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68th ORCA Online Congress

Zagreb, Croatia, 7–10 July, 2021

Abstracts

Dear friends, colleagues and attendees of the 68th ORCA congress, dear ORCA family.

For the second time we have been forced to organize our organization's yearly congress in the virtual world. However, although we regret not meeting old and new friends, we have welcomed many participants who would otherwise not have been able to join us. In these difficult times of the pandemic, this is an opportunity to expand the ORCA family and build on ORCA's strengths by increasing our visibility and thus the footprint of cariology. Widening the reach of our research, and reaching out to colleagues around the world, is a wonderful silver lining to the Covid-cloud.

The program for the 2021 ORCA congress includes more than 100 original research presentations and contributions to the ORCA Education Platform as well as a Saturday Afternoon Symposium on minimally invasive restorative approaches.

For maximum impact and reference even after the congress, the abstracts of the 2021 ORCA congress will be published online in Caries Research.

With a warm thank you to all submitting authors, and to the scientific committee members Carolina Ganss (Editor in Chief) and Marie-Charlotte Huysmans (Vice-president of ORCA), who helped to review the contributions, I am happy and proud to present to you the scientific overview of ORCA 2021.

Hrvoje Juric,
Congress Chair and Co-President of ORCA
Zagreb, Croatia

68 ORCA Online Congress

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Abstracts

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Education Platform

1 Attitudes of dental students and young dentists towards treatment of dentin caries

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The aim of the study was to assess the knowledge and attitudes of dental students and young dentists towards treatment of dentin caries lesions. A total of 211 respondents filled in the internet questionnaire. Six questions were related to diagnosis of dentin caries, 9 questions analyzed cavity preparation, and 7 questions cavity restoration. Chi-square test was used in statistical analysis. Anamnesis is considered crucial for the proper diagnosis, followed by radiography and vitality test. Seventy five percent would perform cavity preparation with rotary instruments, and 23% would use rotary instruments combined with hand instruments in the proximity of the pulp. The main criterion for the caries removal is dentin hardness for 96% of respondents. The majority (82%) thinks that all microorganisms should be removed from the cavity. In deep caries lesions 70% would opt for complete caries removal. If incomplete removal was to be preformed, 85% would perform stepwise excavation. Calcium hydroxide was the material of choice for indirect pulp capping (74%), and calcium hydroxide and MTA were most often selected for direct pulp capping (48% and 44%, respectively). Glass-ionomer and zinc phosphate cement were usually chosen as temporary restorations (47% and 44%, respectively), while composite was most frequently selected for definitive restoration (60%). There were no significant differences between students and young doctors regarding the treatment choice ($p>0.05$). In conclusion, invasive treatment is still widely accepted among students and young dentists in Serbia. Teaching should encourage them to adopt principles of minimum intervention approach to dentin caries.

