthodontic patients and patients with special health care needs. A comprehensive bibliographic search was conducted in PubMed, Cochrane Central, EMBASE, AMED, ProQuest, CINAHL, AYUSH, DHARA, and Clinical Trial Gov databases. A total of 3918 titles were identified during the initial search. Of these, 32 studies were selected for quality assessment. A total of 5038 participants from 10 countries were thus included in this review with 22 (66.7%) studies conducted in India. All included studies were published between 2004 to 2021. Included studies investigated the effect of HMR on caries increments, which records DMF (ICDAS), DMFT/S, and Incipient caries. Changes in bacterial count (Streptococcus mutans, and Lactobacillus) and alterations in levels of Candida albicans from saliva or plaque samples were also reported. The effect of herbal mouth rinses on gingival and plaque indices among adolescents undergoing orthodontic treatment and children with special health care needs were reported in 2 studies. No studies reported the effect of HMR on remineralisation of white spots and on improvement in halitosis. There are evidences that herbal mouth rinses may be effective in altering S. mutans levels. The heterogeneity of the data precluded precise conclusions to be drawn. This warrants high-quality randomised controlled trials with longer intervention periods involving children below 6 years to yield more conclusive results.

This systematic review was a funded project by Indian Council of Medical Research (ICMR).

89 Latin American consensus in Spanish of cariology teaching for dental schools

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Aim: To achieve a consensus of cariology teaching in Spanish for dental schools in Latin America in response to the 2021 Latin American Oral Health Association (LAOHA) Call-to-Action to improve regional oral health.

Methods: The Delphi consensus methodology used included three phases. The Preparation phase (1st) consisted of selecting the participants and designing the baseline Cariology teaching document (2021). Four regional groups were selected: 1-Coordinator Group (RCG), 2-Institutions' Expert Panel (RIEP), 3-Dental Schools' Expert Panel (DSEP) -inviting all regional Spanish-speaking and English-speaking dental schools: n=265, 21 countries, and 4-Expert External Peers (EPP). The RCG developed a baseline Cariology teaching document [including Domains, Main Competences (MC) and Specific Competences (SC)] based on consensus documents from Europe, Colombia, the Caribbean, USA, Chile and Spain. 2nd phase: Consultation and Agreements. A participants' agreement of ³80% was previously defined. After a step-wise sharing of the updated consensus document version with all parties using diverse communication strategies (RIEP: MC and SC google-form questionnaires, and two online workshops; DSEP: MC google-form questionnaires), agreements were achieved throughout 2022. 3rd phase: Consensus. This was reached after a RIEP MC and SC on-site workshop, followed by an online meeting with the EPP.

Results: 132 individuals participated, representing 129 academic/professional institutions [RCG+ RIEP=13; DSEP=112 dental schools (42.3%, 20 countries), and 4 EPP members]. The baseline Cariology teaching document of 5 Domains, 10 MC and 92 SC underwent modifications after agreement with the RIEP and DSEP, and consensus with the RIEP and EPP, for a final consensus document consisting of 5 domains, 10 MC and 85 SC (October 2022).

Conclusion: A Latin American Spanish Consensus document of Cariology Teaching for Dental Schools was successfully developed, with participation from regional dental academic and professional institutions.

This study was co-funded by LAOHA and Universidad El Bosque. Participating institutions: LAOHA Core team, UNICA, LAOHA Action 2 Core Team, IADR LAR Cariology Group, IADR LAR GLIOC, ALODYB, OFEDO/UDUAL, ACODEB, ACP, FOC, FOLA, LARO, ORCA, Education Platform ORCA, FDI, IAPD, AFLC Colombia, COHI, and 113 Latin American Dental Schools. 2 Core team, UNICA, AFLC-CC, Caribbean Oral Health Initiative (COHI)

90 Consensus for teaching dental caries in Portuguese language for Brazilian dental schools

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Aim: To achieve a national consensus in Portuguese for teaching dental caries for undergraduate Brazilian dental students.

Methods: The consensus is a result of the October-2021 Call-for-Action promoted by the Latin American Oral Health Association (LAOHA) and the Brazilian Association of Dental Education (ABENO). The final document was developed in three steps: A) Experts (Cariology, Operative Dentistry, Pediatric Dentistry, Public Health, and Dental Education) from all five regions of Brazil were invited by ABENO and LAOHA cariology group. The theoretical support for crafting the first draft of the consensus was based in two publications: National Curriculum Guidelines of the Dentistry graduation in Brazil, Ministry of Education (2021) and the European core curriculum in cariology, ORCA-ADEE (2011); B) The core team was divided into 5 working groups: G1-Domain, Main and Specific Competences, G2- Essential knowledge, G3-Life course perspective, G4-Social determinants and dental caries, G5- Glossary. The background document finalized by undergoing a thorough reviewing process using Delphi methodology; C) The 5-chapter document was submitted to three public consultations in 2022 (May-June, August, and October) using a Google-forms. The suggestions (content or wording) were later discussed within the core group as: totally accepted, partially accepted, and rejected.

Results: A total of 192 suggestions were registered from 31 dental faculties from all regions of Brazil. The distribution of suggestions by chapters were: 84, 28, 26, 24, 30 for G1, G2, G3, G4 and G5, respectively. Most of the suggestions were totally accepted by the core group (n=172, 89.6%), 15 were partially accepted (7.8%) and only 5 were rejected. Conclusion: The final document is regarded as the first national consensus for teaching dental caries in Brazil

This study was co-funded by LAOHA, ABENO and LAOHA Action 3 Core Team. This material was also discussed and revised by Dr. Stefania Martignon from UNICA. Special thanks go to SPBqO (Brazilian IADR Division), GBPD (Brazilian Group of Dentistry Teachers), ABRASCO (Brazilian Association of Collective Health) and GBPOO (Brazilian Group of Orthodontics and Pedodontics Teachers) for their great contribution.

91 Minimal invasive treatment choice based on macroscopic and histological image diagnosis by dentists and students

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Aim: Identify difference in caries diagnosis and minimal-invasive approach treatment choice among dentists and students in Moscow

Material: Occlusal surface images (n=28) of extracted molars and its sections through the central fossa in magnification 2.5 with a spectrum of lesions according to ICDAS were used. The examiners (n=98), dental students (STUD-group), dentists from preventive (PREV-group) and cariology (CAR-group) university departments, public (PUB-group) and private (PRIV-group) clinics, diagnosed the lesion from macroscopic image, chose minimal-invasive or traditional treatment; checked histological image and repeat-diagnosis, and treatment choice. Examiners' reproducibility was measured by Kappa. To compare caries diagnosis and treatment choice distribution within groups, Chi-square test was used.

Results: Intra- and inter-examiner reliability of trained dentists (IK,DS) was 0.95 and 0.90; in groups varied 0.76-0.85 and 0.58-0.66, respectively. The macroscopic diagnosis compared to histological changed in PREV-group ($p=0.043$, Chi-square) and STUD-group ($p=0.004$) to less prominent stage of caries. PREV-group showed no significant change in treatment methods after histological examination ($p=0.583$), but with higher percentage of non-and-minimal-invasive (44% and 27%) versus traditional treatment (29%) choice. CAR-group corresponding figures were 24%, 21% and 55%; but treatment decision changed ($p<0.001$) to less invasive approach. No change observed in PUB-group ($p=0.566$) with prevalent traditional treatment (58%). PRIV-group changed treatment ($p=0.016$) from minimal-invasive to non-invasive techniques. No change observed in STUD-group ($p=0.986$), but higher choice of non-and-minimal invasive methods (40% and 34%). Interviewed dentists would favour minimal-invasive approach (33% PUB-group to 91% PRIV-group), most influencing factors mentioned were patient responsibility (54%-87%) and age (53%-75%), followed by technique availability (18%-68%) and cost-coverage (9%-53%).

Conclusion: There are diverse approaches to caries diagnosis and minimal-invasive treatment choices between different types of clinics. Dentists tend to change their treatment approach to minimal-invasive by better understanding the histological process.

The authors received no specific funding for this work.

92 Attitude and practice of faculty members toward “Minimal Invasive Dentistry”: A study in Iran and Turkey

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The adoption of a conservative approach towards dental treatments is becoming increasingly popular among dentists. However, the views of academicians regarding this approach are still unknown. The present study aimed to assess the attitudes and practices of Iranian and Turkish faculty members towards Minimally Invasive Dentistry (MID). A total of 342 faculty members from two universities were invited to participate in the study.

The researchers-made questionnaire included questions about the effectiveness of prevention techniques in primary and permanent dentition, MID methods and principles, and awareness about new caries diagnostic tools. Descriptive analyses and comparison tests were conducted using SPSS 26, including Mann-Whitney U and Chi-square tests to compare the two samples.

Of the 328 participants who completed the survey, 100 were Iranian and 228 were Turkish faculty members. A significant difference was observed between the percentage of Iranian and Turkish participants who had completed courses in conservative dentistry (37% and 58%, respectively; $p \leq 0.001$). However, there was no significant difference in attitude scores between them ($p = 0.8$). While the use of topical fluoride was more common among Iranians, other prevention substances and techniques were more commonly used by Turkish faculty members. Moreover, approximately 83% of Turkish and 60% of Iranian specialists who participated in the survey were accustomed to using blunt instruments for caries detection.

Overall, the study found that there was a moderate to good level of positive attitude towards preventive and minimally invasive dentistry among faculty members in Iranian and Turkish dental schools. These attitudes were not consistently reflected in the professors' clinical practice. Additionally, the use of materials and equipment for MID was more prominent among Turkish professors than Iranian, indicating a need for further training in clinical practices that align with the principles of MID.

This project was partially supported by the Research Bureau of Isfahan University of Medical Sciences Grant #199640 at the Iranian part.

93 Silver diammine fluoride use among Italian dentists: a questionnaire survey

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Silver diammine fluoride (SDF) is an inexpensive and minimally invasive agent used to arrest caries lesions. The aim of this cross-sectional survey was to investigate the educational experiences, knowledge, attitudes and professional behaviour of Italian dentists regarding SDF use. A pre-tested and validated questionnaire was made available online. A total of 2,733 dentists responded (86.2% private); more than half (54.0%) had more than 20 years of work experience. Only 7.0% of the responders reported that they had been instructed well/very well in the use of SDF during the under-graduate course and only 8.5% during post-graduate courses. Knowledge about SDF after graduation was learned through online resources (18.8%), publications (14.8%) and continuing education courses (10.8%). A minority of responders knew very/very much about the application of SDF for the treatment of hypersensitivity (18.8%), for the treatment of caries in children (21.5%) and for the treatment of caries in adults (15.3%). The use of SDF was considered appropriate for non-cavitated caries lesions (62.8%), for cavitated enamel lesions (61.9%), for cavitated dentine lesions (41.0%) and for root caries lesions (37.2%). It was also considered a good alternative for the treatment of caries in uncooperative patients (59.5%) and for special-needs patients (44.5%). Among the respondents, only 6.4% affirmed to use SDF often/very often to arrest lesions in primary teeth, although 73.5% of the responders plan to use it in the near future. The more university training in SDF the responders had, the more likely they were to use it in primary teeth ($p \leq 0.01$).

These results suggest that more education on the use of SDF is needed among Italian dentists in order to increase its use in the future.

The authors received no specific funding for this work.

94 Caries risk assessment by Dutch dental students

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Objectives: Individual caries risk assessment (CRA) is essential for targeted caries management at both preventive and therapeutic levels. This study explores the knowledge and use of CRA by Dutch dental students.

Methods: A total of 213 fifth-year dental students from three dental schools in the Netherlands (Amsterdam (n=119), Groningen (n=44) and Nijmegen (n=50)) were invited to participate. Data was collected using a survey.

Results: This survey was completed by 118 students (55%). All respondents reported using CRA on a regular basis, although only part of them reported applying it on both primary/mixed and permanent dentitions (Amsterdam 67% vs. Groningen 45% vs. Nijmegen 86%; $\chi2=18.671$, $p\leq0.001$). Almost all respondents tailored the frequency of dental visits (96%) and preventive strategies (99%) based on CRA, while 18% of them indicated not to base individual treatment plans on CRA. Oral hygiene, diet as well as active and recent carious lesions were considered as the most important factors in CRA for all patients, regardless of their age (no statistical differences among schools). The interest for continuing education on CRA significantly differed among the three schools (Amsterdam 47% vs. Groningen 61% vs. Nijmegen 24%; $\chi2=14.597$, $p=0.006$). Students that did not use CRA in all patient groups were more likely to express an interest for continuing education on CRA ($\chi2=3.928$, $p=0.047$).

Conclusions: Dutch dental students report a rather similar knowledge on CRA between schools. However, the recently intensified collaboration between the dental schools could homogenize the training of dental students even further.

The authors received no specific funding for this work.

95 The inter-rater reliability of oral hygiene students and lecturers assessing preclinical cavity preparation exams.

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BACKGROUND: During cavity preparation students are assessed on each preparation step. The level of agreement among lecturers or students on these assessments is unknown.

AIM: Assess the inter-examiner reliability between individual examiners or students during preclinical cavity preparation exams and the consensus assessment.

METHODS: Data comprised 31 preclinical cavity preparation exams by 3rd year oral hygiene students. Cavity preparations were assessed on outline, enamel-dentine junction, bottom and overall pass or fail by the student and the examiners present. Consensus was determined by at least two examiners including one expert by verifying, perceiving and observing the described criteria together. The inter-examiner reliabilities between students' or examiners' assessments and consensus assessments were determined using the kappa on crosstabs (IBM SPSS 24).

RESULTS: Agreement for individual students with the consensus assessments for the different preparation steps was poor to moderate (kappa 0.045-0.679). Agreement for experienced lecturers with the consensus was moderate to excellent (kappa 0.539-1), while for unexperienced lecturers it was poor to good (kappa 0.222-0.889). Students were poor at predicting a pass or fail on the test (kappa 0.061), while experienced examiners had good to excellent agreement (kappa 0.854-1) and more unexperienced lecturers had poor to good agreement with the consensus (kappa 0.417-0.735).

CONCLUSION: Working with a consensus assessment during cavity preparation exams provides a more solid grounded decision for this exam. By making a consensus agreement, individual items can be reassessed or discussed and consequently included in the final consensus assessment. The inter-examiner differences observed ask for continuous attention during teaching, exams and among lecturers/examiners in order to get an individual assessment generally as close as possible to the consensus assessment. Practicing consensus assessments with students may improve their self-assessment skills.

The authors received no specific funding for this work.

96 Where do we put the money for implementing active learning on caries detection?

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This study aimed to estimate the incremental cost of implementing a theoretical-practical workshop for training undergraduate students in caries detection to substitute the theoretical activity solely. We also provided a budget impact analysis and explored the final cost composition related to the activity. This economic evaluation was based on data from a randomized and controlled study (CEP-FOUSP:99.071/1.0114.991). The educational activity (theoretical-practical workshop) involved 4 stages: preparation of didactic materials (2 h), tutors' training and calibration (1.5 h), theoretical class (1 h) and workshop training, with the assessment of images and extracted teeth (1.5 h). The resources were valued in Brazilian Real using a microcosting strategy assuming a group of 80 undergraduate students. The cost was converted into international dollars using PPP. The incremental cost per student for implementing the laboratory activity in addition to the theoretical class was estimated. The total cost for implementing the complete strategy in 80 students (organizational budget impact) was also calculated. Monte-Carlo simulations were used to estimate the uncertainties. The incremental cost for the workshop implementation would be $7.93 per student (interquartile interval- IQI: $7.8-8.1). The total cost of the complete educational activity would be approximately $ 684 (IQI: 672-696) for a group of 80 students. Students' laboratory training comprised more than 50% of the total cost. A higher percentage of this value was related to human resources costs (72%). Saving up to 40% could be expected for the next rounds of activities, assuming no need for additional preparation of didactic material and tutors' training. Although the incremental cost per student of the proposed educational activity implementation is relatively low, when really implementing, an organizational budget impact should be expected mainly related to the human resources involved.

CNPq 16974/2021-8, 400736/2014, CAPES, FAPESP (2011/16415-0, 2013/27206¬8)

97 Effectiveness of dental faculty education intervention in caries management

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There has been a paradigm shift in caries management towards preventive and minimal intervention. Agreement among dental faculty (licensed dentists, henceforth termed “faculty”), enhanced by faculty education, is paramount to student training aligned with current protocols.

Aim: To assess the effectiveness of webinar-based faculty education interventions through surveying their agreement on three caries management topics. Clinical faculty (n=63) were invited to three twenty-minute educational webinars and answer questions related to: A) threshold of surgical intervention for caries management; B) repair or restore decision; and C) selective caries excavation. For each topic, faculty were asked three knowledge-based and three treatment-decision questions with four possible answers each. Frequency of responses and Cohen’s kappa scores for intra-faculty agreement between pre- and post-intervention responses were calculated.

Results: Of the 29-consenting faculty (n=29), 50% had graduated ≥25 years ago, 52% had been academics for 6-15 years, and 59% were in private practice.

For topic A, the webinar had an inconsistent impact on treatment decisions for both high-caries-risk (kappa range 0.5 to 0.7) and low-caries-risk cases (kappa range 0.4 to 0.8).

For topic B, the webinar had high impact on knowledge-based questions (kappa ≤0.4) but little impact on treatment-decision questions (kappa ≥0.7).

For topic C, the webinar had an inconsistent impact on both knowledge and treatment-decision questions (kappa range -0.2 to 0.5).

For the nine knowledge-based questions, correct answers increased post-webinar in eight instances, (9.5% to 77.0%). For the nine treatment-decision questions, correct answers increased post-webinar for six questions (3.9% to 37.8%).

Conclusion: The impact of this educational intervention was overall positive, but varied with the complexity of the clinical case and topic. To improve faculty calibration, particularly in complex topics, focused interventions are warranted.

The authors received no specific funding for this work.

Session 6
ORCA Nathan Cochrane Junior Scientist Award part 2

Friday, July 7 2023, Afternoon

98 Impact of silver diammine fluoride use on the need for dental general anaesthesia treatment in children

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Silver diammine fluoride (SDF) has been reintroduced in dentistry, frequently for treating high caries-risk young patients who are unable to tolerate conventional, invasive restorative treatments.

This study aimed to analyse the impact of 38%-SDF application on the need for dental general anaesthesia (DGA) treatments in children in a German university dental setting.