2 Caries OUT: COVID-19 adapted CCI multicenter study as an innovative cariology teaching ongoing experience

by Martignon, Stefania | Beltrán, Edgar O. | Cortes, Andrea | Douglas, Gail | Newton, Jonathon Timothy | Pitts, Nigel Berry | Deery, Christoffer | Abreu-Placeres, Ninoska | Avila, Viviana | Bonifacio, Clarisa | Braga, Mariana Minatel | Carletto-Körber, Fabiana | Castro, Patricia | Chavarría, Nathaly | Cerezo, María del Pilar | Cifuentes, Olga Lucía | Echeverri, Beatriz | Jácome-Liévano, Sofía | Kuzmina, Irina | Lara, Juan Sebastián | Manton, David | Martinez-Mier Angeles | Melo, Paulo | Muller, Michele | Ochoa, Emilia | Osorio, Jesús Ricardo | Ramos, Ketty | Sanabria, Angie | Sanjuán, Johanna | San-Martín, Magdalena | Squassi, Aldo | Velasco, Karina | Villena, Rita | Ferreira-Zandona, Andrea | Usuga-Vacca, Margarita | UNICA - Caries Research Unit, Research Department, Universidad El Bosque, Bogotá, Colombia. | UNICA - Caries Research Unit, Research Department, Universidad El Bosque, Bogotá, Colombia. | UNICA - Caries Research Unit, Research Department, Universidad El Bosque, Bogotá, Colombia. | Dental Public Health, Leeds Dental Institute, University of Leeds, UK. | Dental Innovation and Impact, Faculty of Dentistry, Oral & Craniofacial Sciences, King's College London, UK. | Dental Innovation and Impact, Faculty of Dentistry, Oral & Craniofacial Sciences, King's College London, UK. | School of Clinical Dentistry, The University of Sheffield, UK. | Universidad Iberoamericana UNIBE, Santo Domingo, Dominican Republic. | UNICA - Caries Research Unit, Research Department, Universidad El Bosque, Bogotá, Colombia. | ACTA, Amsterdam, The Netherlands. | University of Sao Paulo, Brazil. | Universidad Nacional de Córdoba, Argentina. | Corporación Universitaria Rafael Núñez, Cartagena, Colombia. | UNICA - Caries Research Unit, Research Department, Universidad El Bosque, Bogotá, Colombia. | Universidad Autónoma de Manizales, Colombia. | Universidad Autónoma de Manizales, Colombia. | Universidad Cooperativa de Colombia, Envigado, Colombia. | UNICA - Caries Research Unit, Research Department, Universidad El Bosque, Bogotá, Colombia. | University of Moscow, Russia. | Indiana University School of Dentistry, Indianapolis, USA. | University of Groningen, The Netherlands. | Indiana University School of Dentistry, Indianapolis, USA. | University of Porto, Portugal. | Universite Cote d'Azur, France. | Universidad Cooperativa de Colombia, Envigado, Colombia | Viva 1A IPS Health Provider, Barranquilla, Colombia. | Universidad de Cartagena, Colombia. | UNICA - Caries Research Unit, Research Department, Universidad El Bosque, Bogotá, Colombia. | Institución Universitaria Colegios de Colombia UNICOC, Bogotá, Colombia. | Universidad Católica del Uruguay, Montevideo, Uruguay. | Universidad de Buenos Aires, Argentina | UNICA - Caries Research Unit, Research Department, Universidad El Bosque, Bogotá, Colombia. | Universidad San Martín de Porres, Lima, Perú | Tufts University, Boston, USA. | UNICA - Caries Research Unit, Research Department, Universidad El Bosque, Bogotá, Colombia.

Funding: UNICA, U. El Bosque funded the design and development of the e-learning, and UNICA leader researchers meeting time with centres. Other leader universities (KCL, U. of Leeds and U. of Sheffield) funded their researchers' contribution time. The study received a grant from IADR Regional Development Program Latin American Region (IADR RDP LAR) to promote research in Latin American countries (13 centres). The Alliance for a Cavity-Free Future Colombian Chapter (ACFF CC) funded partially the e-learning and the printing of the didactic aids. The Global Collaboratory for Caries Management (GCCM) uploaded the e-learning in the CCI website. The 20 dental schools (universities) and 1 health provider funded each centre study setting and development.

CariesCare International (CCI) is a health outcomes-focused, patient-centred, risk-based caries management system (2019). UNICA, with KCL and the University of Leeds, designed a 1-year schoolchildren-multicentre RCT to assess its caries-progression-control effectiveness. Twenty-one centres in 13 countries joined. UEB-IRB: Feb-2020.

Aim: this report aims at describing the study's cariology-related education strategies including pandemic-era adaptations.

Methods: cariology-education strategies: training centres' dentists in CCI through the CCI oral-health record (OHR), an e-learning and a workshop. After the pandemic initiated, UNICA shifted to a multicentre single-group children-interventional study with pandemic-adapted CCI (non-aerosol generating procedures -non-AGP and remote consultation), plus a CCI short toothbrushing/dietary habits behaviour-change tool (SBCT) (COM-B model). All agreed (UEB-IRB: July-2020). An additional 1-module non-AGP CCI-4D e-learning was planned.

Results:

Oral-health record: a CCI 4D-cycle pandemic-adapted OHR in Excel and a WHO-guided daily-sugar food/beverage-consumption pictures diagram were designed.

SBCT: a 6-item behaviour-assessment form and six children-/parent-motivation didactic aids and self-assessment forms were designed.

CCI pandemic-adapted centres' workshop: two 4-hour workshops were conducted (Nov-2020) with coordinators/practitioners (English: n=16; Spanish: n=43).

CCI 4D-cycle implementation e-learning: 5-module English/Spanish-language e-learning were designed (duration time: 39'4'' and 39'8'', respectively) with QR docs.google.com quizzes and uploaded to CCI's webpage (GCCM: March/May: <https://cariescareinternational.com/e-learning/>, <https://cariescareinternational.com/spanish/>), respectively. Up-to-last-January website statistics: Correspondent versions have been accessed by 252.0 (± 90.6) and 356.8 (± 96.6) faculty/researchers/dentists, spending around 39'8''(June-Dec) and 35'5'' (Sept-Jan), with docs.google.com-related modules' quizzes answered by n=191 and n=54 with a 75.0% and 82.7% success rate.

Non-AGP CCI e-learning: designed (English/Spanish; Dec-2020); under sharing with centres/CCI-website.

Subject to local restrictions the pandemic-adapted CCI study has initiated in six centres (Jan-2021).

Conclusion: innovative CCI cariology-related education strategies have been successfully developed and accepted by faculty researchers/teachers/practitioners, further contributing - even under existing constraints- to translation into dental education, the practice and the patients.

3 Cariology education - Master-of-Science in Dentistry program in cariology and operative dentistry at Indiana University

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The Indiana University School of Dentistry offers a three-year Master of Science in Dentistry (MSD) program in Cariology and Operative Dentistry. This program is unique in the US with a specific focus on Cariology. Two courses address non-surgical caries management strategies: Advanced Preventive Dentistry I and II. These courses aim at training graduate students in the advanced diagnosis and management of dental caries and other dental hard tissue disorders. Learning outcomes are achieved via lectures and clinical practice while incorporating innovative teaching strategies. For the detection of caries lesions, students learn the use of ICDAS, practice with extracted teeth and are assessed by examining 26 human-extracted-teeth selected by trained/calibrated instructors. Instruction also includes technology-based caries detection methods. Students receive lectures on hyposalivation and learn how hyposalivation cases are managed clinically. Finally, they learn how to manage behavioral issues. Students are expected to apply their knowledge in the clinic. Clinical application is assessed using Objective Structured Clinical Examinations (OSCE), a hands-on, real-world approach to learning that keeps students engaged. The implemented OSCE is expected to be superior to the existing written exam in fostering the acquisition of clinical proficiency. As an additional assignment, students are encouraged to accompany a Community Sealant program that aims to provide preventive oral health services for children with inadequate access to dental care. Student agreement with a gold-standard during their assessment of caries diagnosis indicate our educational approach meets our learning outcomes. Over the last five years, students achieved average weighted-Kappa scores ranging from 0.74 to 0.81. Comprehensive and innovative, the MDS program teaches non-surgical caries management including the management of hyposalivation and behavioral issues with individual and community level learning outcomes.

4 Impact of a caries lesion detection didactic-laboratorial training for dental students. A COVID-19 adapted methodology

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Recently, the Indiana University School of Dentistry (IUSD) joined a multicenter collaborative initiative to assess the impact of a didactic/laboratorial training activity for caries lesion detection. Due to the COVID-19 challenges, changes in methodology had to be made.

Aim: to assess the impact of the above-mentioned activity on 1st-year IUSD dental students nested in a multicenter controlled study.

Methods: one hundred and five 1st-year dental students were exposed to a didactic lecture on caries detection and ICDAS via Zoom. Then, they were randomly allocated in 2 groups. To allow social distance, groups were divided into 6 groups (12 groups-total). Test group students received a training on images with discussion guided by an instructor on Zoom and a hands-on activity on extracted teeth models with individualized feedback and discussion. Finally, students assessed a set of 22 teeth (31 surfaces). Control group students were submitted first to the assessment and then received the training. The Poisson regression analysis was used to verify the influence of proposed training on the students' correct answers. Subgroup analyses were performed to check the differential influence of training in different circumstances.

Results: correct answers were 27% more frequent among students in test group (RR=1.27, IC:1.16 to 1.41). The severity also influenced on the correct answers. The most evident difference between groups was observed in students' performance for assessing sound surfaces (RR=1.98, IC:1.61 to 2.44, $p<0,001$) and initial caries (RR=1.50, IC:1.23 to 1.83, $p<0.001$).

Conclusion: The adapted COVID-19 methodology had a positive impact on the students' performance for caries lesion detection. Differences between pre- and COVID-19 approaches will be further tested as part of the multicenter initiative.

5 Innovative ways of teaching cariology: working in class on practical problem-solving

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Funding: the authors received no specific funding for this work

Inverted class is defined as a pedagogical approach to education which aims to increase students' engagement and learning skills by having students reading basic contents of a given subject before class and working on practical problem-solving during class time. The teacher provides the material for reading in different formats such as computer mediated instructions, chapters in textbook, scientific articles. The training during class time is interactive, limitations of the learning activities are considered, and students' difficulties are discussed and solved.