Data from 1–8-year-olds who were treated with 38%-SDF between 2019-2021, with/without referral to DGA, high caries risk, and/or were unable to tolerate invasive chairside caries treatments were extracted from patients' clinical dental records. Data from patients presenting with irreversible pulp involvement at baseline were excluded. Outcome measures were reduction of DGAs and tooth-level clinical failures (minor: reversible pulpitis, caries progression, etc. and major: irreversible pulpitis, abscess, etc.). Descriptive analysis, sample proportion test, and Kaplan-Meier survival analysis were performed.

In total, 65 patients (mean age= 4.3±1.6 yr.; dmft/DMFT= 6±4.2/0.7±1) with 339 treated teeth (99.4% primary, 0.6% permanent) were included. All 38%-SDF treated teeth were diagnosed as ICDAS 3-6.

At the 2-year follow-up (23.4±12.5 months), the majority (58/65) of DGA eligible children were treated chairside, while 7/65 children still needed DGA, resulting in an 89.2% DGAs reduction in eligible patients. At the tooth level, most 38%-SDF treated teeth (n=302, 88.8%) did not show any failure. There were 38 teeth (11.2%) presenting with major failures, and no minor failures were reported (p=.001). Regarding reported complications, there were 5 (7.7%) cases reporting minor sensitivity with immediately relief during 38%-SDF application.

In conclusion, 38%-SDF was effective for caries management of young children with high caries-risk and high dental-treatment need without the need for DGA. Hence its use should be considered as a caries management option to avoid the risk of DGA.

The authors received no specific funding for this work.

99 Differential learning vs. conventional method in improving tooth brushing in children: a randomized controlled trial

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Aim of this study was to investigate the effect of home-based differential learning for improving tooth brushing in children (NCT04905784). 58 caries risk children (3-8 years, mean age 5.7±1.5, 29 female) were randomly assigned to test or control groups by letting the child draw an unlabelled envelope from a box. All children received tooth brushing instructions and information in these sealed envelopes and were asked to follow these instructions at home. The children in the test group received additional instructions with exercises using differential learning. At baseline and follow-ups after 4 and 12 weeks, plaque and papillary bleeding indices (QHI, PBI) were collected. Statistical analysis included means, standard deviations and a comparison with t-tests. At baseline, there were no significant differences between test and control group (QHI: 4.1±0.5 vs. 4.1±0.4; p=0.7; PBI: 0.6±0.3 vs. 0.6±0.3; p=0.7). At the 1st follow-up, both groups showed improvement of QHI, but without significant difference (QHI/test: 2.1±0.9; control: 2.6±0.9; p=0.07). In contrast, there was already a statistical significant difference regarding gingivitis (PBI/test: 0.1±0.2 vs. control: 0.3±0.2; p≤0.001). At the 2nd follow-up, the test group (n=24) showed statistically significant and clinically relevant better oral health indices than the control group (n=22; QHI/test: 2.1±0.9 vs. control: 3.2±1; p≤0.001; PBI/test: 0.1±0.2 vs. control: 0.5±0.2; p≤0.001). In conclusion, differential learning led to oral hygiene improvements even in children with high caries risk and initially poor oral hygiene, which was superior to the conventional learning method through repetition in the medium term.

The authors received no specific funding for this work.

100 Oral health and dental anxiety in recall patients in a specialised pedodontic university clinic

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Objective: to assess the patient profile (oral health and dental anxiety) of recall patients in a specialized pedodontic service.

Methods: This questionnaire and dental record based study is part of a RCT (randomised controlled trial) to assess the motivational effect of choosing the taste of a fluoride varnish (Profluorid, VOCO GmbH, Germany) in schoolchildren (NCT05285228). 70 healthy children aged between 5 - 10 years who presented for a dental check-up to the specialized pedodontic department at Greifswald University, for whom an application of fluoride varnish is indicated, were included. The accompanying parent (n=70) was asked to evaluate dental anxiety dichotomously with a single question (yes or no) and the oral health status (good, satisfying, poor). Caries risk was categorized according to the caries experience based on WHO suggestion ("very low/low" when dmft ≤ 2.6; "moderate" when dmft between 2.7-4.4; "high/very high" when dmft ≥ 4.5).

Results: An overall frequency of dental anxiety of 40% (n= 28) according to the parental report was found. Only 39% of the 5 - 10 year-old children belonged to the low/very low caries risk category, while 35% belonged to the high/very high risk group. Dental anxiety was significantly associated with the caries risk (p=0.030, chi-square test). Parental assessment of the oral health status of the schoolchildren and caries risk level according to the dmft-index showed also a statistically significant association (p=0.020; chi-square test). Still, the oral health of 8 children (11%) was rated as good by the parent despite high/very high caries experience.

Conclusion: The parental evaluation of the oral health status of their children might not always be adequate, still dental anxiety in children is clearly associated with higher caries experience.

This study was partially financially supported by VOCO GmbH, Germany.

101 The effect of different sweeteners on oral microbiome: a clinical exploratory pilot study

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Introduction: An unbalanced diet can affect oral health; however, there are food components that could benefit oral health. The aim of the study was to evaluate the effects of five different commonly used sweetener containing (10% solution) mouth rinses (glucose, inulin, palatinose, tagatose, trehalose) on the oral microbiome. Methods: The study was designed as a single-centre, double-blind, parallel randomized clinical trial. Healthy 18–55 year-old volunteers (N=65) rinsed twice-daily for 2 weeks with one randomly assigned solution. Samples were collected from the tongue dorsum and the upper molars. Amplicon sequencing of the V4 hypervariable region of the 16S rRNA gene was performed (Illumina Miseq). The representative sequence of the zero-radius operational taxonomic units (zOTUs) were assigned using the HOMD database and the RDP classifier. As secondary outcome, the pH of unstimulated saliva was measured. All outcomes were recorded 6 times during the 2-week period. Results: PERMANOVA analysis using robust-Aitchison distance showed significant plaque microbiome changes for three groups: inulin ($F=1.864$, $p\leq0.001$), palatinose ($F=0.848$, $p=0.005$), tagatose ($F=1.106$, $p=0.027$), while tongue microbiome did not change significantly during the study period. ANOVA-like differential expression analysis (ALDEx2) using Benjamini-Hochberg correction for multiple comparisons revealed significant changes only within inulin group for one zOTU Streptococcus sanguinis (effect=1.388, $p=0.086$); additional two zOTU's had an effect size greater than $|1|$: Granulicatella adiacens (1.135), and Corynebacterium matruchotii (-1.014). No significant changes were observed for secondary outcomes. Conclusion: After the use of an inulin mouth rinse, the differential (relative) abundance of Streptococcus sanguinis and Granulicatella adiacens were higher, but were not associated with changes in salivary pH. A reduction of plaque forming bacteria, such as Corynebacterium matruchotii, was observed, suggesting plaque-modulating effects. Further full-scale clinical studies are required for assessment of clinical effects.

The collaboration project between ACTA and TNO was co-funded by the PPP Allowance made available by Health~Holland, Top Sector Life Sciences & Health, to stimulate public-private partnerships. The project was further co-funded by GSK and Philips. Additional support was received from Ministry of Economic Affairs and Climate Policy (The Netherlands).

102 Variations in salivary composition upon a single protein-rich food ingestion; a pilot study.

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Despite limited evidence, diet may influence saliva composition, and in turn, affect caries outcomes, either locally upon consumption or later through a systemic effect due to nutrient absorption. We, therefore, aimed at exploring the effect of a single dose of a high-protein food on caries-related salivary biochemical composition.

Four healthy participants (2 women and 2 men) donated 1.5 mL of saliva after fasting for 8 h, at 9:00 AM (baseline). Participants ate 7 boiled chicken egg whites (approximately 25 g of protein). Unstimulated saliva samples (1.5 mL) were collected at 5, 10, 20, 30, 60, 120, and 240 min after high-protein consumption. At each time-point, caries-associated biochemical substances, i.e., phosphate, calcium, lactate, nitrate, nitrite, and ammonium were assessed, using a spectrophotometer (Reflectometer, RQflex) with reactive strips. Salivary pH and buffer capacity were also determined at each time-point. Differences were estimated with ANOVA and Tukey as Post hoc ($p \leq 0.05$).

At 5 min after egg white consumption, pH increased from 6.90±0.09 to 7.33±0.07 ($p \leq 0.05$). Non-significant changes in buffer capacity were detected. Different phosphate levels were observed across the sample, with differences between women and men at the first time-points, but without statistical significance. Although not significant, lactate had an initial peak at 5 min, from 12.5±12.66 mg/L to 22.4±11.96 mg/L and a late peak between at 240 min (17.3±1.9 mg/L) ($p \geq 0.05$). Calcium, ammonium, nitrate and nitrite did not show a consistent pattern across the participants ($p \geq 0.05$).

These preliminary results suggest that high-protein food consumption may locally change the biochemical composition of saliva during the first minutes, but can also modulate some caries-related molecules in saliva through a systemic mechanism. Further research is needed to better understand these results.

Funded by the Chilean Government Grant Fondecyt #1210188 to RAG.

103 DMFT related dental plaque scoring by using different imaging systems

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The aim of this study was to analyse the correlation between the dental plaque scores measured using clinical examination and different imaging methods.

Twenty-eight volunteers between the age of 18-45 were included in the study. The volunteers were divided into two groups according to DMFT (D: Decayed, M: Missing, F: Filling T: Teeth) scores (under 4 and over 10). Dental plaque on the anterior buccal surfaces was scored using clinical visual examination with/without staining and different imaging systems after staining. Digital photography, intraoral digital scanning, and FluoreCam were used for taking intraoral images. Dental plaque scoring was done with the Turesky Modified Quigley Hein Plaque Index for the clinical examination and the taken images. The correlations between the clinical examination and imaging scores were analysed. Linear Models and Bonferroni were performed using IBM SPSS Statistics V23 ($p \leq 0.05$). Normality was assessed for all continuous variables, and nonnormality distributed data were transformed using the natural log (Ln) value where relevant.

Plaque scores differed significantly between DMFT groups in all methods except FluoreCam ($p \leq 0.05$). In the low DMFT group, the scores in the clinical examination with staining were similar to the scores obtained with digital camera and intraoral scanner. The lowest plaque score was obtained in the clinical visual examination without staining agent (-1,27 ± 1,02) while the highest score was recorded FluoreCam in the low DMFT group (0,28 ± 0,33). In both groups, the scores obtained with FluoreCam were higher than the other imaging methods. All methods were similar in the high DMFT group. Plaque staining in the low DMFT group increased the efficiency of both clinical and imaging methods. Under the conditions of this study, digital imaging methods following plaque staining can be used instead of visual evaluation methods.

The authors received no specific funding for this work.

104 Sixty-month clinical evaluation of a universal adhesive's different adhesive strategies in class II bulk-fill restorations

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The aim of this clinical study was to evaluate performance of two different strategies of a universal adhesive in Class II bulk fill restorations over a 60-month period.

Thirty-five patients with at least two approximal lesions in premolar/molar teeth participated in the study. Eighty-four Class II cavities were restored using Tetric EvoCeram Bulk Fill with two strategies of a universal adhesive, Adhese Universal VivaPen (etch&rinse (ER), self-etch (SE)) according to the manufacturer's instructions. All restorations were placed by one operator. The restorations were evaluated at baseline and at 6, 12, 24, 36, 48, and 60 months using modified US Public Health Service criteria by two blinded and calibrated examiners. Data were statistically analysed using the Chi-square, the Friedman, and Cochran Q tests ($p \leq 0.05$).

At the end of 60 months, 55 restorations were evaluated in 24 patients, with a recall rate of 68.5 %. Marginal discoloration was rated as Bravo for 21.4% and 33.3% of ER and SE strategies, respectively ($p \geq 0.05$). ER group showed 2 bravo scores (7.1%) for marginal adaptation, while 6 bravo scores (22.2%) were observed in SE group ($p \geq 0.05$). At 60 months, two restorations, one from each group, failed due to secondary caries ($p \geq 0.05$). In terms of all criteria tested, no statistically significant differences were found between SE and ER strategies at the end of 60 months. In ER group, significant differences were found between 60-month and the other recalls in terms of marginal discoloration ($p \leq 0.05$) whereas in the SE group; 60-month data were statistically different from baseline, 6-month, and 12-month recalls ($p \leq 0.05$).

Both ER and SE adhesive strategies performed similar performance within 60 months of clinical service.

The authors received no specific funding for this work.

105 The effect of considering marginal defects when assessing posterior restorations – the CaCIA Cluster Randomized Controlled Trial

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The aim of this study was to evaluate the effect of two visual criteria to assess permanent posterior restorations on long-term survival. It was a cluster randomized triple-blind, controlled trial with two parallel groups: patients who received the restorations' assessment according to a "traditional" approach based on three FDI (International Dental Federation) criteria (marginal adaptation, marginal staining, and caries recurrence) - FDI group; patients who received the assessment of the restorations according to the CARS (Caries Associated with Restorations or Sealants) criteria from ICCMS - CARS group. The main outcome was the restoration failure. The univariate and multiple Cox regression analysis with shared frailty were conducted in the intention-to-treat (ITT) population to compare the groups. We included 185 participants in the study, totaling 727 restorations. Up to 502 (69.1%) of the restorations were assessed on the follow-up, with a time range between 6 and 71 months (mean 41.3, SD 16.3). A total of 243 restorations randomized by the CARS criteria were followed-up, of which 17 operative treatments were performed initially and 32 failed. Up to 259 restorations assessed by the FDI criteria were followed-up, of which 77 interventions were performed initially and 30 failed. The multivariate Cox regression on intention-to-treat analysis did not show significant association between the restoration's failures and the diagnostic strategy (p=0.841). When adjusted to age, caries experience, number of surfaces and material, only number of surfaces showed risk association with failure (HR 2.08, 95% CI 1.494 - 2.923, p≤0.001). Material fracture was the main reason for failure, followed by secondary caries. In conclusion, considering multiple marginal defects when assessing secondary caries initially leads to more invasive decisions without representing less restorations failures the long-term.

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001 (Proc. # 88882.346898/2015-01) and part by the Radboud UMC.

106 Influence of gender and combined hormonal oral contraceptive on parotid saliva flow-rate, pH, and electrolytes concentration

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Aim

The physicochemical process of de-remineralisation of dental hydroxyapatite are influenced by saliva. Endocrinal variations of an individual impact electrolytes composition, pH, and flow-rate (FR) of saliva. The aim was to evaluate the gender-specific differences and the combined-hormonal-oral-contraceptives (COCs) effect on FR, pH, and electrolytes concentrations in the parotid saliva (PS) of a group of healthy adults.

Experimental approach

Stimulated PS was collected from 21 healthy adults using a Lashley cup; 11 males, 9 females, 1 female undertaking combined contraceptive therapy (Levonorgestrel/Ethinyloestradiol 0.1 mg + 0.02 mg). FR and pH were recorded for each saliva sample. Electrolytes concentrations (Na^+, Ca^{2+}, K^+, Mg^{2+}) were measured using Inductively-Coupled-Plasma-Optical-Emission-Spectrometer (ICP-OES). Differences between groups were assessed by Student-test at p-value ≤0.05.

Results

PS FR varied from 0.13 to 0.42 ml/min in females not taking any medication and from 0.08 to 0.5 ml/min in males not taking any medication. PS pH of females and males not taking any medication ranged from 6.23 to 7.50 and from 6.15 to 7.55. PS pH and FR of the female taking COCs were 6.5 and 0.1 ml/min. PS pH, FR, and electrolytes concentrations were not statistically significant different between females and males not taking any medication: Ca^{2+} (t-0.46; p≥0.05), Na^+ (t-0.28; p≥0.05), K^+ (t-0.76;p≥0.05), Mg^{2+} (t0.29;p≥0.05). PS concentrations of Ca^{2+} and Na^+ were significantly higher in the female taking COCs than in the females not taking any medication (t-2.36, p≤0.05; t-2.52, p≤0.05). Whereas, concentrations of K^+ and Mg^{2+} did not differ significantly between the female taking COCs and females not taking any medication (t-1.99, p≥0.05; t-1.37, p≥0.05).

Conclusions

There are no significant gender-specific differences in PS FR, pH and electrolytes concentrations. The effect of COCs on PS requires further investigation to confirm that the decrease of FR, pH, and the increase of Ca^{2+} and Na^+ concentrations are the result of COCs intake.

The authors received no specific funding for this work.

107 Gene-environment interactions and caries risk assessment: MMP3, VDR, IL-6 and TNF- α gene polymorphisms

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The purpose of our study was to investigate the effects of gene polymorphisms in the vitamin D receptor/VDR, matrix metalloproteinase 3/MMP3, tumour necrosis factor alpha/TNF-α and interleukin-6/IL-6 genes and environmental caries risk factors in the caries risk assessment model. After routine oral examination in male individuals aged 20-44 years, the diagnosis was made according to the decayed, missing and filled teeth/DMFT index and classified into two groups: “high caries risk” (DMFT ≥ 14) and “low caries risk” (DMFT≤5)(n=150). The participants completed a questionnaire about environmental caries factors. Plaque index/PI, gingival index/GI, bleeding on probing/BOP, probing depth/PD, clinical attachment level/CAL, and saliva buffering capacity/SBC, salivary quantity of Streptococcus mutans/SM and Lactobacillus spp/LB were measured and recorded. After DNA isolation from blood samples taken from the participants, MMP3(rs679620), VDR(rs731236), IL6 (rs1800795) and TNF-α (rs1800629) genotyping of MMP3 (rs679620), VDR (rs731236), IL6 (rs1800795) and TNF-α (rs1800629) was determined using the real-time PCR technique. The results were evaluated under p≤0.05 significance level. There was a significant difference between the groups in terms of PI, GI, PD, CAL, BOP, salivary flow rate, SBC and salivary amount of LB factors (p≤0.001). MMP3 and TNF-α polymorphisms are effective (p≤0.001); VDR (p=0.862) and IL6 (p=0.284) polymorphisms were not effective in determining caries risk. Stepwise Regression Analysis was performed to examine the variables affecting the DMFT, and the model was examined in 7 steps which includes PI, BOP, salivary quantity of LB, frequency of consumption of sugary snacks/FCS, SBC, MMP3 and TNF-α gene polymorphism as environmental risk factors, explained 58.3% of DMFT. PI, BOP, FCS, SBC, salivary quantity of LB, MMP3 and TNF-α gene polymorphism as an environmental risk factor in the caries risk model will be effective in determining the risk groups of individuals.

The authors received no specific funding for this work.