In cariology, the use of this pedagogical approach is particularly interesting for developing students' abilities to diagnose, to assess risk, to take treatment decisions and to monitor oral health conditions in daily practice. Dental caries and erosive tooth wear (ETW) are chosen to illustrate this approach. To this end, five case presentations of each condition are set-up in a Power Point presentation simulating a class where delegates of the ORCA congress are invited to attend interactively. In the framework of dental caries (Caries Res 2018;52:58-70) and erosive tooth wear (Eur J Oral Sci 2021;DOI: 10.1111/eos.12764), the case presentations were validated for face and content by experts in the field. The reliability of the assessments performed for diagnosis, risk assessment, and treatment decision of the case presentations had kappa values (k) ≥ 0.80 as determined by three experts of each condition. For ETW, sensitivity values of 94-99% and specificity values of 91-95 % were recorded. Practicing dentists, 81 assessing dental caries and 104 assessing ETW, ranked high the overall quality of the case presentations, 83% and 86%, respectively.

In conclusion, inverted class is an educational tool that might be applied in the training of dental students and dentists in continuing education courses.

6 Methodology changes to ICDAS teaching/learning approach for first-year dental students in Indiana due to Covid-19

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The ICDAS is taught at Indiana University School of Dentistry as the caries detection strategy since its inception to first-year students. The aim of this study was to assess the implementation of an ICDAS modified teaching approach due to Covid-19 vs the Pre-Covid-19 (PC) educational approach. PC students received three ICDAS-related didactic lectures and two faculty-supervised hands-on training laboratories using extracted human teeth models in groups of 25 students each; previous results (2016-2019) were used for this study. After-Covid-19 (AC) students received 2 virtual lectures using Zoom platform. In 2020 AC students were divided into 12 teams (7-12 students/each) to allow social distancing and attended activities in 2 different weeks (6 Teams per week). AC students received a third zoom-lead-instruction and a hands-on experience during their first of 2 lab sessions using extracted human teeth models. Both PC and AC students had access to lecture materials to study. For their final practical exam, 2 set of 26 previously selected extracted teeth/dental surfaces (smooth/occlusal) were scored as follows: a. sound (ICDAS-0); b. initial caries lesion (ICDAS-1-2); c. moderate (ICDAS-3); d. moderate (ICDAS-4); and e. extensive (ICDAS-5-6). Kruskal-Wallis tests were conducted to compare both educational approaches. Final-exam mean of correct answers for AC was 17.98 (SD:2.2) (max-23 min-13); for PC was 17.57 (SD:2.3) (max-23 min-10). Percentages of correct answers per score for AC were 69%(a), 79%(b), 65%(c), 51%(d) and, 84%(e) for PC scores were 71%(a), 65%(b), 65%(c), 38%(d) and, 98%(e). Scores D and E remained statistically different ($p < 0.05$), however, AC (d) scores improved which is an important finding as it is the most difficult ICDAS score to detect.

Methodology changes due to Covid-19 for teaching ICDAS did not affect student performance.

7 Teaching cariology throughout the dental curriculum without a cariology course: the University of Talca model

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Our cariology curriculum follows the recently created national curriculum framework and is delivered by the Cariology Unit composed of a multidisciplinary team of ten faculties. Contents are inserted in various courses, at the different years of dental school, thus, cariology contents and competencies are gradually incorporated during the educational process following the constructivist-learning theory. Unlike a canonical cariology course, cognitive, procedural, and attitudinal components of the curriculum are assigned to an expert on each topic. Having specific focus on certain topics allows deepening on each subject and dedicating to the preparation of innovative teaching strategies. In many cases, the topic chosen is close to the research expertise of each faculty. Under this model, each faculty designs specific strategies for their assigned topic using various didactic materials, including lectures, written documents, brief videos, and several active-learning activities. Since its implementation in 2009, cariology teaching at the University of Talca has evolved from classic lectures to concise, precise, and participative synchronous sessions. Besides lectures, activities such as real or simulated clinical cases with oral presentations, group discussions, workshops, and experimental activities are used to apply contents as they are being covered (progressive learning). Formative assessments (using TICs) are frequently used to provide direct feedback to students. An interesting methodology is a debate called “Controversies in Cariology”, where students must prepare in advance to debate in favor or against unresolved current controversial topics. Feedback from students has been extremely positive, expressing encouragement to learn. Students have highlighted the motivation of the faculty and the use of multiple learning methodologies. We conclude that progressively incorporating cariology topics through the dental curriculum by a collaborative team using innovative methodological approaches seems effective to teach cariology.

8 Teaching ICDAS at Preventive Dentistry Department, Moscow University of Medicine and Dentistry Russia, in collaboration with University of Copenhagen

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The European Cariology Core Curriculum (2011) isn't taught in full in Moscow State University of Medicine and Dentistry (MSUMD), however many principles are used. MSUMD focuses on teaching students in early diagnosis and minimally invasive treatment. Aim: To improve the knowledge of these aspects by introducing ICDAS in the students' curriculum.