108 Caries indicators in twin children: comparison between monozygotics and dizygotics

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Monozygotic twins (MZ) share 100% of the genetic composition, while dizygotic twins (DZ) have an average of 50%. We aimed to assess the agreement of caries indicators in twin children and the influence of zygosity on the occurrence of dental caries. Twins born between 2007-2017 at a University Hospital (São Paulo, Brazil) were contacted and invited to participate in this cohort study. Information about twins was collected and an oral clinical examination was performed to calculate the decayed, missed, and filled primary and permanent teeth index, considering all lesions (dmft-D1/DMFT-D1) and cavitated lesions (dmft-D3/DMFT-D3). Comparisons of caries indicators between MZ and DZ twins were conducted with multilevel negative binomial regression adjusted by the child's age. Agreement in the caries parameters in MZ and DZ twins was calculated through Intraclass Correlation Coefficient (ICC) and 95% Confidence intervals (95%CI). Heritability (h^2) was calculated with Falconer's method. We included 144 twins being 68 MZ and 76 DZ. No significant differences were observed between MZ and DZ for all caries indicators ($p \geq 0.05$). The agreement between the pairs was consistently higher for MZ, with the ICC (95%CI) varying from 0.601 (0.336 to 0.778) to 0.842 (0.707 to 0.918), for dmft-D3 and dmft-D1, respectively. For DZ twins, the higher ICC value was for DMFT-D1 (0.695; 0.484 to 0.829). The h2 values in most cases were higher than 0.700, except for DMFT-D1, with an h2 value of 0.090. The highest h2 values were 0.908 for dmft-D1 and 0.944 for dmft-D1+DMFT-D1. In conclusion, the higher agreement in MZ twins shows a genetic influence on the occurrence of dental caries.

Funded by 'Fundação de Amparo à Pesquisa do Estado de São Paulo—FAPESP' (Grant no 2019/27560–2) and 'Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES)'.

109 Plaque indices and planimetrically measured plaque coverage- a true relationship?

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Effects of mechanical plaque control, for example comparing different toothbrush types, are usually quantified by indices, with the Turesky-modified-Quigley-Hein-Index (T-QHI) and the Rustogi-modified-Navy-Plaque-Index (RMNPI) being most commonly used. However, depending on the index used, different effect sizes may result. Therefore, the present study aimed to investigate how changes in index scores relate to change in the true plaque coverage.

After ethical approval and informed consent, 30 participants (age 24±4 yr) were included. After 72 h without oral hygiene and subsequent habitual toothbrushing, intraoral-scans (Carestream 3800) were taken after disclosing. Standardized screenshots of the Ramfjord teeth (16, 21, 24, 36, 41, and 44) were taken from these intraoral-scans, and a grid representing the evaluation areas of the T-QHI and RMNPI was projected onto the teeth of interest and scored. Subsequently, planimetric evaluation (PM) was performed using self-programmed software. Parameter of interest was the percentage reduction in index scores or plaque coverage (mean±SD). Statistical methods: t-tests, Bland-Altman analysis.

All methods revealed a significant plaque reduction after brushing (PM: 42.1±14.0%, T-QHI: 32.7± 9.5%, RMNPI: 19.7±9.5%; $p \leq 0.001$ each) with significantly lower values for both indices compared to PM ($p \leq 0.001$ each). The Blandt-Altman analysis showed a significant systematic and proportional bias for both indices in relation to PM. At RMNPI changes of ≥10≤20% and ≥20≤30%, PM values ranged between 20.6% and 53.4% and 21.5% and 74.1%, respectively, which do not differ significantly from one-another. At T-QHI changes of ≥20≤30% and of ≥30≤40%, PM values ranged between 21.5% and 43.4% and 36.1% and 53.4%, respectively, differing significantly from one-another ($p \leq 0.01$).

Both indices reflected the true plaque coverage only to a limited extent; the T-QHI seems to be a more appropriate measure than the RMNPI.

The authors received no specific funding for this work.

110 Dental healthcare costs of children living in Amsterdam and associated socio-demographic characteristics

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Aim: The aim of this study was to assess associations between socio-demographic characteristics and dental costs of children living in Amsterdam. Having incurred dental costs was an indicator for having visited the dentist. Having incurred low or high dental costs may indicate the type of dental care provided (periodic examination, preventive care or restorative treatment).

Approach: This study followed a cross-sectional, observational design. The research population contained children up until 17 years living in Amsterdam in 2016. Dental costs from Dutch healthcare insurance companies were classified as no dental costs (0 euros), low dental costs (≥0 to ≤100 euros) or high dental costs (≥100 euros). Socio-demographic data from Statistics Netherlands (CBS) were obtained and multivariable logistic regression analyses were performed. We adjusted for socio-demographic independent variables.

Results: In the population of 142,289 children, 44,887 (32%) incurred no dental costs, 32,463 (23%) incurred low dental costs and 64,939 (46%) incurred high dental costs. Migration background (adjusted Odds Ratio (aOR) range 1.23-1.98), low(er) household income (aOR range 0.45-0.93), low(er) parental educational level (aOR range 0.51-0.87) and living in a single-parent household (aOR range 0.89-0.91) were strongly associated with incurring high (versus low) dental costs. Furthermore, a lower level of secondary education (aOR range 1.12-1.17) and living in households receiving social benefits (aOR 1.23) were associated with incurring high dental costs.

Conclusions: Among children living in Amsterdam in 2016, one in three children did not visit a dentist. For children that did visit a dentist, those with a migration background, low parental educational level and from a low household income were more likely to incur high dental costs, which could be indicative for additional restorative treatment.

The authors received no specific funding for this work.

111 Prevalence of root caries and psycho-social perception in the Indian geriatric population.

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The aim of the study is to assess the prevalence of root caries in geriatric population and influence of psycho-social factors on prevalence of root caries. An observational, cross-sectional study compromising of clinical evaluation and psycho-social questionnaire (MAGIC psychological form) were collected from 296 individuals aged 65 yr and above. The demographic details were enrolled directly in digital form, dentition status (root caries) was examined clinically using mouth mirror and WHO probe after drying the tooth, and psycho-social responses were obtained through interview using the data collection tool Epicollect 5. Chi-Square analysis revealed that overall prevalence of root caries was 34.5% and 26.6% had bad gingival health. 47.6% used fluoridated dentifrice. 70.2% of the study population was suffering underlying systemic disease, 66.8 % experienced reduced functionality due to either impairment of vision, hearing or restricted movements. 15.5% suffered from memory loss and only 29.1% were covered by medical insurance. However, no significant association was found between psycho-social factors and root caries. ($p \geq 0.05$). In conclusion, systemic illness and root caries were found to be common. In terms of socioeconomic background, urban geriatrics had a greater exposure to oral hygiene maintenance than their rural counterparts.

The authors received no specific funding for this work.

112 The use of fluoride toothpaste mitigates oral health inaequalities: The Korean National Children's Oral Health Survey

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The purpose of this study was to evaluate the mitigating effect of the use of fluoride toothpaste on oral health inequality. This study was based on data obtained from the 10th National Children's Oral Health Survey (KNCOHS VII; 2018). In 2018, a total of 11,561 participants aged 5 and 12 completed KNCOHS VII. Multivariate logistic regression analysis was performed based on gender, house income, preventive dental service utilization, oral health promotion activities, and sugary and acidic foods intake habits. The study analysed the effect of reducing inequality in oral health according to the use of fluoride toothpaste. The prevalence of dental caries (95% confidence interval) was 2.99 (1.42-6.28) for gender and house income (model 1) in the group not using fluoride toothpaste. Gender, house income, and preventive dental service utilization (model 2) were 2.86 (1.36-6.00). Gender, house income, preventive dental service utilization, and oral health promotion activities (model 3) were 2.54 (1.20-5.41). Gender, house income, preventive dental service utilization, oral health promotion activities, and sugary and acidic foods intake habits were 2.62 (1.15- 5.94) according to (Model 4). The conclusions that can be drawn from this study are as follows: in the group that did not use fluoride toothpaste, according to the gender, the group with low house income, low preventive dental service utilization and oral health promotion activities, and low sugary and acidic foods intake habits had a higher prevalence of dental caries. The results suggest that the use of fluoride toothpaste could alleviate oral health inequality.

This work was supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIT) (No. 2021R1F1A1064231).

113 Parental and caregivers' perspectives on addressing persistent oral health inequality among young children

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Aim

The influence of family's complex daily reality on oral health inequality among young children is poorly understood. This study provides insight into parental and caregivers' perspectives on poor oral health of children (≤4 years) growing up in families living in vulnerable circumstances. Furthermore, opportunities to improve children's oral health that fit these families' perspectives and daily context are discussed.

Methods

122 respondents (mothers, fathers, grandparents and residents) participated through participatory observations (n=8), focus group discussions (n=16), and semi-structured interviews (n=24) conducted in a disadvantaged neighbourhood in Amsterdam, the Netherlands. Topics discussed were the meaning of child oral health and its role in daily routines, social gatherings and professional settings. Transcripts and notes were analysed through thematic analysis.

Results

Parents struggle to cope with their children's preference for candy and non-compliance towards tooth brushing. Parents mention that they are busy and give an account of unpredictable daily lives, e.g. irregular work hours and raising multiple children simultaneously. According to parents, oral health gets little attention in their social surroundings, dental practices, general health care, schools and social welfare organisations. Most parents acknowledge their paramount role in child oral health promotion, especially mothers feel highly responsible. However, parents feel challenged by their daily living circumstances and low support by the wider social and professional context. An approachable educational communication strategy is perceived as promising by parents.

Conclusions

Addressing child oral health inequality goes beyond parental responsibility and requires policy change, intersectoral collaboration and community support. Given the complexity and the interrelatedness of the risk factors underlying poor oral health in young children (≤4 years), political, professional and public action have a particular advantage in supporting families living in vulnerable circumstances.

Supported by The Borrow Foundation and Eklund Foundation.

114 Compliance to a Dutch national caries prevention advice (CPA) in 1-year olds living in Amsterdam

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Caries is a common health problem, affecting 25% of 5-year-olds in the Netherlands. The Caries Prevention Advice (CPA), a lifestyle advice, was introduced in 2011 by Ivoren Kruis to prevent caries from early childhood. This study aimed to describe socio-demographic and family-related factors associated with CPA-compliance. Families who participate in the Amsterdam Infant Microbiome Study (AIMS) - a longitudinal cohort study on the influence of (oral) microbiome on healthy development of children from 0-3 years of age – were included. Mothers completed an online questionnaire on socio-demographic factors and oral hygiene and feeding habits of their 14-months old child. CPA-compliance was scored on 5 items and a total compliance score was calculated. Fisher's exact test (SPSS.v.25) was used to analyse relationships between CPA-items, socio-demographic factors and family-related factors and deemed significant at $p \leq 0.05$. 58 respondents completed the questionnaire. Most respondents had a Dutch ethnic background (81%) and had a high educational level (88%). Thirty-six percent of the families complied to all CPA-items and 10% complied to less than 50% of the items. The most common discrepancies were 'not brushing the teeth before night sleep' (24%), 'skipping toothbrushing at least once a week' (19%) and 'feeding the child after toothbrushing in the evening' (19%). Non-fluoridated toothpaste was used by 15.5% of the participants. Non-Dutch ethnic background was associated with nocturnal feeding habits ($p=0.01$) and lower total CPA-compliance score ($p=0.009$). Although based on a small sample of participants, these findings suggest that children of non-Dutch families might be at higher risk for developing dental caries at an early age due to lower CPA-compliance. Planned research with larger numbers of participants involves caries development in relation to microbiome, socio-demographic factors and family-related factors.

The authors received no specific funding for this work.

115 Factors in early childhood affecting dental caries incidence by age 42 months in Japan

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The present study was performed to assess the relationships of factors noted in children aged 18 months with caries incidence from 18 to 42 months of age. The data was collected from municipal health examinations which are mandatory for all children of these ages in Japan. The examinations included an oral inspection and colorimetric caries-risk test to determine bacterial factors, in addition to general health such as height and weight. Access to anonymized data of 5019 children living in Toyonaka City obtained from April 2018 to March 2020 was approved by the Ethics Committee of Osaka University (approval R2-E25). The available information included lifestyle factors collected on-site in the form of parent-reported questionnaires. Multivariate logistic regression analysis was done to compute odds ratios (OR) with a 95% confidence interval (CI) and statistical significance. Overall, 724 (14.3%) of the children had caries experience, of whom 674 (93.1%) developed dental caries during the period from 18 to 42 months of age. The analysis identified a statistically significant relationship between number of erupted teeth at age 18 months and later caries incidence (OR=1.98, CI: [1.06–3.72]) revealing that the risk of caries increased as dentition developed before the window of infectivity. The findings also showed that bacterial factors in early childhood had an impact on oral health in the primary dentition stage (OR=5.42, CI: [2.47–11.90]). Additionally, lifestyle issues of children such as unsettled bed-timing (OR=2.03, CI: [1.37–2.99]) had a significant influence on oral health later in life. The present results indicate that lifestyles and oral development at an earlier age are key factors for dental caries prevention throughout childhood together with bacterial factor.

This work was supported by KAKENHI research project grants (22K10268) from the Japan Society for the Promotion of Science.

116 Validity and reliability of a questionnaire designed to evaluate knowledge and perception of sugar substitute and oral health.

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This study aimed to assess the validity and reliability of a self-reported questionnaire designed to assess students' knowledge and perception of sugar substitutes and their impact on oral health. The first stage of this study involved developing a self-administrated questionnaire according to the objectives. The 67 questions were nominal close-ended, whilst 23 of them were open-ended designs to test knowledge of oral health impact of various types of sugar-substitutes. The second stage involved the assessment of questionnaire's validity (content, construct and face) and reliability (consistency, test-retest and internal). Measure of validity involved 17 experts from fields of dentistry, psychology and nutrition. 40 participants aged 25.53±6.93 years completed the online pilot survey twice, with an interval of three weeks. Final questionnaire consisted of three sections (background characteristics and general health, eating habits and lifestyle, oral health awareness). Experts' face and content validity assessments on importance, appropriateness and phrasing of questions resulted in minor edit. The participants' experiences indicated that the questionnaire was straightforward to complete (≤30 min) and comprehensible. Overall internal-reliability found to be good (Cronbach's alpha=0.90). Test-retest reliability was assessed using Cohen's Kappa statistics and the range of Kappa value of 0.7 revealed substantial agreement with 95% CI. Intraclass correlation coefficient (ICC), assessed for internal consistency, showed the values ≥0.8 for most questions expect four items which were decided to be removed from the final survey. In conclusion, this proposed survey meets the psychometric criteria for reliability and validity and forms a suitable instrument for assessing the study's aim with a large sample size in future.

The authors received no specific funding for this work.

117 Development of a Clinical Practice Guideline for dental care for pregnant women in primary healthcare

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Global Burden of Disease Study 2017 estimates that more than 530 million children suffer from caries of deciduous teeth. Data from Brazil estimates a prevalence of untreated dental caries of 48.2% in children in 2010. Providing oral health advice for pregnant women can prevent early childhood caries. Intending to increase access of pregnant women to dental care and provide oral health advice, including caries prevention for children, a Clinical Practice Guideline (CPG) was developed to be disseminated in Brazil's Public Health system. The CPG was developed based on the best available evidence by a group composed of methodologists, experts, primary healthcare dentists, and stakeholders, using the GRADE methodology for guideline development and evidence assessment, and reported using the AGREE Reporting Checklist II. As a result, three recommendations developed, they are related: (1) offering dental assistance regardless of the gestational semester; (2) attention to pharmacotherapy; and, (3) giving advice related to dental hygiene, harmful effects of using pacifiers and bottles, the importance of a healthy diet, and breastfeeding, and the adverse effects of sugar. The CPG was widely disseminated to dentists working in primary healthcare units and is easily accessible on government websites. The CPG provides orientations to overcome beliefs and lack of knowledge about dental care during this period and improve pregnant women and early childhood oral health.

Funded by Brazil's Ministry of Health and the Coordination for the Improvement of Higher Education Personnel (CAPES).

Session 7

De- and Remineralisation & Erosion

Friday, July 7 2023, Afternoon

118 Association of remineralising agents with in-office dental bleaching on enamel demineralisation

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Objective: This study evaluated the effect of remineralising agents on enamel demineralisation promoted by in-office dental bleaching procedure. Methods: 40 enamel/dentine bovine discs with flat and polished surface were prepared. The baseline Knoop microhardness was measured. The specimens were divided into 5 groups according to the remineralising treatment applied: C (control) – no protective or remineralising treatment was performed; BF- 10% sodium fluoride varnish (Bifluoride 10; Voco) was applied 48 h before bleaching; PF - 5% sodium fluoride varnish (Profluoride; Voco) was applied 48 h before the bleaching; PRG-before –SPR-G containing gel (PRG Pro-Care gel; Shofu) was applied immediately before bleaching; PRG-after - SPR-G containing gel was applied immediately after bleaching. For the groups BF and PF, after varnish application the specimens were immersed in artificial saliva for 24 h and then the varnishes were removed with acetone. All groups received the application of a 35% hydrogen peroxide bleaching gel (Whiteness HP, FGM) for 45 min. The microhardness was measured again immediately after. The specimens were immersed in artificial saliva for 7 d and the microhardness measured again. The percentage of enamel microhardness at each revaluation in relation to baseline (100%) was calculated. The data were analysed by ANOVA and Tukey tests. Results: Significant differences were observed among the groups immediately after the treatment and after 7 d ($p \leq 0.05$). The results immediately after the bleaching were: C-96.20(13.6)a, PRG-before-95.99(9.85)a, PRG-after-98.36(19.78)b, Bifluoride-100.24(18.08)b, Profluoride-100.09(10.08)b. The results after 7 days were: C-98.46(12.49)a, PRG-before-98.71(11.6)a, PRG-after-104.18(20.68)b, Bifluoride-103.31(12.70)b, Profluoride-101.66(10.09)b. Conclusion: The use of fluoride varnish before bleaching or S-PRG containing gel after bleaching can protect or recover the enamel microhardness from demineralisation produced by the bleaching procedure.

The authors received no specific funding for this work.

119 The effect of various remineralisation agents on artificial enamel lesions according to two different quantitative fluorescence systems

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The study aims to evaluate the effectivity of two different remineralisation agents in artificial initial caries lesions using Quantitative Light Effect Fluorescence (QLF) and Laser Fluorescence(LF). In-vitro study was conducted from 2019 to 2020 after approval from the ethics review committee of Marmara University. Three groups were created: Group 1 (casein phosphopeptide amorphous calcium phosphate (CPP-ACP) + 900 ppm fluoride), Group 2 (calcium glycerophosphate, magnesium chloride, and xylitol), and Control (remineralisation solution). pH cycling was applied and morphological alterations between sound dental structure and artificially induced white spot lesions in human permanent and deciduous teeth were performed through the loss of fluorescence by QLF and the LF System. In the comparison at baseline, after demineralisation and application of remineralisation agents in groups were tested by the Friedman test and, Dunn's Multiple Comparisons test was used. There was a statistically significant decrease in ΔF and ΔQ values for each treatment group ($p \leq 0.01$). In deciduous enamel samples, ΔF and ΔQ decreased significantly in Group 1, Group 2, and Control respectively. In permanent enamel samples, no statistically significant difference was found between the groups ($p=0.052$ for ΔF, $p=0.18$ for ΔQ). Percent of fluorescence change values are listed as Group 1≥ Control ≥ Group 2. While comparing the percent of LF change values of groups, no statistically significant difference was found in both deciduous and permanent enamel samples ($p=0.1$, $p=0.18$). Percent of change in LF values were listed as; Group 2≥ Group1≥ Control, respectively in deciduous enamel samples and Control ≥Group 2 ≥Group 1 in permanent enamel samples. In conclusion, remineralisation agents containing CPP-ACP+F and CaGP are successful in providing remineralisation. However, because of detecting statistically significant changes in measurements made with QLF, may be more sensitive in diagnosing small changes in initial caries and is recommended for clinical use.

The authors received no specific funding for this work.

120 Optical coherence tomography versus transverse microradiography to determine lesion depth of demineralised enamel

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This study compared optical coherence tomography (OCT) as a new non-destructive imaging technique with the destructive transverse microradiography (TMR), which is an established reference technique for measuring the depth of enamel demineralisation. For this purpose, caries-free bovine enamel specimens were subjected to a microcosm biofilm model for artificial enamel demineralisation for 5 d. The specimens were treated daily with toothpaste (n = 6) and mouth rinses (n = 6). For OCT, the resulting artificial lesions were scanned non-destructively, and measured with a semi-automated algorithm (CarlQuant). For TMR analysis, specimens were transversally sectioned and the mean lesion depth (LD) was calculated for both methods. The range of the sensitivity of the CarlQuant was tested between 0.27 to 0.5 arbitrary units with a step size of 0.35. A correlation (Spearman's rank test with/without outliers) and a regression analysis (linear model) were used with the response LDOCT and the predictor LDTMR; outliers were determined by Cook's distance threshold 0.038. The LD values for both methods highly overlap: LDTMR ranged from 59.2 to 198.0 µm (solutions 95%CI=106.2-130.5) and from 33.2 to 133.4 µm (toothpastes 95%CI=52.9-74.7); the LDOCT ranged from 24 to 205 µm (solutions 95%CI=100.1-127.5) and 18 to 209 µm (toothpastes 95%CI=50.8-78.1). The best agreement between LDOCT and LDTMR was obtained with a sensitivity of 0.4, thus we calibrated the sensitivity of CarlQuant (mean diff=2.08 µm). There was a strong correlation between both methods (LD Spearman with outlier p≤0.001/Rho= 0.79; LD Spearman without outlier p=0.001/Rho=0.69). There is a tendency for OCT to estimate slightly higher lesion depth compared to TMR, yet LDOCT and LDTMR strongly agree (p=0.001, R2adjusted=0.68). In conclusion, both methods have a similar measuring outcome. In addition, OCT has the benefit of being non-destructive.

The São Paulo Research Foundation supported this work (FAPESP 2017/00556–0, 2017/17249–2, 2018/26506–1).

121 Effect of silver diammine fluoride (SDF) on secondary caries in vitro

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Aim of the present study was to evaluate the effect of SDF on the progression of dentine caries lesions adjacent to composite restorations. A total number of 50 bovine dentine slabs (6 mm × 4 mm × 4 mm) were prepared and polished. The specimens were embedded in acrylic resin leaving the top surface and one side unprotected. Artificial caries lesions (4 mm × 3 mm) were created on both unprotected dentine surfaces by immersing the specimens in a demineralising solution for three days. Afterwards, a self-etch adhesive (Scotchbond Universal) was applied on the top surface leaving an unbonded square shaped window (2 mm × 2 mm). In this window, a 2 mm wide and 100 mm thick copper foil was placed. A 2 mm thick composite layer was applied in bulk on the top surface of the dentine specimens leaving a 100 µm gap. In half of the specimens (n=25), the induced caries lesions were treated with SDF for 3 min while the other half (n=25) served as untreated control. To simulate the oral conditions, all specimens were subjected to a Lactobacillus rhamnosus GG biofilm model. After seven days, the difference in integrated mineral loss (ΔZ; adjusted for silver radioopacity) of dentine surface lesions (DSL; the side dentine surface) and dentine wall lesions (DWL; the top dentines surface) were measured and statistically analysed. Mineral loss (ΔZ) [median (Q1/Q3)] at DSL was significantly lower in the SDF group [630 (408/1507) vol%×µm] compared to the control group [1463 (1133/1931) vol%×µm] (Mann-Whitney, p≤0.05). At DWL, no significant difference was observed between the groups. It can be concluded that SDF had a protective effect in caries progression adjacent to the restoration surfaces but not in dentine wall lesions adjacent to restoration gaps.

The authors received no specific funding for this work.

122 Remineralisation by dental gels containing S-PRG Fillers (S-PRG)

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Surface-reaction type Pre-Reacted Glass-ionomer filler (S-PRG) is known to inhibit demineralisation and we found that toothpastes containing S-PRG can enhance remineralisation remarkably. The aim of this study was to examine effects of dental gels containing S-PRG or its water extract on remineralisation. Bovine enamel blocks were demineralised by 0.1 M lactic acid (pH 4.5) for 48 h. After measurements of fluorescent reduction rate (ΔF, %) by quantitative light-induced fluorescence (QLFTM, Inspektor Research Systems, Netherlands) at baseline, the samples were treated by one of the followings (n = 10/group) as untreated control (A), APF gel (0.48 mM NaF) applied for 4 min once (B), treated by water extract of S-PRG; P/W ratio =1:1 (C), CMC gels containing S-PRG extract (D) or 5 wt% S-PRG (E). All specimens were then immersed in artificial saliva (200 mM Hepes, 1.5 mM $CaCl_2$, and 0.9 mM KH_2PO_4, pH 7.0) for 7 d. In the groups C-E, specimens were treated with test agents for 4 min every 24 h to simulate self application. After 7-day treatments, all samples were assessed by QLFTM again, and data were analysed by the one-way ANOVA with post-hoc Tukey-Kramer multiple comparisons. The ANOVA indicated significance (p = 0.0006) and the geometric mean of ΔF values in the groups C-E (C: 5.8%; 95%CI [3.2-8.4], D:5.0%; 95%CI [3.0-7.0], E: 5.2%; 95%CI [3.0-7.4]) were significantly lower ($p \leq 0.05$ at least) compared to the group A (11.2%; 95%CI [8.7-13.7), and indicated no statistical difference with group B (6.3%; 95%CI [3.7-8.9] at $p \geq 0.05$). Compared to the baseline ΔF value (12.4%; 95%CI [8.7-13.7]), the groups C-E showed ΔF recovery rates (ΔΔF, %) by 53-60% and group B indicated 49%. In conclusion, it was suggested that topical application of S-PRG agents tested would provide remineralisation effects to be comparable with APF gel.

The authors received no specific funding for this work.

123 Efficacy of Ca and Na salts of poly-gamma-glutamic acid on demineralisation inhibition of hydroxyapatite discs

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Poly-gamma-glutamic acid (ɣ-PGA) inhibits demineralisation in caries-simulating model systems [Prattia et al.: Polymers 2022;14:2937]. Commercially, ɣ-PGA is also available as calcium or sodium salt, both more soluble than the pure acid. The calcium salt could potentially be more beneficial for inhibition.

Aim : To investigate the demineralisation inhibition of synthetic hydroxyapatite (HAP) discs exposed to caries simulating conditions following after treatment with either calcium or sodium ɣ-PGA salts at a range of concentrations.

Methods. Ca-ɣ-PGA (Nippon Poly-Glu Co. Japan) and Na-ɣ-PGA (Meiji, Japan; MW 70kDa) were dissolved in water at concentrations 0.05-4.0% w/v. The concentration of Ca, Na, and P was determined using ICP-OES for 15 d following immersion. HAP discs (20% porosity) without biological variability were immersed in deionised water. Each disc was treated in 50 mL of 0.1 M acetic acid (pH 4.0) for 1 h; then exposed to 5 mL Na-ɣ-PGA formulation for 2 min; then re-exposed to acid for a further 1 h, at 37°C. Real-Time Ion Selective Electrodes (RTISEs) were used to measure calcium ion release every 60 s for 1 h before and after treatment, and the ≥60 data points plotted as a function of time. The percentage demineralisation inhibition was calculated for each ɣ-PGA concentration.

Results. CP-OES: Ca-ɣ-PGA flocculated and precipitated decreasing the Ca concentration. Na-ɣ-PGA did not flocculate. Na-ɣ-PGA released Na but negligible Ca. Neither salt contained or released P. RTISE: demineralisation inhibition by Na-ɣ-PGA at 0.05%, 0.1%, 0.5%, 1.0%, 2.0%, and 4.0% w/v% was 41.9%, 54.0%, 61.2%, 73.1%, 70.8%, 59.8%, and 33.8% respectively. Linear regression showed R2 exceeded 0.99 for all, and was statistically significant.

Conclusion: The sodium ɣ-PGA salt reduces demineralisation similarly to free acid ɣ-PGA, also with a maximum between 1 and 2% w/v%. The calcium ɣ-PGA salt is unusable due to reactions leading to flocculation.

The authors received no specific funding for this work.

124 Gastric acid erosion protection from a toothpaste containing various sources of calcium, phosphate, and fluoride in vitro

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Objective: To evaluate the erosion protection efficacy of calcium, phosphate and fluoride containing toothpastes against simulated gastric-acid challenge in vitro.

Methods: Polished human enamel blocks (3 mm x 3 mm, n=36) were allocated to 3 treatment groups (n=12) with surface microhardness (SMH) measured at baseline. Specimens were then exposed to 4 cycles as follows: 1:2 (w/w) toothpaste: dH2O slurry for 2 min; artificial saliva for 2 h (20 mmol/l HEPES, 1.5 mmol/l $CaCl_2$, 0.9 mmol/l KH_2PO_4, 130 mmol/l KCl; pH 7.0); and exposure to simulated gastric acid for 30 s (10 mmol/l HCl; pH 2.3). Toothpaste treatments consisted of toothpaste containing 1450 ppm F as SMFP (Toothpaste A), toothpaste containing calcium silicate and sodium phosphate salts plus 1450 ppm F as SMFP (Toothpaste B), and toothpaste containing calcium silicate, sodium phosphate, and calcium phosphate plus 1450 ppm F as SMFP (Toothpaste C). Enamel SMH was remeasured after 2 and 4 treatment cycles and ΔSMH calculated as the % change from baseline. One way ANOVA followed by Tukey's test was used for statistical analyses ($p \leq 0.05$).

Results: Following 4 cycles, Toothpaste C delivered the smallest change in ΔSMH (-3.79±1.39SD) followed by Toothpaste B (-20.31±0.96SE) then Toothpaste A (-30.61±1.18SE). Both Toothpaste B and Toothpaste C gave significantly greater ($p \leq 0.0001$) protection against acid challenge compared to the fluoride-containing control. Enamel treated with Toothpaste C exhibited a significantly lower ΔSMH than either Toothpaste A or Toothpaste B over the course of the experiment ($p \leq 0.0001$).

Conclusion: Toothpastes containing sources of calcium, phosphate, and fluoride exhibited the greatest protection from simulated gastric acid challenges in vitro.

This study was funded by Unilever Research and Development.

125 Effect of an experimental TiF4/NaF solution in preventing tooth erosion- in vivo study

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The aim of this study was to determine the protective potential of titanium tetrafluoride and sodium fluoride (TiF4/NaF) compared to its respective positive and negative controls under an in vivo model, as well as the perception of subjects regarding the use of this experimental solution. After the ethics approval and the selection procedures, 33 subjects were divided into 3 treatments: TiF4/NaF solution (500 ppm F, pH 4.5); Elmex® AmF/NaF/SnCl2 (500 ppm F, pH 4.5, positive control) and water (negative control). After professional cleaning, the subjects rinsed with one of the solutions for 1 min and waited 2 h for the erosive challenge. The erosive solution (1% citric acid, pH 2.5) was applied for 10 s on each central incisor (enamel area: 4.92 mm^2) and collected for calcium analysis using III Arsenazo colorimetric method. The data were compared using Kruskal-Wallis/ Dunn tests ($p \leq 0.05$). Teeth treated with both fluoride solutions released less calcium into the acid (median and interquartile interval: TiF4/NaF – 0.45/0.19 mM and Elmex – 0.46/0.15 mM Ca^{2+}, $p = 0.99$) compared to the negative control (1.12/0.42 mM Ca^{2+}, 60% reduction, $p \leq 0.0006$). For both F solutions, only 1 subject per group reported unpleasant taste. However, 4 subjected belonging to Elmex reported burning sensation post-rinse while only 1 subject described such feeling after TiF4/NaF rinsing. Therefore, the experimental TiF4/NaF solution was as effective as the commercial Elmex in protecting enamel against erosive demineralisation with a good acceptability by the subjects.

Funded by FAPESP.

126 Experimental varnishes based on the association of polymethacrylate copolymers with fluoride against erosive tooth wear

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This study investigated the efficacy of experimental formulations simulating dental varnishes based on polymethacrylate copolymers associated to sodium fluoride on the protection of enamel against erosive/abrasive challenges. Polished bovine enamel specimens were demineralised (0.3% citric acid, 5 min) and allocated into groups (n=15) according to the experimental formulations used: aminomethacrylate copolymer (AMC - Eudragit E100/Evonik- 15%); methylmethacrylate copolymer (MMC - Eudragit L100/Evonik- 15%); AMC with sodium fluoride (AMC+F); and MMC with sodium fluoride (MMC+F). Negative control (NC) was ultrapure water and positive control was a commercial varnish (D – Duraphat/Colgate). All formulations with fluoride contained 22,600 ppm F-. The products were applied on the enamel surface, and the specimens underwent an erosion-abrasion cycling (5 min in 0.3% citric acid solution, 60 min in artificial saliva, 4/d, 9 days), with 2/d toothbrushing. Surface loss (SL) was determined immediately after treatments, after 1st, 3rd, 5th, 7th, and 9th days. SL data were analysed with ANOVA/Tukey tests (5%). Means ± standard deviation of SL (µm) obtained at the 9th day were: NC (-18.31±2.62)a, MMC (-11.26 ± 2.38)b, AMC (-11.23 ± 3.50)b, MMC +F (-7.03 ± 2.49)c; AMC +F (-6.26 ± 1.79)c, and D (-4.56±1.78)c. Different letters show significant differences among the groups. It was concluded that the association of polymethacrylate copolymers with fluoride simulating varnishes for professional application provided protective potential similar to that of the commercial Duraphat varnish, being promising agents to control erosive tooth wear.

Supported by *FAPESP 2020/13050-0.*

127 In vitro investigation of the anti-erosive efficacy and durability of a stannous/chitosan/fluoride toothpaste

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The objective of this in vitro study was to assess the anti-erosive efficacy and durability of a stannous/chitosan/fluoride toothpaste compared to a regular fluoride toothpaste using a cross-over erosive pH cycling model.

Polished human enamel samples were subjected to a cyclic erosion model for 20 d including daily treatments of 6x2 min citric acid (0.5%, pH 2.3), 2x6 min toothpaste-deionized water slurry 1:2 (w/w) and the storage in a remineralisation solution (pH 6.7) in between the treatments. Six specimens each were randomly assigned to five test groups: 1- Untreated control (NC), 2-Regular NaF toothpaste (STP; 1450 ppm F-), 3- stannous/chitosan/fluoride toothpaste (CTP; 1400 ppm F-) and 4-STP switching to CTP and 5-CTP switching to STP after 10 d, respectively. Tissue loss (erosion depth (ED)) was measured after 5, 10, 15 and 20 d by optical profilometry using a laser scanning microscope (VK1050 Keyence, Germany) and is given as the arithmetic mean with the respective standard deviation. Statistical evaluation was done by one-way ANOVA and post-hoc Tukey test.

After 20 d, an anti-erosive efficacy for CTP was shown by significantly ($p \leq 0.0001$) lower ED (11.5±5.3µm) compared to NC (89.5±9.7µm) and STP (83.6±11.1µm). A fast protective onset was demonstrated by no further progression of ED after switching from STP to CTP (group 4): 34.4±5.3µm (10 d), 35.8±5.9µm (15 d), 35.4±5.9µm (20 d). ED significantly increased after switching from CTP to STP (group 5): 7.4±3.5µm (10 d), 16.7±6.0µm (15 d), 37.4±14.1µm (20 d), and no lasting protective effect of CTP could be shown.

The stannous/chitosan/fluoride toothpaste builds up quickly an anti-erosive protection and prevents effectively from further enamel tissue loss with continued use.

The study was sponsored by Colgate-Palmolive Company.

128 Influence of the salivary enamel pellicle on the wettability of different polymer solutions

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The adsorption of film-forming polymers (FFP) to the enamel surface needs to be better investigated, especially when the salivary pellicle is present. This study analysed the wettability of FFP solutions on enamel, in the presence (P) and absence (NoP) of the salivary pellicle. Nine solutions were used: water (negative control); NaF (225 ppm F^-); NaF/Sn (225 ppm F^-; 800 ppm Sn^{2+}); or polymer (Carbopol; Chitosan or Linear Sodium Polyphosphate - LPP) with or without NaF. Polished enamel specimens were left in a humid chamber (NoP) or taken to salivary pellicle (P) formation (1 min). Wettability was evaluated using a drop shape contact angle device (needle Ø = 1.1 mm), where a droplet (1 µl) of solution was placed on the enamel surface and their contact angles measured. Nine drops were performed for each solution and condition. Data were statistically analysed (α=0.05). All solutions presented higher wettability in P than in NoP, except NaF (p=0.24). For P, Sn/F [median (IQR): 19 (14.6-21.8)], Carbopol/F [17.8 (13.4-20.9)] and LPP [19.2 (17.5-19.7)] showed the highest wettability, not differing significantly from Carbopol [21.5 (18.1-27.5)] and Chitosan/F [20.4 (19-21.2)], which did not differ from the remaining groups. For NoP, NaF [31.2 (30.1-34.4)] and Carbopol/F [35.4 (33-37.8] showed the highest wettability, without differing from Chitosan/F [38.8 (33.1-41.3)] and water [37.2 (34.2-38.9)]. The latter groups did not differ significantly from Carbopol [49.8 (35.7-53.4)] and Chitosan [43.1 (41.2-44.6)], which also did not differ from LPP [46.7 (45.4-48.9)], LPP/F [41.2 (39.4-47.3)] and Sn/F [47.6 (45.7-52.4)]. In conclusion, the presence of the salivary pellicle increased the wettability of all solutions, except for NaF. Regardless the presence of the pellicle, the wettability of FFP solutions did not differ from those without FFP.