Methods: the two first authors were calibrated by the third author, during courses in Moscow and Copenhagen. The students' teaching material at MSUMD consisted of 34 extracted teeth with approximal lesions and 40 teeth with occlusal lesions at different stages of caries, selected from a tooth bank at the University of Copenhagen. X-rays and photos were prepared, lesion by surface was classified by ICDAS. The teeth were hemisected through the lesion and microscopic pictures with different magnifications; tables with ICDAS codes were prepared. In total 773 photos were used for diagnosing tool. Students were introduced to ICDAS principles during 3rd-4th semesters by means of 2 lectures, including an introduction to the above-mentioned material with emphasis on learning and self-control. Students examined every tooth visually, opened them, controlled if his/her diagnosis was correct in terms of histological changes in the underlining structure. Results: the analysis of answers and students' interviews showed a diagnosis improvement of 70% after 1-month training. The most difficult part was the diagnosis of ICDAS codes 1,2,4. About 90% of students preferred to perform the diagnosis on extracted teeth, improving the skills before patient clinic diagnosis. Introducing ICDAS encouraged them to perform early diagnosis for minimally invasive approaches in caries treatment. Conclusion: using ICDAS in teaching processes improved students' skills. The material used could become a motivational factor for new methods of early caries diagnosis.

9 The MILA system to teach integrated cariology curriculum for postgraduate students.

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The multiple interacting learning algorithm (MILA) is an education system that harnesses the advancing front of technology to integrate an effective, enthusiastic and active learning environment for the students (Nallaswamy *et al* 2020). MILA algorithm is set for 120 minutes which is divided further divided into 20 minute micro-sessions suited for a strength of 30 students. This is brought about by a combination of 18-minute lecture, followed by a 2-minute activity, which will be related to the 18-minute lecture to enhance and test the thinking and retention skills of the student. This is followed by an activity chosen from a box comprising of SCALEUP, Critical Pedagogy, JIGSAW, POGIL, Concept Mapping, Game based Learning, Role Play, Flipped Class, Peer-led Team based Learning. For the first time, the MILA algorithm was used to integrate teaching cariology for post-graduate students of 4 departments - Conservative Dentistry and Endodontics (n=8), Oral Pathology (n=5), Paediatric Dentistry and Preventive (n=5) and Public Health Dentistry (n=3). The curriculum was adapted from the European core curriculum for undergraduates with emphasis on evidence-based learning through critical appraisal sessions. The entire module was covered in 3 months. The students were assessed on a continuous basis and a final theoretical and practical assessment with an external examiner was conducted. The average marks scored were $73.2 \pm 4.3\%$ (CI 95% - 71.2, 75.2%) in theoretical assessment and $71.9 \pm 7.1\%$ (CI 95% - 68.7 to 75.1%) in the practical assessment. The MILA system is an effective method of teaching cariology as an integrated module for postgraduate students.

<http://ijpronline.com/ViewSpecialArticleDetail.aspx?ID=1105>

10 Use of a student response system for teaching radiographic caries detection and treatment planning

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As part of the cariology teaching at the Faculty of Dentistry in Oslo, dental and dental hygienist students participate in a seminar that includes modules of individual and group-based case exercises for training in caries diagnosis and treatment planning. One digital module aims to develop and increase individual student skills in radiographic caries lesion detection, scoring and differential diagnosis in relation to treatment planning. The module contains selected bitewing radiograph pairs obtained from the faculty patient register, with examples of both enamel and dentine caries. An internet link takes students to each bitewing pair and they log in with their clinical code. Using a digital scoring sheet students perform individual registration of dental caries lesions on all proximal and occlusal tooth surfaces. For each tooth surface, a single-choice line of radio buttons in a matrix set-up is available for scoring using established diagnostic criteria. Tooth surfaces can be registered as not visible or not possible to grade. Prior to individual scoring, students perform trial registrations on bitewings using a student response system integrated into a PowerPoint presentation with anonymous live polling. Results of the students scoring are discussed in plenum, after which students perform individual registrations on at least 12 bitewing pairs. No direct performance feedback for each surface is provided, however teachers are available to answer questions from students and discuss findings. After this, students rescore a selection of the most challenging or uncertain tooth surfaces using the live polling system, and results are discussed in plenum. The module provides a positive, interactive learning environment that ensures student anonymity, interactivity and engagement; and combined with the other seminar modules gives them basic skills in caries diagnosis and treatment planning.