FAPESP (São Paulo State Research Foundation), research grant #2020/05374-0; #2020/06313-4; and #2021/07684-9

129 Effect of the interaction between polymers and the salivary pellicle on enamel demineralisation

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This study investigated the interaction between film-forming polymers with the salivary pellicle and the anti-erosive ability of this modified layer on enamel, using a model simulating severe erosion. One hundred and thirty five enamel specimens were submitted to 10 cycles. First, salivary pellicle was formed for 1 min, followed by 1 min immersion in one of the 9 experimental solutions (n=15): water (negative control); NaF (225 ppm F^-); NaF/Sn (225 ppm F^-; 800 ppm Sn^{2+}); or polymer (Carbopol; Chitosan or Linear Sodium Polyphosphate – LPP) with or without NaF. Then, salivary pellicle was further formed for 28 min. The specimens were then submitted to an erosive challenge with 1% citric acid (pH 3.6), either for 1 min (first 5 cycles) or 5 min (last 5 cycles), totalling 30 min erosion. otal amount of calcium release (CaR) in the citric acid was assessed after the 10 cycles. Data were analysed by Kruskal-Wallis, Dunn's and Mann-Whitney tests (α=0.05). NaF/Sn, Chitosan/NaF and NaF presented the lowest values of CaR [median (IQR): 53.5 (43.6 - 68.0), 56.5 (51.5 - 62.3) and 62.7 (59.7 - 66.0), respectively], without differing from each other and from Chitosan [65.7 (57.8 - 75.8)] and LPP with or without NaF [70.4 (68.9 - 72.2) and 68.3 (64.3 - 73.7), respectively]. Carbopol and Carbopol/NaF presented the highest values of CaR [109.4 (103.0 - 116.6) and 87.3 (84.6 - 93.0), respectively], without differing from each other and from water [79.1 (73.3 - 84.0)]. In conclusion, Chitosan and LPP alone or with NaF interacted with the salivary pellicle reducing enamel demineralisation similarly to NaF and NaF/Sn.

Funded by FAPESP (São Paulo State Research Foundation), research grants #2020/06313-4; #2021/07684-9.

130 Effect of combining fluoride with polyphenol-rich plant extracts on the proteomic composition of dentine pellicles

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Combining fluoride with polyphenol-rich plant extracts improves the erosion protective properties of enamel pellicles. This study aimed to investigate through proteomic analysis the effect of combining fluoride with polyphenol-rich plant extracts on the composition of dentine pellicles.

We prepared 75 human dentine specimens of identical size (4 mm x 4 mm) and assigned them to five groups (n=15): NaF (500 ppm F); GSE+F (grape seed extract + 500 ppm F), GTE+F (green tea extract + 500 ppm F), BBE+F (blueberry extract + 500 ppm F), Sn+F (commercial rinse containing $SnCl_2$/NaF/AmF). Each specimen was incubated with human saliva (30 min, 37°C), followed by pellicle modification according to the groups (2 min, 25°C), and further salivary pellicle formation (60 min, 37°C, no agitation). The pellicles were then harvested using sodium dodecyl sulfate and rubbing with cotton pellets. We repeated this sequence 3 times with each specimen. The harvested pellicles where digested with trypsin and subjected to LC-MS/MS for proteomic analysis. Proteins identified in at least two repetitions of the same treatment were considered as present and included in the qualitative analysis.

A total of 299 proteins were identified, of which 156 were common to all 5 groups, including proteins considered important for the acid-resistance, like proline-rich proteins, cystatins, histatins and mucins. Protein diversities differed between the groups (Sn+F=246, BBE+F=220, NaF=220, GSE+F=206, GTE+F=200), and each group contained exclusive proteins as well (Sn+F=20, BBE+F=10, NaF=8, GSE+F=6, GTE+F=5).

We conclude that adding polyphenol-rich plant extracts to fluoride solutions impacts the effect of these solutions on the protein diversity of the dentine pellicle. This could in turn lead to differences in acid protective properties of the pellicle.

Funded by a grant from the German Society of Preventive Dentistry (DGPZM) and CP GABA.

131 Proteomic analysis of salivary dentine pellicle modified with plant extracts

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The aim of the study was to investigate through proteomic analysis the effect of solutions containing plant extracts on the modification of salivary pellicle formed on dentine. Sixty dentine squares (4 mm x 4 mm) were prepared from human molars and divided into 4 groups (n=15): Control (deionized water), GSE (grape seed extract), GTE (green tea extract), and BBE (Blueberry extract). The specimens were subjected to salivary pellicle formation (30 min, human saliva, 37°C), and salivary pellicle modification (2 min, experimental solutions, 25°C; and 60 min, human saliva, 37°C). Afterwards, the salivary pellicles were harvested from the dentine surfaces (sodium dodecyl sulphate) and collected with cotton pellets. This sequence was repeated 3 times per specimen. Proteomic analysis was performed with liquid chromatography-mass spectrometry (LC-MS/MS). Only the identified proteins that were present in at least two repetitions were considered for the qualitative analyses. A total of 288 proteins were identified. A smaller number of protein diversity was identified in the groups treated with the plant extracts (GSE=212, GTE=216, BBE=226 proteins) than in the Control group (245 proteins). A total of 163 proteins were common for all 4 groups, including acid-resistance proteins like proline-rich proteins, cystatins, histatins and mucins. Each group also presented exclusive proteins (GSE=6, GTE=8, BBE=10, Control=18). Six proteins were exclusively found in Control and GSE groups, 10 in Control and GTE and 14 in Control and BBE. Nine proteins were present exclusively in GSE and GTE, 3 in GSE and BBE and 2 in GTE and BBE. It can be concluded that modification of salivary dentine pellicle with plant extracts impact the protein diversity of the pellicle, which could explain their protective effect against demineralisation.

Funded by a grant from the German Society of Preventive Dentistry (DGPZM) and CP GABA.

132 Protein composition in acquired pellicle of adolescents with erosive tooth wear or extensive caries

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Aim: To compare the acquired pellicle protein composition in 12- to 15-year-old adolescents with clinically sound enamel, or erosive tooth wear (ETW) or extensive caries lesions (Caries).

Methods: Calibrated examiners in ETW (BEWE Index) and ICDAS-merged criteria (inter-/intra-reproducibility weighted Kappa values ≥0.70) selected a sample of n=30 12- to 15-year-old adolescents presenting with ETW: n=10 (total BEWE ≥9); Caries: n=10 (≥1 ICDAS-merged extensive caries lesion), and Sound: n=10. Two-hour formed acquired pellicle samples were taken from buccal, palatal and occlusal tooth surfaces. After elution, pellicle protein content was analysed by Liquid Chromatography Tandem Mass Spectrometry in triplicate. Proteins detected in all sample replicates were included in the analysis. Protein abundances were compared across the three groups to calculate fold changes using mean reporter ion values. Over 2-fold changes in protein increase or decrease were reported (t-test, p≤0.05).

Results: Most proteins detected were associated with stress response (GO analysis). Proteins showing an increased relative abundance in the ETW group were Antileucoprotease (2.85 fold vs. sound, and 2.34 fold vs. Caries; p≤0.05), Histatin (2.42 fold in ETW vs. sound, and 2.20 fold vs. Caries) and Prolactin-induced protein (2.30 fold vs. sound, and 2.06 vs. Caries). Hemoglobin Alpha (HBA) and Beta (HBB) showed a decreased relative abundance in ETW and Caries groups in comparison with the sound group (HBA: 0.42 in ETW and 0.40 in caries; HBB: 0.45 in ETW and 0.38 in caries; p≤0.05). Hemoglobin has been previously reported as protective ETW in patients with gastroesophageal reflux disease. Conclusion: Protein composition in ETW showed an increased relative abundance of proteins that favour homeostasis and a decreased relative abundance of proteins related to salivary protection against acid challenges.

This study was co-funded by LAOHA and Universidad El Bosque Research Department.

133 Effect of salivary pellicle modification with grape seed extract on enamel erosion and abrasion

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This study aimed to investigate the effect of salivary pellicle modification with grape seed extract on enamel erosion and abrasion. We prepared 60 human enamel specimens, assigned to four pellicle-modifying groups: DW (deionized water – control); NaF (500 ppm Na); Sn+F (commercial solution – SnCl2/NaF/AmF); and GSE+F (grape seed extract + 500 ppm F as NaF). The specimens were submitted to 5 cycles consisting of: pellicle formation with human saliva (30 min, 37 °C, no agitation), followed by pellicle modification with the test solutions (5 ml, 2 min, 25 °C, 70 rpm), further salivary pellicle formation (60 min, 37 °C, no agitation), and then erosion and abrasion. For erosion, the specimens were submitted to 1% citric acid (1 min, pH 3.6, 70 rpm, 25 °C). The abrasion consisted of brushing the specimens with a NaF toothpaste slurry on a toothbrushing machine (50 strokes, 200 g load, total of 2 min exposure to slurry). Surface loss was assessed with an optical profilometer. Kruskal-Wallis and post-hoc Wilcoxon rank sum tests with Bonferroni-Holm corrections were applied (α=0.05). Significant differences were found between the solutions ($p \leq 0.01$). Surface loss (median, IQR) was greatest for DW group (0.487 µm, 0.477–0.625), presenting significantly more wear than all other groups ($p \leq 0.01$). The lowest values were observed for the GSE+F (0.263 µm, 0.195–0.325) group, with significantly better protection (p=0.043) than NaF (0.364 µm, 0.342–0.429) and comparable (p=0.142) to the Sn+F solution. The latter exhibited intermediate values (0.315 µm, 0.300 – 0.414), also similar (p=0.443) to the NaF solution. We conclude that the pellicle modification with grape seed extract and fluoride promoted greater protection against erosion/abrasion than water and sodium fluoride, similar to the commercial SnCl2/NaF/AmF solution.

Swiss Excellence Government Scholarships (ESKAS) for the first author (grant number: 2022-0094).

134 Cross-sectional clinical study on salivary enzyme activity and erosive tooth wear of different aetiology

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Erosion is caused by exogenous and/or endogenous acids. However, not all patients with relevant acid impacts show signs of erosive tooth wear (ETW). Therefore, aim of this cross-sectional study was to identify different factors in saliva (basic parameters and enzyme activity) potentially relevant for development of ETW of subjects with regular intraoral acid exposure with/without clinical signs of ETW compared to healthy subjects. One-hundred-forty-seven subjects aged 35.0±14.4 (mean±SD) were included from six different groups: control without erosion (n=54), exogenously caused erosion (n=20), gastroesophageal reflux disease with/without ETW (n=20/19) and bulimia nervosa with/without ETW (n=20/14). BEWE-score was assessed, and unstimulated and stimulated saliva were collected. Basic parameters (flow rate, pH, buffering-capacity) and activity of proteolytic (general proteolytic activity, pepsin, trypsin, collagenase) and control (lysozyme, amylase, peroxidase) enzymes were assayed and statistically analyzed by linear mixed regression models (multiple testing correction by Scheffé). Groups with ETW showed a BEWE-score of 1.78±0.57; mean salivary flow rate amongst all groups was 0.42±0.26 ml/min unstimulated and 0.88±0.61 ml/min stimulated. Hardly any differences between groups were found for salivary parameters. Only in bulimic subjects with ETW compared to healthy controls, lysozyme activity in unstimulated saliva (4.15±0.96 kU/ml vs. 2.01±1.10 kU/ml) and proteolytic activity in unstimulated (0.36±0.30 U/ml vs. 0.09±0.20 U/ml) and stimulated (0.42±0.23 U/ml vs. 0.27±0.33 U/ml) saliva was higher ($p \leq 0.05$). Endogenous acids led to statistically significantly higher activity of all proteolytic enzymes in unstimulated saliva ($p \leq 0.05$) and, except for trypsin, in stimulated saliva ($p \leq 0.01$). Conclusively, the activity of proteolytic enzymes is higher in persons with regular intraoral impacts of endogenous acids. However, the enzyme activity does not explain different susceptibilities to ETW. Probably, a proteome analysis might reveal an erosion-protective potential of specific salivary components. *Funded by the DFG (German Research Foundation).*

135 Tobacco smoking does not affect the erosion-protective capacity of the salivary pellicle

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This study aimed to analyse potential differences in the erosion-protective capacity of the salivary pellicle of daily smokers (≥10 cigarettes/day) compared to non-smokers (never smokers). Bovine enamel and dentine specimens (each n=4) were exposed to the oral cavity of oral-healthy volunteers matched regarding sex and age (n=24 smokers: 30.4±7.9 years, n=25 non-smokers: 30.0±7.5 years) for 120 min to form a salivary pellicle. Subsequently, specimens were eroded (HCl, pH 2.3, 60 s) and calcium release into the acid was determined photometrically. Pellicle-free specimens served as control (each n=30). Additionally, (un-)stimulated salivary parameters (flow rate, pH, buffer capacity, total protein, calcium, phosphate, fluoride) were assessed. Statistical analysis was performed by one-way ANOVA, t tests, Pearson correlations, and multiple linear regressions ($p \leq 0.05$). In enamel, the salivary pellicle significantly reduced calcium loss compared to control (41.4±6.3 nmol/mm^2), with no differences between smokers (33.2±10.6 nmol/mm^2, p_adj.=0.001) and non-smokers (32.7±8.6 nmol/mm^2, p_adj.=0.001). The salivary pellicle did not reduce calcium loss of dentine (control: 30.2±3.3 nmol/mm^2); the effect of the salivary pellicle was not different between smokers (27.9±8.9 nmol/mm^2, p_adj.=0.876) and non-smokers (29.2±7.4 nmol/mm^2, p_adj.=0.876). Except for phosphate in stimulated saliva (smokers: 5.5±2.1 mmol/L, non-smokers: 3.6±1.0 mmol/L; p_adj.=0.003), salivary parameters were not significantly different between smokers and non-smokers. Calcium release was not correlated with or predicted by salivary parameters. In conclusion, the erosion-protective capacity of the salivary pellicle of smokers and non-smokers does not differ. Further investigation regarding the proteomic profile in smokers / non-smokers is required.

Funded by the German Society of Dentistry and Oral Medicine (DGZMK).

136 Dental erosion and its impact on quality of life in the patient with gastroesophageal reflux

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Objectives: To assess the prevalence of dental erosion and its impact on the oral-health-related quality of life (OHRQoL) in patients with gastroesophageal reflux disease (GERD).

Methods: A cross-sectional study were performed in GERD patients (18 - 70 years olds), at Nguyen Trai hospital, Ho Chi Minh city from November 2021 to June 2022. Dental erosion (DE) was assessed by three calibrated dentists using the Basic Erosive Wear Examination (BEWE). A questionnaire enquired about general health, dietary, habits and typical reflux symptoms. OHRQoL was measured by OHIP-14. Chi-square, Mann Whitney, Fisher's exact test and logistic regression model were used. The statistical significance was adopted as p≤0.05, CI 95%.

Results: A total of 169 GERD patients were examined. Average age of participants was 56.0 ± 10.6; of these, 114 were female (67.5%). DE was registered in 78.1% of the GERD patients, more often in older age group (p≤0.05). Regarding severity, mild erosion accounted for 50% while moderate and severe was 42% and 8% respectively. DE was more frequent in posterior teeth. Severe lesions were most observed in the first molars (p≤0.05). The analysis revealed a 3 fold increased odds of DE in patients with symptoms of dyspnea, compared to those without this symptom (OR 3.0, CI 95% 1.2-7.8). The mean total OHIP-14 score was significantly higher in GERD patients with DE (19.5±11.4) compared to without DE (8.4±8.7) (p≤0.001). When associated with erosive severity, the mean OHIP-14 scores were significantly different in mild, moderate and severe erosion (16.0±16; 23.3±10.5 and 21.5±8.8 respectively) (p≤0.001).

Conclusion: DE was a common extraesophageal manifestation of GERD patients in the study. OHRQoL of GERD patients was significantly associated with DE.

This work was supported by the University of Medicine and Pharmacy at Ho Chi Minh city, Vietnam.

137 Food habits and erosive tooth wear in a sample of vegans and omnivores

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Frequent consumption of acidic foods/drinks is directly related to an increased risk of erosive tooth wear (ETW). Here, we evaluated acidic foods/drinks consumption, ingestion characteristics, and degree and distribution of ETW in a sample of vegans or omnivorous.

We recruited 48 healthy and young participants who followed a vegan or omnivorous diet for ≥ 18 months (n=24/per group matched by age and socioeconomic status). ETW was determined by using BEWE index and diet using a self-report questionnaire. According to each variable, chi-square, t-student, or U Mann Whitney were used to compare vegans vs. omnivores. The significance level was set at 5%.

Vegans (66.7% women; 26±3.8 [mean±SD] years old) and omnivores (45.8% women; 26±4.9 [mean±SD] years old) did not differ in the consumption of acidic foods/beverages (p≥0.05). Tea or coffee was the most habitual drink that vegans and omnivores consumed 1/d to 3/d (43.8% and 35.4%, respectively). Soda, energy drinks, beer or wine, were rarely consumed daily. Most of the acidic food/drink is consumed with main meals. Almost none reported using a straw to drink acidic beverages (n=1), but a third (37.5%) described moving drinks in their mouth. BEWE 2-3 codes were more prevalent in vegans (5.1±5.6 [mean±SD] surfaces vs. 2.8±2.3). Superior incisors were the most affected teeth, especially in vegans. Total BEWE was higher in vegans (7.0±2.9, [mean±SD]) than in omnivores (5.0±1.9 [mean±SD]; p=0.016), as well as the sum BEWE codes found in all dental surfaces (21.6±10.8 vs. 12. 7±6.2 [mean±SD]; p=0.002).

Although the consumption of acidic food/drinks was not different between vegans and omnivores, vegans present more indicators of ETW. Implementing preventive strategies to prevent ETW seems necessary for both groups of patients.

ANID FONDECYT Initiation 11220057 granted to CEF.

Session 8
Fluoride, Hard Tissues & Pulp-Dentinal Reactions

Saturday, July 8 2023, Morning

138 Fluoride clearance from the oral environment after rinsing with an eluted solution of S-PRG fillers

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Clearance of fluoride derived from surface pre-reacted glass-ionomer (S-PRG) fillers from the oral environment were compared with those of conventional fluoride applications. Three kinds of fluoride solutions (100 ppm F) were prepared: One from the filtrate of slurry of dental polishing agent containing S-PRG fillers and another from the filtrate of fluoridated toothpaste slurry (A and B), while the other from a NaF solution for topical application (C). Twenty-two subjects (18-41 years) rinsed their mouths for one minute with 10 mL of each solution according to a controlled schedule. Unstimulated saliva samples accumulated for three minutes were collected from their mouth floors 0, 10, 20, 30, 60 and 90 min after spitting out the solutions. Each sample was immediately weighed, and a pair of samples for analysis was taken from the supernatant after centrifuge and lyophilized. One freeze-dried sample was used to determine F electrometrically and another to analyze Al, B, Si and Sr by ICP-atomic emission spectroscopy. The results were tested with the Kruskal-Wallis test and multiple comparisons. Salivary fluoride concentrations (mean±SEM) 0 and 10 min after rinsing with solution A, B and C were 14.1±1.61/1.65±0.13, 25.4±2.19/3.78±0.57, and 27.5±2.61/4.49±0.70 ppm, respectively, indicating that solution A made the concentrations significantly lower than solution B ($p \leq 0.01/0.05$) or C ($p \leq 0.001/0.01$). Fluoride amounts in the same samples were 14.0±1.30/1.72±0.19, 35.7±5.08/3.99±0.65, and 29.7±4.13/3.76±0.49 µg, respectively, showing similar statistical results. There were no significant differences between solution B and C. Significantly higher ($p \leq 0.001$) concentrations of aluminum (34.3 ppm), borate (43.7 ppm) and strontium (90.2 ppm) were found in saliva samples collected just after rinsing with solution A. These results suggested that several ions released from S-PRG fillers may influence on oral retention of fluoride than fluoride delivered by conventional fluoride applications.

Supported by KAKENHI (C) No. 20K10306, Japan.

139 Caries prevention effect of toothpaste using fluoride deposition technology

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Objectives: It is well known that fluoride is effective in preventing dental caries. Since the maximum fluoride concentration allowed in toothpaste is defined in each country, it is necessary to elevate fluoride level on teeth surface and maximize its caries-preventive effect within the range. Here, we evaluated the potential of sodium fluoride toothpaste supplied with calcium (Ca) and phosphorus (P) containing compound as well as cationic polymer in improving fluoride uptake and reducing demineralisation.

Methods: Sound bovine enamel blocks (n = 8 per group) were demineralised and treated with toothpastes (1,450 ppm F (TP-F), or 1,450 ppm F+Ca+P (TP-FCaP)). The treated samples were immersed in hydrochloric acid solution, and uptaken F in the blocks was measured using ion electrodes. Fluorescence behaviour of the samples after acid challenge (n = 9 per group) with toothpaste/water slurries was determined using the quantitative light-induced fluorescence (QLF) analysis (QLF-D Biluminator™2 Inspektor Research Systems BV, The Netherlands). Electron probe microanalyser (EPMA) was employed for F mapping of the samples after the acid challenge (n = 1 per group). Statistical analyses were performed using Tukey's test ($\alpha = 0.05$).

Results: The degree of demineralisation ($\Delta\Delta F$, ΔF after − ΔF initial) in the TP-FCaP group (-8.2 ± 3.5) was smaller than that in the TP-F group (-16.3 ± 3.6) ($p \leq 0.01$).The amount of F deposition was larger in the TP-FCaP group (0.659 ± 0.095 μg/cm^2) than in the TP-F group (0.508 ± 0.085 μg/cm^2) ($p \leq 0.01$).

Conclusions: Fluoride toothpastes containing Ca and P showed more fluoride deposition and higher demineralisation inhibitory function than toothpastes without the additives. Addition of Ca and P may be useful for enhancing fluoride potential in caries prevention.

The authors received no specific funding for this work.

140 Longitudinal fluoride intake is not associated with age 23 tibial bone strength from finite element analyses

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Fluoride intake affects tooth and bone mineralisation. Few studies have comprehensively assessed fluoride intake and childhood/young adult bone development; none has related fluoride intakes to bone strength. Purpose: To assess associations of fluoride intake from birth to age 23 with age 23 Finite Element Analyses (FEA) bone strength estimates of the distal tibia from Multi-row Detector Computed Tomography (MDCT). Methods: In this prospective birth cohort study, participants were a subset (n=180 female/148 male) from the longitudinal Iowa Bone Development Study (IBDS). Parents and participants provided detailed questionnaire data 2-5 times yearly (birth to age 23) concerning fluoride intake from water, beverages, selected foods, dentifrice, and supplements. Individual water sources and major beverages were assayed for fluoride. Cumulative fluoride intakes (area-under-the-curve, AUC) for different periods (0-8, 8-15, 15-23, and 0-23 years) were examined for their associations with strength measures (Compressive elastic modulus (MPa) and Stiffness (KN/mm)) of the whole (cortical and trabecular) bone from previously-validated nonlinear continuum Finite Element Analyses (FEA) algorithms using 4-6% of the distal tibia obtained from MDCT imaging (Siemens SOMATOM Force Scanner). Sex-specific linear regression analyses (adjusted for age, height, weight, maturity offset, calcium, protein, Healthy Eating Index score, and physical activity score) were conducted. Results: Mean combined daily fluoride AUC intakes were 0.67/0.72 (female/male), 0.70/0.81, 0.94/1.11, and 0.77/0.90 mg/day for the 4 time periods, respectively. In the adjusted analyses, all associations of periods' F intakes with bone outcomes for both women and men were modest and none were statistically significant (all $p \geq 0.14$, most ≥ 0.5) at age 23. Conclusions: Results suggest that childhood, adolescent, and early adult fluoride intakes in the range of this study do not have adverse effects on tibial bone strength at age 23.

Supported in part by NIH R01-DE09551, R01-DE12101, R56-DE12101, UL1-TR000442, the Carver Charitable Trust, and the Delta Dental of Iowa Foundation.

141 Total fluoride intake across pregnancy amongst pregnant women in North-East England

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Data on fluoride exposure during pregnancy are sparse. Therefore, this study aimed to estimate total daily fluoride intake (TDFI) in pregnant women living in fluoridated- and non-fluoridated areas in North-East England. Daily dietary fluoride intake was assessed using a food frequency questionnaire and information on toothbrushing habits using a semi-quantitative oral hygiene questionnaire. TDFI was estimated from the diet and dentifrice usage. Samples of home tap water were collected and analysed for fluoride using a fluoride ion-specific electrode. The water samples and questionnaires were collected in each of the three trimesters (T1, T2 and T3) of pregnancy. Thirty pregnant women in non-fluoridated (NF-A) and twenty in fluoridated (F-A) areas took part in the study. The mean (SD) fluoride concentration of tap water was 0.09 (0.02) and 1.10 (0.08) µg F/ml in the NF-A and F-A areas, respectively. Mean (SD) TDFI for pregnant women living in NF-A were 0.022 (0.009), 0.020 (0.009) and 0.017 (0.008) mg/kgbw/d at T1, T2 and T3, respectively. The corresponding figures for F-A were 0.063 (0.018), 0.069 (0.024) and 0.059 (0.021) mg/kgbw/d, respectively. Mean TDFI values were significantly different ($p \leq 0.001$) between F-A and NF-A in each trimester. The contribution of dentifrice usage to TDFI was almost 21% in F-A and 50% in NF-A on average, respectively. There were no considerable variations in TDFI across the first two trimesters of pregnancy, but the mean values declined in the last trimester for women in both areas. To conclude, fluoride usage from fluoridated-dentifrice can also be a key source of fluoride exposure in pregnant women. This emphasises the importance of estimating fluoride exposure from all sources at an individual level in prenatal studies on fluoride and its subsequent effects.

Supportd by Doctoral Training Alliance (DTA).

142 Engineering and fluoride release of fluoride salts nanoparticles

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Fluoride is the most effective anticaries agent, but its intraoral retention, especially in the dental biofilm, is poor due to the abundance of negatively charged groups in the biofilm mass. To overcome this limitation, we designed fluoride nanoparticles with a positive charge that could bind to the biofilm, and assessed their fluoride release. Electrohydrodynamic jetting was used to encapsulate CaF_2 (low solubility salt) or SnF_2 (high solubility salt) using the positively charged polymer chitosan (Chit). Particles were characterized by scanning electron microscopy and Nanoparticle Tracking Analysis (NTA). Total (after acid extraction) and soluble fluoride concentrations in the suspensions were measured over time using a fluoride electrode. For fluoride release, suspensions were immersed in DPBS in dialysis tubes at 37°C and released fluoride was measured over time. The fabricated nanoparticles showed a homogeneous distribution of spherical, sub 200 nm particles at dry state. Upon preparation, the ChitCaF_2 and ChitSnF_2 particles suspension had 0.5±0.2% and 17.7±3.6% of soluble fluoride, respectively. The suspensions were shown to be stable, with the soluble proportion in the ChitSnF_2 suspension remaining at 25.2%±0.3% even at least 30 days after preparation. In the release test, after 7 days the ChitCaF_2 nanoparticles released 20.7±1.3% of their total fluoride content, while the ChitSnF_2 particles released ≥80% of their fluoride content (≥40% after only 3 h). The results confirmed the engineering of stable positively charged fluoride nanoparticles with fluoride release mirroring the solubilities of their respective fluoride salts. These particles can be used in the formulation of more intelligent fluoride treatments, with improved intraoral retention and fast and sustainable fluoride release.

Funded by NIH/NIDCR Award# R01DE031236.

143 Prevalence of receipt of fluoride varnish in dental and medical settings in school-aged U.S. children

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Dental caries is a major public health problem for children. Fluoride varnish (FV) helps prevent caries and can be applied in both dental and medical settings, but few studies have assessed its use in these settings longitudinally.

Objective: To assess prevalence of FV application in dental and medical settings from age 4 to 10, and factors associated with the applications.

Methods: Primary caregiver/child pairs (1,326) were enrolled at child age 12 months in 2012-2013 at 3 study sites as part of a caries risk assessment study. Every 4 months, questionnaires asked separately about dental and medical FV application. Cross-sectional FV rates were determined from age 48 to 122 months and factors (study site, dmfs count, demographic, SES, insurance) related to FV applications were determined in bivariate analyses.

Results: The majority of children at age 4 years were male (51%), white (51%), non-Hispanic (87%), and Medicaid-insured (54%). Receipt of dental FV application during the previous 4 months was relatively steady at 38% (at age 48 months), 41% (78 months), 31% (104 months), and 39% (122 months). The prevalence of medical FV application during the previous 4 months declined from 5% (48 months) and 6% (78 months) to 1% (104 and 122 months). Factors significantly related($p \leq 0.05$) to lower dental FV rates at 1 or more time periods were site, higher dmfs, Medicaid-enrolled, Black, Hispanic, lower income, and no public assistance. Factors significantly related to lower medical FV rates at 1 or more time periods were site, not Medicaid-enrolled or public assistance, not Black, Hispanic, and higher income. Sex was not related to either rate.

Conclusion: FV application prevalence is substantially lower in medical settings than dental settings and medical FV rates decrease with age.

National Institutes of Health- NIDCR- DE021412 and NIH CTSA grants: TR002553 (Duke University), TR000006 (Indiana University), TR001356 (University of Iowa), and TR000433 (University of Michigan).

144 Effects of LED curing light on silver diammine fluoride penetration into dentine caries lesions.

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The aim of this ex-vivo study was to examine the effect of light-emitting diode (LED) curing light on the depth of penetration of Silver Diammine Fluoride (SDF) into dentine carious lesions.

Thirty teeth with dentine carious lesions were allocated into 6 groups: four SDF-treated and two untreated controls. Treated teeth received 1 drop of SDF and were rinsed with tap water for stipulated times within 5 min after extraction as listed: (1) n=6; SDF for 1 min with 10 s rinse, (2) n=6; SDF for 10 s and exposed to LED curing light for 20 s followed by 10 s rinse (3) n=6; SDF for 10 s and 10 s rinse, (4) n=6; SDF for 10 s with 1 min rinse (5) n=3; untreated and (6) n=3; untreated, exposed to LED light for 20 s. Samples were embedded, sectioned, and carbon coated. The extent of silver penetration was imaged and measured using backscattered electron scanning electron microscopy (BSE-SEM) and energy-dispersive X-ray spectroscopy (EDS).

Control groups had no silver present. For the SDF-treated groups, results were expressed as the average relative depth of silver penetration (%) which equals “silver depth/lesion depth x 100” from five measurement sites in each lesion. Group means were compared using mixed model analysis. Mean ± SD silver penetration was: Group-1: 86.4 ± 20.7%, Group-2: 94.3 ± 13.7%, Group-3: 26.7 ± 13.9%, and Group-4: 24.0 ± 10%. Groups 1 and 2 were statistically similar and different from Groups 3 and 4 ($p \leq .001$).

In conclusion, using LED curing light for 20 s after short SDF application (10 s) seems to facilitate silver penetration, similar to a 1 min SDF application with no LED. Clinical studies are needed to better understand and define the role of silver penetration enhanced by LED light, in sustained caries arrest.

Electron microscopy imaging and elemental analysis was made possible by a National Institutes of Health S10 Shared Instrumentation Program grant, number 1S10OD026989-01.

145 Abrasion of dental hard tissues by baking soda: effect of dilution and brushing force

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This study evaluated the abrasion of dental hard tissues brushed with pure or diluted baking soda (BS) under low- and high brushing force. Slabs of human enamel and root dentine were embedded, levelled/polished and taped bilaterally. Samples were allocated into 5 experimental groups (n=16) according to BS/artificial saliva (AS) ratio by weight [1:0 (pure/unsuspended) and suspended at 1:1, 1:2, 1:3, 1:4 ratios]. Two other groups served as control: mid-abrasive toothpaste (Crest Cavity Protection, P&G; 1:3 slurry) and plain AS. Half of the samples (n=8) of each group brushed in the presence of standardized volume of pure BS, BS suspension, toothpaste slurry or plain AS received 1 N brushing load, while the remaining received 3 N. Brushing was performed at 4.5 Hz, for 55,000 strokes using soft brushes (Oral-B Indicator, P&G). Surface loss (SL) was assessed profilometrically (µm) and compared using Kruskal-Wallis and Student-Newman-Keuls tests (α=5%). Pure BS [enamel – 1 N load: mean 1.23 (sd 0.89); 3 N load: mean 1.55 (sd 1.03); root dentine: 1 N load: mean 8.59 (sd 3.87); 3 N load: mean 10.14 (sd 8.77)] and 1:1 BS/AS caused significantly higher SL ($p \leq 0.001$) than plain AS [enamel – 1 N load: mean 0.19 (sd 0.07); 3 N load: mean 0.23 (sd 0.08); root dentine: 1 N load: mean 0.65 (sd 0.50); 3 N load: mean 0.71 (sd 0.35)]. However, pure BS and 1:1 BS/AS were not more abrasive than toothpaste slurry. Increasing the brushing load, 1:2 suspension also provided higher SL than plain AS. Low x high force applied during brushing did not affect SL ($p \geq 0.15$). Although BS may influence SL of enamel and root dentine in a concentration-dependent fashion, even pure BS used under high brushing force does not harm enamel and root dentine more than a mid-abrasive toothpaste.

The São Paulo Research Foundation (FAPESP, grant # 2021/01166-6).

146 Bonding of restorative materials to caries-affected dentine disinfected with photodynamic therapy and chemical disinfectants

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The aim of this laboratory-based study was to evaluate the effects of different cavity disinfections on the microtensile bond strength (μTBS) of restorative materials frequently preferred in individuals with high caries risk. Seventy-two extracted human molars with occlusal carious lesions were selected. After caries excavation with bur, the specimens were randomly divided into 3 groups according to different cavity disinfection protocols (n=24); no disinfection, disinfection with photodynamic therapy (100 mg/L methylene blue solution and diode laser), disinfection with 2% chlorhexidine gluconate. Following disinfection protocols, restorative materials as follows: two pre-conditioned materials: Activa Bioactive-restorative (Pulpdent Corp.), Fuji II LC Improved (GC Corp.), and one bulk-fill glass-hybrid restorative (Equia Forte Fil (GC Corp.) were applied to specimens. After the restored teeth were thermocycled (5-55, 1,000X), beam-shaped sticks were obtained and subjected to a μTBS test (Bisco, Schaumburg, IL, USA). The beams located at the periphery of the block were discarded. The fracture surfaces of the specimens were examined using a light microscope at 40x magnification and the type of failure was determined. Representative specimens were selected from each group and evaluated by scanning electron microscopy. Statistically significant differences were recorded using Welch's ANOVA with Games-Howell contrast ($p \leq 0.05$). The highest μTBS values were obtained from the disinfection with photodynamic therapy (100 mg/L methylene blue solution and diode laser) groups ($p \leq 0.05$), which exhibited no statistical differences in terms of the restoratives tested ($p \geq 0.05$). Activa Bioactive restorative showed higher μTBS values compared to other restoratives, regardless of the disinfection protocol ($p \leq 0.05$). Within the limitations of this study, first disinfection of the cavity with photodynamic therapy followed by application of Activa Bioactive restorative appears promising for better bonding to caries-affected dentine in patients at high caries risk.

The authors received no specific funding for this work.

147 Bond strength of bioactive materials to laser-prepared dentine

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The purpose of this study was to evaluate the shear bond strength of different bioactive restorative materials to laser-prepared dentine.