Session 1

Nathan Cochrane Junior Scientist Award

11 Erosion of CAD/CAM materials and human enamel: in situ/in vivo and in vitro studies

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Funding: the Guiding Project for Science and Technology of Fujian Province (2018Y0029) and the Science Foundation for Medical Innovation of Fujian Province (2019-CX-32)

Purpose: This study aimed to evaluate the effects of erosion both *in situ/in vivo* and *in vitro* on the surface properties of CAD/CAM materials and human enamel.

Methods: An intraoral appliance capable of retaining 3 CAD/CAM material specimens (IPS emax CAD, Lava Ultimate, and PMMA block) and 1 enamel specimen *in situ* was constructed and worn by 8 healthy volunteers. The specimens were subjected to *in vivo* erosion cycles by rinsing with 150 ml of cola drink (4 × 5 min/d) for 14 days. The subjects' teeth were protected by soft mouthguard during erosion. The same frequency and duration of erosion was modelled *in vitro*. The surface microhardness, substance loss, and surface roughness of the specimens were measured at baseline and day 14. The data were statistically analyzed using repeated measures ANOVA and Bonferroni's test ($\alpha = 0.05$).

Results: Erosion both *in situ/in vivo* and *in vitro* significantly decreased the surface microhardness of tested materials and enamel (all $p < 0.001$). A significant increase in surface roughness and substance loss was observed for enamel after erosion both *in situ/in vivo* and *in vitro* (all $p < 0.001$), while the surface roughness and substance loss of tested materials remained unchanged after erosion. The percentage of surface microhardness loss (%SMH_i) of PMMA block (17.5 and 12.67, respectively) and enamel (29.35 and 14.41, respectively) and the substance loss (μm) of enamel (52.08 and 35.73, respectively) due to *in vitro* erosion was significantly higher than *in situ/in vivo* erosion ($p < 0.001$).

Conclusion: The acid resistance of human enamel was lower compared to CAD/CAM materials. For the substance loss of enamel and %SMH_i of PMMA block and enamel, the *in vitro* erosive effect were approximately 1 to 2 times greater than *in situ/in vivo*.

12 Staining potential of carious lesions treated with silver diammine fluoride (SDF) and potassium iodide (KI)

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Funding: Perth Children's Hospital Foundation

Aim: Silver Diammine Fluoride (SDF) is a cariostatic agent that has been used globally to stabilise carious lesions in high-risk groups. Black staining subsequent to SDF treatment is an important clinical indicator of lesion stability, but also limits treatment acceptability. Potassium Iodide (KI) has been postulated to modify SDF staining. An understanding of the natural history and resultant shade of SDF/KI treated lesions will inform clinical decision making. This study aims to describe the staining potential of carious lesions in primary teeth treated with SDF and KI. **Methods:** This study forms part of a larger clinical trial aiming to arrest dental caries among refugee children. A case series of the first 100 carious lesions in primary teeth of children under 12 years of age, treated with SDF/KI (Riva Star, SDI) and followed up over six months is presented. Lesion shade was determined using standardised intraoral photography and broadly categorised into four shades; yellow, light brown, dark brown, and black. Average CIELAB values of each lesion were elucidated. **Results:** Lesions (n=132) were followed in order to conduct 100 valid observations. Lesions were excluded due to exfoliation (2), restoration (15), or pulp exposure (1) or being unable to observe (11). Overall, 29 lesions progressed to a darker shade over six months while seven lesions became lighter. Of lesions classified as “black” at six months, only 17/34 (50%) lesions progressed to the “classical” black staining attributed to SDF application. **Conclusion:** Although staining was not completely mitigated, most lesions did not become a darker colour following application of SDF and KI.

13 Effect of two fluoride therapies on hypersensitive carious primary teeth: An observational cohort study

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Our goal was to assess caries arrest and hypersensitivity relief effect of two treatment techniques for managing hypersensitive carious lesions (ICDAS 5) in primary teeth utilising silver fluoride and potassium iodide (38% Riva Star[®]) compared to sodium fluoride varnish (5% Duraphat[®]).

Twenty-six children (13 boys and 13 girls) aged 2-5 years (3.68 ± 1.03) requiring a desensitising treatment of hypersensitive carious lesions were consecutively recruited and allocated equally into the groups: Duraphat[®] ($n=13$; $dmft=8 \pm 3.44$) and Riva Star[®] ($n=13$; $dmft=8.23 \pm 2.98$). Fluoride application was performed following clinical assessment of caries activity (Bjørndal Criteria; 0-9) and parental reported hypersensitivity (Visual Analogue Scale: 0-10=no-severe pain). Clinical variables were evaluated at baseline and 3 months after treatment. Chi-squared and Fisher exact tests were used for comparisons between the groups. Paired t-test, Wilcoxon signed rank and McNemar used for comparisons between baseline and follow-up in each group. One tooth per child was analysed.