Materials and Methods: A total of forty-five extracted human molar teeth were ground to expose dentine. The dentine surfaces were prepared using Er,Cr:YSGG laser irradiation (3 W, 20 Hz, 70% H2O, 60% air). The teeth were then randomly assigned to 3 groups (n=15) Group I: Glass hybrid material, EQUIA Forte HT, Group II: Bioactive resin composite, Activa BioActive-restorative, Group III: Giomer restorative material, Beautifil II. All restorative materials were applied according to the manufacturer's recommendations using the Ultradent shear bond Teflon mold system. After storage of the bonded specimens in distilled water for 24 h, shear bond strength was determined using Instron Universal testing machine at crosshead speed of 1.0 mm/min. Data were analysed using One-way ANOVA with Games-Howell multiple comparison testing.

Results: Equia Forte HT showed significantly lower bond strength values than the other tested materials ($p \leq 0.05$). No statistically significant difference was found between Activa BioActive- restorative and Beautifil II ($p \geq 0.05$).

Conclusion: The tested bioactive resin composite and giomer might be more promising materials than the tested glass hybrid material for bonding to laser-prepared dentine.

The authors received no specific funding for this work.

148 The effect of treatment regiments on mineralisation of MIH enamel in vitro

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Aim was to investigate the effect of a treatment regiments on mineralisation of Molar-Incisor Hypomineralisation (MIH) enamel in vitro.

After obtaining ethical approval, eleven human MIH teeth were used to generate 20 slabs containing MIH lesions. The slabs were randomly allocated into four groups: F free toothpaste (control); 1450 ppm F toothpaste (control); 1450 ppm F toothpaste + Sensodyne repair and protect with NovaMin toothpaste and 1450 ppm F toothpaste + tooth mousse casein phosphopeptide-amorphous calcium phosphate (10% w/v CPP-ACP). The slabs were immersed in toothpaste slurries for 5 min twice per day and stored at 37°C in artificial saliva during 28 d. The lesions were analysed for hardness (KHM) using a microhardness and surface roughness (µm) using a profilometry before and after treatment.

Paired ample t-test ($p \leq 0.05$) result shows that there was a significant difference in hardness MIH lesions in comparison between the baseline and after treatment for all groups (Diff ± SD) (32.2 ± 46 KMH) ($p \leq 0.01$). However, it did not reach significance in hardness of MIH lesions in comparison between groups.

The Wilcoxon Signed Ranks test ($p \leq 0.05$) of surface roughness data (Diff ± SD) (-0.7 ± 2.6 µm) within the groups shows between the baseline and after treatment did not reach significance. Furthermore, a Kruskal-Wallis test ($p \leq 0.05$) shows that there were no difference in the surface roughness in comparison between groups.

In our in vitro model all regimens resulted in an improvement in the MIH enamel lesion's hardness. The addition of tooth mousse CCP-ACP or Sensodyne with NovaMin with fluoridated toothpaste treatment did not add a further benefit in hardness of the MIH lesions.

The authors received no specific funding for this work.

149 Partial pulpotomy in young permanent molars: a systematic review and meta- analysis

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Avoiding irreversible treatments like pulpectomies, root canal procedures or extractions in children at high caries-risk is desirable. Currently new materials and minimally invasive treatments for partial pulpotomy were introduced. Thus, clinicians could benefit from a comprehensive analysis of partial pulpotomies procedures.

Aim of this study was to evaluate the evidence regarding the clinical and radiographic success, as well as pathological outcomes of techniques and materials used for partial pulpotomies in deep caries processes or post eruptive breakdown defects in vital permanent teeth in young patients.

Electronic databases PubMed, Scopus and Embase were searched, followed by a manual search. Randomised controlled trials evaluating partial pulpotomy and a follow up period of ≥12 months were included. ROBINS-I risk-of-bias-tool was used to assess the quality of eligible studies. Meta-analyses using a fixed effect model was performed.

3,017 papers were found and nine papers were eligible and included into the systematic review. Overall success rate of partial pulpotomy was very high (98%). Regardless of partial pulpotomy technique or material used, there were no significant differences between clinical and radiographic success rates. Five studies were included for meta-analysis that did not indicate any statistically significant differences in success rates when mineral trioxide aggregate was compared to calcium hydroxide (95% CI 0.146, 7.795, p=0.059).

In conclusion, this research systematically evaluated the evidence and summarised all available data for partial pulpotomy in young patients. This treatment should be taken in consideration as it is a successful option, regardless of the materials used, especially when vital pulp therapy needs to be performed in highly damaged young permanent teeth as the biological and economical saving is an important goal as well as to postpone more invasive endodontic treatments.

The authors received no specific funding for this work.

150 Combined vital pulp therapy and direct restoration saved a hopeless tooth: 5 years case report.

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This case report describes the preservation of a mature maxillary molar. The patient came for a second opinion because her dentist diagnosed the tooth as hopeless and wanted to extract it. The clinical diagnosis was a reversible pulpitis because of a secondary caries. However, it was not clear whether the tooth could be preserved vital to restore. Therefore, the filling and the caries were removed first by also using rubber dam, opaldam and a microscope. Since it could not be excluded that the distal pulp was infected, it was decided intraoperatively to perform a vital pulp therapy through a pulpotomy. The slightly bleeding pulp stumps and cavity were disinfected with 2% CHX and covered only with sterile cotton pellets for 3 min. The pulp was then covered with MTA (Biodentine) and the cavity was sealed with a bulk fill material (SDR). The clinical controls after 3 and 6 weeks as well as 3, 6, 12, 24 months show a clinically and radiographically normal situation, even after 5 years. Based on the diagnosis of hopelessness, the tooth could be preserved in a minimally invasive way with little effort. A standardized protocol for the vital preservation of teeth and strict follow-up control help to achieve a high cost/benefit advantage for the patient and overall public health.

The author received no specific funding for this work.

Session 9
Clinical studies part 2

Saturday, July 8 2023, Morning

151 Preliminary assessment of caries lesion trajectories over time in children from a US population

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Objective: To determine cavitated caries lesion trajectories in primary teeth of a population of U.S. children ages 1-8 years, and associations with lesions in permanent teeth at age 9.5.

Methods: 549 children received caries examinations using the International Caries Detection and Assessment System criteria at ages 1, 2.5, 4, 6.5 and 8 years; and bitewing radiographs at ages 6.5 and 8. Age 9.5 exams are ongoing. Latent class mixed model analysis was used to determine groups based on trajectories of new cavitated carious surfaces in primary teeth from ages 1-8. Chi-square analyses tested the associations of the trajectory-groups with caries in permanent teeth at age 9.5.

Results: Four trajectory-groups were identified with distinct caries counts and lesion locations at each age. Groups' demographics ranged from female=49-57%, white=28-58%, Hispanic=12-22%, Medicaid-enrolled=41-73%. Trajectory-group 1 (total children=7%) developed the highest caries counts at ages 2.5 and 4 of all groups, but by age 6.5 had significantly lower counts than groups 3 and 4. Trajectory-group 2 (total children=49%) had lower caries counts at ages 2.5, 4 and 8, but similar counts at age 6.5, than group 1. Trajectory-group 3 (total children=40%) and Trajectory-group 4 (total children=4%) had almost no lesions until after age 4, but by age 6.5, group 3 had significantly more lesions than groups 1 and 2, while group 4 had significantly more lesions (the majority in posterior-interproximal surfaces) than all other groups. Ongoing age 9.5 data showed that caries counts for all permanent tooth surfaces, and for posterior surfaces, were significantly lower ($p \leq 0.05$) in Trajectory-group 2 than groups 1 and 3.

Conclusions: Four caries trajectory-groups were identified in the primary dentition. Preliminary age 9.5 data showed these trajectory-groups can inform caries counts in permanent teeth.

Supported by NIH Grant U01DE021412-12.

152 Comparison of oral status and oral health behavior using CRASP in Japanese dental clinics

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Caries risk assessment (CRA) plays an important role in successful caries management. However, any formal CRA is not often carried out in Japan because it is time-consuming and costly. Caries Risk Assessment Share with Patient (CRASP) is a simple CRA model newly developed by The Japan Health Care Dental Association that focuses on sharing clinical information with patients at low cost. The purpose of this study was to investigate the relationship between oral status and oral health behaviour in patients undergoing CRASP. The subjects in this study comprised patients aged 6 years and older who underwent CRASP at four Japanese dental clinics between January and December 2020. A total of 280 subjects were analysed. Among these, 124 had untreated decayed teeth (DT) and 156 no DT (NDT). A chi-squared test was used to make comparisons between the DT and NDT groups or having DMFT ≥ 10 and ≤ 9 groups. The study was approved by the Ethics Committee of Tokyo Dental College (Approval no: 1107). The percentage of subjects with NDT brushing their teeth every day before going to bed was higher than among with DT ($p = 0.031$). The percentage of those who ate and drank after brushing their teeth before going to bed was 14.3%, did not use fluoride toothpaste twice a day with the proper amount was 41.1%, and rinsed three times or more after toothbrushing was 58.6%. A higher percentage of subjects who rinsed three times or more had DT ($p = 0.041$) and had DMFT ≥ 10 ($p = 0.039$). The results indicate that Japanese patients have problems with oral health behaviour, especially rinsing behaviour, which is part of CRASP.

The authors received no specific funding for this work.

153 Longitudinal status of dental caries and risk factors for cavity in the occlusal surface of first permanent molars in a school oral health program

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This study aimed to evaluate the caries status in the occlusal surface of first permanent molars (FPM) and to identify risk factors for progression to cavity in schoolchildren. The study was ethically approved. Participants signed an informed consent. Children who were enrolled in the program between Sep/2017 and Oct/2019, 5-10 years-old, with four FPM were included. Four calibrated examiners assessed caries using Nyvad criteria. Chi-square test was used in the bivariate analysis and logistic regression adjusted for cluster was used to identify significant risk factors for cavity. Independent variables were gender, baseline age, deft, upper/lower molar, initial caries score, MIH, fluorosis, occlusal sealing. From 174 children enrolled in 2017/2019 (age 7.64 years ± 1.26), 120 (70%) were re-evaluated in 2022, 63 (52.5%) girls, age 11.5 ± 1.5. From 480 FPM, 53 (11%) were excluded due to cavity in the baseline, orthodontic band, or treated elsewhere. The final sample comprised 427 FPM in 120 children. In the baseline, 281 (65.8%) FPM were sound and 146 (34.2%) presented initial active caries. In the follow-up, 346 (81%) were sound, 70 (16.4%) presented initial active caries, and 11 (2.6%), cavity. Active caries lesions in the baseline tended to be active in the follow-up more frequently ($p \leq 0.001$) but did not show a higher progression to cavity ($p=0.52$) in comparison with sound surfaces. Eleven (2.6%) FPM presented cavity in the follow-up. Significant risk factors for cavity were caries experience in the primary teeth (OR=5.59; CI: 1.4 – 22.3) and the presence of MIH (OR=5.33; CI: 1.6 – 18.1). Most of the active lesions in the follow-up were already active in the baseline. The progression to cavity was low, significantly influenced by past caries experience and MIH.

Funded by *CAPES.*

154 Primary incisor crowding: association with children's caries risk

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Objective: To assess the relationship between primary incisor spacing/crowding at age 2.5 years and caries development over time.

Methods: 556 children received caries examinations using the International Caries Detection and Assessment System (ICDAS) criteria at ages 1, 2.5, 4, 6.5 and 8 years, including bitewing radiographs at ages 6.5 and 8. Caries experience was assessed and tested for association with incisor spacing. Analyses were performed using generalized estimating equation (GEE) models for binary data.

Results: There were statistically significant associations ($p \leq 0.05$) between: 1) lack of spacing between the primary maxillary central incisors at age 2.5 years and any caries experience (dmft+DMFT≥0; d/D=ICDAS≥3) at 4 years of age [No space=26% vs. space=22%, p=0.011; Odds Ratio-OR (95% CI)=1.26 (1.06, 1.51)]; 2) lack of spacing between the primary maxillary central incisors at 2.5 years and caries experience on the mesial surface of these teeth at 4 years of age [No space= 11% vs. space =4% $p \leq 0.001$; OR (95% CI) = 3.46 (2.34, 5.10)] and at 6.5 years [No space= 7% vs. space = 2%, $p \leq 0.001$; OR (95% CI)=5.10 (3.49, 7.44)]; 3) primary mandibular incisor crowding (≥3 contacts closed) at 2.5 years and any caries experience at age 6.5 years [Crowding=64% vs. no crowding=69%, p=0.001; OR (95% CI)=1.33 (1.10, 2.76)] and age 8 years [Crowding=71% vs. no crowding=61%, p=0.018; OR (95% CI)=1.74 (1.10, 2.76)].

Conclusion: Children with lack of spacing between the primary maxillary central incisors at age 2.5 years were more likely to have interproximal caries lesions involving these specific teeth over time. Children with primary mandibular incisor crowding incisor crowding at age 2.5 years were more likely to have overall cavitated caries lesion experience by age 6.5 and 8 years.

Supported by NIH Grant Number U01 DE021412 and NIH CTSA grants: UL1-TR000442 (University of Iowa), 2UL1-TR000433(University of Michigan), and UL1-TR000006 (Indiana University).

155 Variations in tooth contact and proximal caries in children: a 3-year prospective cohort study

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This study aimed to evaluate the association between the contact areas of teeth and proximal caries after three years of observation. This prospective cohort study included 1,119 caries-free children, aged 3–4 years, from Puducherry, India. At baseline, contacts were assessed using the OXIS criteria. Two calibrated dentists measured dental caries at one-year intervals following the International Caries Detection and Assessment System for three years. Poisson regression analysis with a multilevel approach was used to determine the association between contact type and proximal caries. Of 3,848 contacts observed at the end of three years, 499 (13·0%) were carious. The adjusted analysis revealed a significant association between contact type and proximal caries ($p \leq 0{\cdot}05$). The risk ratios for the development of proximal caries were 2.3 for X-type contacts (0·5–11·4, $p = 0.307$); 12.7 for I-type (4·1–39·6, $p \leq 0{\cdot}05$); and 22.5 for S-type (7.2–70.6, $p \leq 0.05$), when compared with O-type. Compelling evidence suggests that variations in contacts between teeth are significant in the development of proximal caries. The S-type contact is the most susceptible to proximal caries, followed by the I type.

This study was funded by the DBT/Wellcome Trust India Alliance (IA/CPHE/17/1/503352).

156 Clinical detection and monitoring of occlusal caries in young adults. Thirty-month follow-up.

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Aim of this clinical study was to examine the agreement in detecting occlusal caries lesions in young adults between the International Caries Detection and Assessment System (ICDAS II) visual criteria and an intraoral scanner (IOS) and to monitor the detected initial caries lesions over two and a half years. Sixty adult patients, aged 19-25 years, participated in the present study. The occlusal surfaces of the posterior teeth of all patients were initially examined using the ICDAS II criteria and scanned with the TRIOS 4 IOS (3Shape TRIOS A/S, Denmark). TRIOS Patient Monitoring software was used for automated caries scoring on the 3D models. The final assessments were performed approximately 30 months after the initial examination using the same evaluation systems. At baseline, 60 patients with 2,985 occlusal sites were examined with both evaluation systems. At the 30-month recall, 55 patients with 2,661 occlusal sites were recorded. Paired sample test showed that there was a statistically significant difference between ICDAS and IOS evaluation both at baseline ($p \leq 0.001$, 95% CI: [0.043-0.075]) and the 30-month recall ($p \leq 0.001$, 95% CI: [0.050-0.085]). At baseline, the positive percentage agreement between the two evaluation systems was 0.592, while the negative percentage agreement was 0.908 (AUC: 0.750, 95% CI: [0.727-0.772]). At 30-month recall, the positive percentage agreement was 0.545, while the negative percentage agreement was 0.879 (AUC: 0.712, 95% CI: [0.690-0.734]). Regarding the monitoring of caries lesions, the two evaluating systems reported a statistically significant progression of lesions between the baseline and 30-months examination (ICDAS $p \leq 0.000$, 95% CI: [0.091-0.053] and IOS $p \leq 0.001$, 95% CI: [0.041-0.011]), according to the paired sample test. In conclusion, the automated system tends to detect fewer initial caries lesions compared to the visual assessment.

This study was supported financially by Innovation Fund, Denmark (grant no.8053-00005B) and 3Shape TRIOS A/S.

157 Brushing and chewing movement – are synergisms conceivable?

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Video observations, even those from the 1970s, consistently show recurring movement patterns during tooth brushing, which are characterised by frequent switches of the acting toothbrush between the different areas of the dentition. This may indicate that tooth brushing largely is an entrenched spontaneous behaviour. Similar applies to chewing, which is rhythmically coordinated by central pattern generators (CPGs) located in the central nervous system. This has led to the question of whether both movements have shared control components. Thus, our study investigated whether brushing movements and chewing movements are related to each other.

Sixty-five subjects (24.6 ± 2.7 yr) were included. Their toothbrushing behaviour was video-taped in a cross-over design before and after gum-chewing or watching a relaxing video. In addition, subjects were filmed once while gum-chewing for 2 min. Parameters studied were brushing movement frequency (BMF: back-and-forth movements/s) and chewing frequency (CF: jaw movements in the vertical plane/s). Statistics: Wilcoxon-test and Spearman´s rho, values are given as median (min;max).

The BMF was 7.8 (3.3;10.5) and 8.0 (3.3;0.7) before and after gum-chewing and 7.9 (3.1;10.4) and 8.0 (4.2;10.8) before and after video watching. These differences did not reach significance. The corresponding correlation coefficients ranged from 0.909 to 0.951 ($p \leq 0.01$ each). The CF was 2.78 (1.8;3.7). Correlation coefficients between BMF and CF ranged from 0.289 and 0.338 ($p \leq 0.05$).

The results show that BMF is a firmly anchored movement. Although it is not directly influenced by gum-chewing, its correlation with CF suggests that there may be a connection via nerve fibres between the respective CPGs. This warrants further investigations and offers a broad perspective for further interdisciplinary research that could be important for the development of new strategies for oral hygiene education, such as influencing neural circuits.

The authors received no specific funding for this work.

158 The effect of an enzyme-containing lozenge on dental biofilm accumulation: A clinical pilot study

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Dental biofilms consist of microorganisms embedded in an extracellular matrix that comprises a complex mixture of macromolecules, including extracellular DNA and polysaccharides. Matrix-degrading enzymes have been shown to destabilize dental biofilms and thereby contribute to caries control. The aim of this work was to test the effect of a lozenge containing a mixture of glucanase, mutanase and DNAse on biofilm formation, the development of gingivitis and the composition of the oral microbiota.