Findings show a decline in mean pain scores in Riva Star[®] group, from moderate (4.46 ± 0.52) to no/mild pain (0.46 ± 1.20 ; $p=0.002$). However, pain scores decline in Duraphat[®] group was not statistically significant, dropping from 4.77 ± 1.83 to 3.23 ± 2.45 ($p=0.12$). Comparing both treatments, Riva Star[®] showed to be more effective in relieving hypersensitivity ($p=0.007$). At baseline all carious lesions in both groups were active; following 3-months, 11 (84.6%) lesions treated with Riva Star[®] were inactive and 2 (15.4%) remained active ($p<0.001$). In the Duraphat[®] group, one lesion (7.7%) turned inactive and 12 (92.3%) lesions remained active ($p=0.99$). Comparing both treatments, caries arrest effect was higher in Riva Star[®] group ($p<0.001$).

Considering caries arrest and hypersensitivity relief, treatment with silver fluoride and potassium iodide (Riva Star[®]) was more effective than sodium fluoride varnish (Duraphat[®]) after 3-months period.

14 Pain perception during caries excavation with bioactive caries detecting (BCD) dye solution and air polisher prophylaxis

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Aim: to investigate the working hypotheses of time consumption and pain perception during caries removal with Bioactive caries detecting dye solution (BCD) and Air polisher prophylaxis.

Materials & Methods: four groups (n=20) of permanent teeth were selected from 60 patients (17-40 years). Teeth with occlusal dentinal caries having cavity entrance size of ≥ 2 mm in the molars (clinically and radiographically) were enrolled for the study. Patients allotment to various groups was done using randomization software. Group A: conventional rotary method, Group B: BCD + mechanical excavation (spoon excavator), Group C: air polisher prophylaxis, Group D: BCD + air polisher prophylaxis. For groups B and D, 0.5 mL of BCD was applied with a micro brush (40 s). Subsequently radiographs were taken to visualize the caries extension. In case of residual caries multiple applications of the BCD was done. Working time was taken and Verbal Pain Scale (VPS) scores were recorded for pain experience during caries excavation and caries removal was assessed clinically by using numerical scoring scale (0-5).

Results: ANOVA and Post Hoc Test showed the least working time for Group A, followed by B, D and C (275.02, 461.98, 403.8, 615.41 s respectively). Mean VPS score was highest for group A (1.85), minimum pain was experienced for group B (0.6) as compared to D (1.2) and C (1.45). Ineffective caries removal was seen in group C (2.35), followed by D (1.75), B (1.30), and A (0.90) ($p < 0.05$).

Conclusion: groups B and D comparatively took less time and had minimum/no pain while excavating caries compared to C.

Institutional Review Board: SOADU/IDS/IRB/19/40.

15 Remineralization effect of different agents on artificial dentin caries: an in vitro study

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The purpose of the study was to assess the caries preventive effect of Calcium-glycerophosphate (CaGP) and CaseinPhosphopeptide-AmorphousCalciumPhosphate-Fluoride(CPP-ACFP) on artificial dentin caries-like lesions

Eighty dentin slices (5x5x4 mm) were prepared from 40 extracted primary and permanent teeth. Subsequently, all specimens were embedded in epoxy resin (StruersEpoFixKit) and were soaked at room temperature in demineralisation solution (50 mM acetate, 2.2 mM CaCl_2 , 2.2 mM KH_2PO_4 ; pH 4.5) for 96 h to prepare the completely demineralized dentin.

Specimens were randomly allocated to four groups (n=10): deionized water, negative control (G1), 5% NaF varnish (G2), 10% CPP-ACP+900 ppm F gel (G3) or CaGP+Mg +Xylitol gel (G4) and were treated 4 min using a pH cycling model (8 days). Surface microhardness (SMH; Vickers) measurements were performed (Micromet II, Buehler, USA; 50 g for 15 s). The dentin surface morphology was examined by scanning electron microscopy (SEM). X-ray fluorescence spectroscopy allows precise determination of the elemental composition of the sample. Analyses were performed with SPSS Statistics-V20.0 (IBM Corporation,USA). The Shapiro-Wilk test of normality ($p > 0.05$) was used to assess whether the data had a normal distribution. All percentages of microhardness recovery and changes of mineral variation data were analyzed with the One-Way ANOVA and Tukey's multiple comparison tests. NaF varnish (4.8 ± 4.2) had the greatest mean SMHR% (percentage of surface microhardness recovery) value, for both permanent (4.8 ± 4.2) and for primary teeth (17.7 ± 9.9) ($p < 0.05$). There was no significant difference of mean SMHR% between CaGP (5.17 ± 3.9) and CCP-ACFP (7.2 ± 5.4) for permanent and also for primary teeth (4.3 ± 3.3 and 3.7 ± 3.5 resp.; $p > 0.05$). SEM analysis revealed that all agents deposited particles on the demineralized dentin surface which formed a new surface layer. After pH cycling, XRF spectrum analyzed high levels of Ca and P in all agents. In conclusion, all agents are effective in inhibiting artificial dentin caries-like lesions considering chemical and morphological aspects and indicate that the application of these remineralization agents could be recommended and promoted as an alternative treatment of dentin caries to that of conventional management of caries, particularly among children.