24 healthy volunteers were enrolled in a randomized, double-blind placebo-controlled study with two parallel arms. After an initial professional tooth cleaning, participants refrained from oral hygiene and used three enzyme-containing or placebo lozenges/d for 7 d. After 1 and 7 d, the Turesky-modification of the Quigley-and-Hein Plaque Index (TM-QHPI) was assessed in the first and second quadrant, respectively and compared to TM-QHPI after a one-day baseline period without oral hygiene (two-sample t-tests). At baseline and after 7 d of intervention, the gingival index (GI) was recorded and compared (two-sample t-test), and the species richness was analysed in plaque and saliva samples by 16S rRNA sequencing (linear mixed model). The protocol was approved by the local Ethics Committee (1-10-72-260-20).

Enzyme treatment resulted in a reduced mean TM-QHPI compared to control treatment after 1 d (Δ=-0.61±1.00 SD vs. 0.03±0.59 SD; p=0.07; Δ=-0.82±0.74 SD vs. -0.09±0.45 SD; p=0.01 without outliers) but not 7 d (Δ=1.03±1.42 SD vs. 1.61±1.36 SD; p=0.39), and in a reduced increase in average species richness (17±9 SE vs. 35±7 SE; p=0.04) from baseline to day 7. Mean GI did not increase over the intervention period for both treatment groups (Δ=-0.06±0.63 SD vs. 0.02±0.44 SD; p=0.39). Lozenges containing matrix-degrading enzymes may be a promising adjunct to oral hygiene.

This work was funded by Novozymes A/S.

159 Aesthetic caries infiltration – long-term masking efficacy after 6 years

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Objectives: This study aimed to evaluate the masking efficacy of caries infiltration technique of initial caries lesions (ICL) six years after debonding and single treatment.

Methods: In 10 adolescents, 74 ICL (ICDAS 2) in 74 teeth were treated by resin infiltration (Icon, DMG) at a mean (SD) of 1.2 (1.2) months after bracket removal. The etching procedure was performed up to 3 times. Standardised digital images were taken before treatment (T0), seven days (T7) and 6 years (T2190) after treatment. Outcomes included the evaluation of the color differences between carious and healthy enamel at T0, T7 and T2190 by quantitative colorimetric analysis (ΔE), ICDAS scores, quantitative light-induced fluorescence (QLF; ΔF,ΔQ,WS Area) and qualitative visual evaluation (5-point Likert-scale [deteriorated (1), unchanged (2), improved, but not satisfying (3), improved and no further treatment required (4), completely masked (5)). Inter-observer reliability was analysed using Fleiss-Kappa.

Results: The median colour difference ΔE0 (25th/75th percentiles) at T0 was 10.3 (8.56/13.0). At T7 a significant decrease was observed (ΔE7=3.7 (2.0/5.8); p≤0.001; Friedmann-test; ICDAS p≤0.001; Chi-square test). No significant changes based on ΔE (p=0.972; Friedmann-test) and ICDAS grading (p=0.511, chi-square test) were observed between T7 and T2190 (ΔE2190=2.9 (1.8/4.2)). Furthermore, at T2190 four experienced dentists classified 50% and 37% of the lesions as “improved and no further treatment required” and “completely masked”, respectively (Fleiss kappa: T2190: 0.782 (substantial agreement)).

Conclusion: Aesthetic caries infiltration can effectively mask post-orthodontic initial caries lesions for at least 6 years. These results for most of the teeth could not only be observed by quantitative but also by qualitative analysis.

The study was supported by DMG, Hamburg the producer of the infiltration kit (Icon), which is hereby acknowledged. The manufacture had no role in design, conduct, evaluation, interpretation of the study or in writing the manuscript. HML receives royalties from Icon sales.

160 Clinical performance of resin-modified glass ionomer cement applied to partially erupted permanent molars: preliminary report

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This study aims to evaluate and compare the clinical performance of partially erupted permanent molars that are treated with resin-modified glass ionomer cement (RMGIC) with and without adhesive as a fissure sealant. 48 permanent molars were selected from 24 children with high caries risk and with at least two partially erupted permanent molars. Teeth were randomized into 2 groups: (1) universal adhesive+RMGIC and (2) RMGIC-only groups (n=24 teeth/group) in a split-mouth study design. The amount of plaque on the occlusal surfaces of the teeth in both groups was evaluated with the visible occlusal plaque index (VOPI), and restorations were evaluated clinically in terms of marginal discoloration, marginal adaptation, surface roughness, secondary caries, and retention. The data were statistically analysed using repeated measures analysis of variance, Friedman test, and McNemar test. VOPI values decreased significantly on the 3rd and 6th-month values compared to baseline. When the oral hygiene of the patients was evaluated with the Oral Hygiene Index of Green and Vermillion (OHI-S), the median values for initial hygiene were significantly higher than those at the 3rd and 6th months ($p \leq 0.01$). No significant difference was observed between the groups in terms of marginal discoloration, marginal adaptation, and retention. No retention failure or caries formation was observed during the 6th-month follow-up of 48 teeth. In patients with high caries risk, fissure sealant application with RMGIC on partially erupted teeth significantly reduced occlusal plaque index, improved oral hygiene and prevented possible caries development. In order to evaluate the effect of the adhesive application, restorations should be followed for a longer period of time.

Funded by Hacettepe University Scientific Research Projects Coordination Unit (Grant No: THD2019-18276)

161 Protocol for reducing the need of dental general anesthesia in young children: the Greifswald concept

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Contemporary paediatric dentistry needs to move towards control-oriented and minimally invasive (MI) care, away from the surgically-oriented "drill and fill" approach. The Greifswald Caries Control concept (GrCo) incorporates: baseline assessment (oral hygiene, caries risk, cooperation, etc.) targeting treatment goals, oral health counselling (age-oriented fluoride toothbrushing, diet) involving parents/carers, desensitisation visits, and MI caries management (38%-SDF application, Hall Technique, etc.). This study aimed to determine whether the adoption of the GrCo would influence high-caries-risk (dmft≥4) children from undergoing dental general anaesthesia (DGA) treatment in a cohort of 1–5-year-olds. Data from high-caries-risk children attending an university paediatric dentistry department between 2019-2021 with/without referral to DGA, who were unable to tolerate invasive chairside caries treatments were extracted from patients' clinical records. Patients presenting with irreversible pulp involvement at baseline, or insufficient data were excluded. 38 patients (mean=3.6±1.1 yrs.; dmft=5.6±3.7, d-component≥83%) met the inclusions criteria and were analysed. The GrCo was implemented; patients received mostly 38%-SDF, at the first (18.4%) or at the desensitisation visits (81.6%). After 1 year (14.6±4.0), the majority (32/38) of DGA eligible children were treated chairside, with 6/38 children who still needed DGA, resulting in an 84.2% DGAs reduction in eligible patients. At the tooth level, the majority (87%) of lesions were arrested, of these, 58.7% were not restored and 31% were treated with any MI-restorative modality (e.g., SMART-Technique, Hall-SMART). In conclusion, the GrCo focuses on empowering children/parents for having long-term oral health and follows current evidence-based caries-control recommendations. This concept showed to be effective in reducing the need of DGA treatment and is particularly beneficial for control of a largely preventable chronic disease like caries, in which behaviour change is key and patient motivation a common challenge.

The authors received no specific funding for this work.

162 Comparative evaluation of plaque removal efficacy of electric toothbrushes between children with attention deficit and hyperactivity disorder and healthy children

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This study was designed to assess the efficacy of electric toothbrushes on plaque removal in children with or without Attention Deficit and Hyperactivity Disorder (ADHD). A total of 52 children (26 with ADHD and 26 without ADHD (Control)) were enrolled in the study. Each group was randomly divided into 2 subgroups according to toothbrush type: electric and manual. All children were trained by a dentist on brushing and DMFT/dft and Löe-Silness Gingival Index (GI) values were recorded. At the first appointment, plaque disclosing was performed, Turesky modification of Quigley-Hein Plaque Index (TQHPI) and Approximal Plaque Index (API) values were recorded both pre- and post-brushing in order to determine the efficacy of single brushing. All children brushed their teeth under the supervision of a dentist in front of a mirror. Then, children continue brushing at home twice daily for 3 months. The same procedures were repeated at first- and third-month visits. Mann-Whitney tests, Wilcoxon and Friedman tests were applied at $p \leq 0.05$ for statistical comparisons between baseline and follow-ups. The mean age of children was 8.8±0.7 years. Brushing time was significantly lower in the ADHD group compared to the control group ($p=0.01$); dft values were significantly higher in the ADHD group than in the control group ($p=0.02$). Statistically significant decreases in TQHPI and API measurements were detected with single brushing under supervision. However, a statistically significant change has not been observed between the electric and manual subgroups ($p \geq 0.05$); only the third-month GI values were significantly higher in ADHD-electric subgroup than ADHD-manual group ($p=0.01$). Within the limitations of this randomised controlled study, there is no statistically significant difference in parameters between electric and manual toothbrushes with single brushing. Children with or without ADHD can brush their teeth effectively under the supervision of their parents.

This study was supported by the Research Fund of Adnan Menderes University (Project number: DHF-21008)

163 Cost-benefit analysis of non-invasive early childhood caries management interventions among Latvian preschool children

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This study aimed to conduct a preliminary cost-benefit analysis of non-invasive early childhood caries (ECC) management strategies. We conducted a randomised, six-arm, patient/parent-blinded, placebo-controlled clinical trial (n=371) (protocol registration ISRCTN17005348) from September 2020 to August 2022 at the Institute of Stomatology of Riga Stradins University, Latvia. Six complex treatment strategies were evaluated, including behavioural modification sessions and non-invasive treatment of cavitated carious lesions with two different fluoride compounds (silver diammine fluoride from SDI Riva Star® (SDF), Tiefenfluorid® (TF)) compared with placebo (P) using two different recall strategies (four applications annually, one-week apart (1) or biannual (2)). We registered all treatment sessions (non-invasive applications and treatments of caries complications with/without general anaesthetics during 12-month follow-up). Costs associated with each ECC management program and associated treatments were identified from the Latvian National Health Service tariff database. The 95% confidence interval (95%CI) of the Incremental Benefit-Cost Ratios was calculated to determine the difference compared to the control placebo-biannual program (P2). Differences in medians were compared with Kruskal-Wallis test (p=0.05). Only the SDF2 generated a median cost averted of €-22 (95%CI: -14 to -3.6, p≤0.001) per every €1 invested in the program. For other treatments, the 95%CI of the median averted costs included zero: SDF1= €-2 (95%CI: -0.95 to 11), TF1 = €-2 (95%CI: -3.3 to 3.5), and P1=-2 (95%CI: -2.5 to 20) compared to P2. Biannual applications of silver diammine fluoride (SDF) generated higher cost savings for treating early childhood caries (ECC) complications than other treatments. These findings provide valuable insights for healthcare providers and policymakers when making decisions on ECC management strategies for preschool children in Latvia.

Funded by European Regional Development Fund 1.1.1.2/VIAA/3/19/543, Contract No 9.-14.5/27. IM acknowledge financial support from the Latvian Council of Science, project IEVA, project No. lzp-2022/1-0047, SEU from the European Union's Horizon 2020 research and innovation programme under grant agreement No 857287.

164 Covid-19 and caries treatment modalities in children, a retrospective clinical study

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Background: Primary teeth with cavitated caries lesions can be treated with different approaches such as Silver Diammine Fluoride (SDF), atraumatic restorative treatment (ART) or traditional restoration (TR). During the Covid-19 emergency, the use of aerosol-free therapies was suggested. This retrospective study aims to investigate if Covid-19 modified caries treatment approach in primary teeth.

Methods: All caries therapies performed in children aged 0-13 year in 12 randomly selected weeks of the years 2019 and 2021 at the Paediatric Dentistry Department of the University of Milan were collected and those performed on primary teeth scored 4-5 according to the International Caries Detection System were selected. Data on sex, age, collaboration grade, and tooth location were also collected. The convenience sample obtained was categorized according to the type of treatment: SDF, ART, TR. Variables were analysed with Chi-square test or Fisher's exact test.

Results: A total of 624 teeth were included. Children’s age, sex and tooth location did not differ between the two years. In 2019, 1 (0.33%) SDF, 98 (32.78%) ART and 200 (66.89%) TR were performed, while in 2021, 95 (29.32%) SDF, 83(25.62%) ART and 146 (45.06%) TR were realised with a statistically significant difference between years ($p \leq 0.01$). In 2019, ART was preferred for uncooperative (OR=21.14; 95CI=8.49/52.66; χ=64.99 $p \leq 0.01$) and younger (χ=31.48; $p \leq 0.01$) children. In 2021, ART was preferred to TR in uncooperating children (OR=4.87; 95CI=2.54/9.33; χ=23.37; $p \leq 0.01$) as was SDF (OR=15.21; 95CI=7.94/29.15; χ=77.90; $p \leq 0.02$).

Discussion: Although SDF and ART have been wide recommended for the control and treatment of caries in children, until 2019 TR was the predominant treatment. Since the pandemic, SDF has been widely used, partially replacing the other treatments. SARS-CoV-2 seems to be able to modify the paediatric dentistry routine in this hospital setting.

The authors received no specific funding for this work.

165 Investigation of antifungal effects of different remineralisation agents on Candida amount in children

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The aim of this study was to compare the antifungal effect of low-fluoride toothpaste, 10% casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) paste, Calcium Glycerophosphate (CaGP) and 12% Xylitol containing paste for Candida amount in children with Severe Early Childhood Caries (S-ECC). Fifty-four healthy children aged 3-5 years diagnosed with S-ECC were examined and 21 Candida positive children included in the study. Children were randomly assigned to 3 groups : Group 1: 500 ppm fluoride (NaF) toothpaste; Group 2: 10% CPP-ACP and Group: 3 CaGP and 12% Xylitol. Oral hygiene training was given to the children and they were told to use remineralisation agents 3 times a day for 3-5 min for 2 weeks. Unstimulated saliva was quantitatively cultured on Sabouraud-dextrose agar for Candida amounts. Candida growth was categorized as low level $\leq 10^3$ cfu/ml, $\geq 10^3$ - $\leq 10^4$ cfu/ml as medium level, $\geq 10^4$ cfu/ml as high level. The Candida amount was determined at the baseline, 2nd week, 1st and 4th months. A statistically significant difference was found between baseline and 2nd week (respectively), 1st and 4th month (respectively) Candida amount in CaGP + 12% Xylitol group ($p = 0.029$). However, despite the reduction in Candida amount in the NaF and CPP-ACP groups, these improvements did not display statistically significant difference ($p \geq 0.05$). These results suggest that CaGP + 12% Xylitol containing remineralisation agent, has an antifungal effect in children when used 3 times a day for 2 weeks.

Funded by 'Marmara University Scientific Research Projects (BAP) unit with project number SAG-C-DUP-080519-0177'

166 Development and test of bee's propolis toothpaste (patented) to control dentinal hypersensitivity

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Aim: To assess on a visual scale, the participant's perception of a new toothpaste's effect to reduce their dentinal hypersensitivity (DH) symptoms in four weeks, with brushing twice daily.

Method: We recruited a total of 30 adults reporting DH pain symptoms and unsatisfied with the current commercial DH offer. We held a randomised controlled trial designed to pre-test propolis and find the optimal concentration against DH. Randomly allocated, 0.25, 0.5, and 0.75 propolis concentrations were pre-tested alternately by 5 participants suffering from DH. Another 5 participants pre-tested other propolis concentrations such as 1.0, 1.25, 1.5, and 2.0 in the same manner. Then, we used a cross-over design to test pre-tested selected propolis concentrations of 0.5 % combined with 10 % of potassium nitrate (PN) to create a new formula. We compared past use of similar products (Colgate and GSK) to these new formulas while assessing the differential DH effect, using 20 participants over four weeks. We asked that people feel their DH symptoms before beginning the tests. The visual scale to measure participants' reactiveness went from 0 (no effect) to 10 (optimal effect).

Results: The successful pre-tested concentrations were 0.5 % and 2.0 %; both generated a 7.5 effective score on the visual scale. In the cross-over product comparison, participants that were previously using Colgate and GSK products with a mean score of 5.5 of satisfaction. The prospect tested of 0.5 % propolis combined with 10 % PN toothpaste and reported a mean score of 9.0 for a net additional reduction of 3.5 units or 35 % ($p<0.001$).

Conclusion: This in vivo design, demonstrated that propolis toothpaste can be considered an effective and natural alternative to reduce DH.

This study was financed by Servidence Inc Canada.

167 A prospective cohort study of post-radiotherapy dental caries in head and neck cancer patients

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Objectives

This observational study aims to investigate variation in the incidence of dental caries among post-radiotherapy head and neck cancer (HANC) patients.

Methods

This prospective cohort study started in December 2018 in the Centre for Dentistry, Belfast, Northern Ireland. Eligible patients with a clinical diagnosis of HANC were assessed and rendered dentally fit prior to radiotherapy (baseline assessment) including provision of high fluoride (5,000 ppm) toothpaste. Patients were then re-assessed at 6-, 12-, and 24-months post-radiotherapy. Oral health data were collected at each visit using a combination of clinical dental assessments and validated patient-administered questionnaires.

Results

Data from 135 patients who attended at least one follow-up appointment by January 2023 is presented (n=135). Due to the COVID-19 pandemic, data from 6- and 12-month post-radiotherapy dental assessments have been pooled. The mean age of the recruited sample was 59.3 (standard deviation (SD) 10.4) years, and 75.6% (n=102) were male. The most common cancer sites under treatment were the oropharynx (n=58), oral cavity (n=22), and larynx (n=21). Approximately half (42.2%) of HANC patients presented with new carious lesions 6-12 months post-radiotherapy. The mean number of carious teeth was 3.5 (SD 3.9). Approximately one-quarter (24.4%) of patients also had periodontitis 6-12 months post-radiotherapy. Statistical tests including independent t-tests and chi-squared tests revealed that patients with: (i) higher mean plaque scores, (ii) more severe xerostomia, (iii) fewer teeth, and (iv) continued intake of prescribed high-sugar dietary supplements, were more likely to develop post-radiotherapy dental caries ($p \leq 0.05$).

Conclusions

Post-radiotherapy HANC patients experience high levels of dental caries. Poor oral hygiene, xerostomia, fewer teeth, and the continued intake of prescribed high-sugar dietary supplements after radiotherapy, may increase their risk of dental caries.

This work was funded by the Public Health Agency, Northern Ireland, through receipt of the 2018 HSC Doctoral Fellowship Award, as well as the Royal College of Physicians and Surgeons of Glasgow, through receipt of the 2018 Ritchie Trust Fellowship Award.