16 The economic impact of two diagnostic strategies in the management of restorations in primary teeth

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This trial-based economic evaluation aims to assess whether the Caries Associated with Restorations and Sealants (CARS) strategy is more efficient in allocating resources than the International Dental Federation (FDI) strategy to guide the assessment and management of restorations in primary teeth. Participants aged between 3 and 10 years with at least one restoration in a primary tooth were randomly assigned to a diagnostic strategy (FDI or CARS). A time horizon of 1 year and the payer perspective from the Brazilian health care system were considered. The cost per tooth was calculated and the health effect was the number of new operative interventions. An intention-to-treat analysis was conducted. Bootstrapped quantile regression analyses were used to assess the association between costs and the diagnostic strategy and the effect was compared using the Mann-Whitney test. For the Cost-Effectiveness Analysis (CEA), Monte-Carlo simulations (10,000) were performed and plotted into a cost-effectiveness plane. Acceptability curves explored uncertainties around the values. A subgroup analysis considering participants' caries experience was performed. A total of 650 restorations (163 children) were included.

CEA demonstrated that considering a willingness to pay (WTP) of \$80, there is a 70% probability of the CARS strategy to be cost-effective in replacing the FDI (mean $\pm$ SD: Δ cost=\$0.6 $\pm$ 14.65; Δ effect=-0.15 $\pm$ 1.39). For participants with low caries experience (dmft+DMFT $\leq$ 3), there is a 76% probability of the CARS strategy being cost-effective (mean $\pm$ SD: Δ cost=\$4.15; Δ effect=-0.33 $\pm$ 1.28), with a maximum WTP of approximately \$70 required. In conclusion, at a 1-year glance, the CARS strategy may be cost-effective for guiding the assessment and management of restorations in primary teeth; being more efficient in resource allocation for children with low caries experience.

17 Combining artificial intelligence and targeted fluorescent particles for caries detection and ICDAS-II scoring

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Previous work has shown Fluorescent, Cationic Submicron Starch (FCSS) particles can identify surface enamel porosity by their ability to label the subsurface of carious lesions and assist dental professionals in the diagnostic process. In this study, we aimed to evaluate the potential of using artificial intelligence (AI) to detect and score carious lesions using the ICDAS system in combination with fluorescent imaging following application of FCSS particles on teeth with a range of caries lesion severities, using visual exam as the reference standard. 130 extracted human teeth with ICDAS scores from 0 to 5 were selected and had one surface scored by a calibrated cariologist using the ICDAS system. Then, the same surface was imaged with a stereomicroscope under white-light illumination, and blue-light illumination with an orange filter following application of the FCSS particles. Both sets of images were labeled by an additional blinded ICDAS-calibrated cariologist to demarcate lesion position and severity. Convolutional Neural Networks, state-of-the-art models in imaging AI, were built to determine the presence, location, ICDAS score (severity), and lesion surface porosity (activity) of carious lesions, and tested by 20 k-fold validation for white-light, blue-light, and the combined image sets. The model showed high performance for the detection of caries lesions (sensitivity 89.3%, PPV 72.3%) and potential for determining the severity via ICDAS scoring (accuracy 76%, SD 6.7%) and surface porosity (potential marker for the activity of the lesions) (accuracy 91%, SD 5.6%). More broadly, the combination of bio-targeted particles with imaging AI is a promising combination of novel technologies that could be applied to many other applications.

18 Oral health - related quality of life versus socioeconomic and gender differences in the Croatian sample

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Purpose: the purpose was to assess oral health - related quality of life with respect to gender and socioeconomic status in the Croatian adolescent and post-adolescent population sample. **Experimental Approach:** the study comprised 151 randomly selected subjects between 13 and 25 years of age. The sample included 64 (42.4%) male ($M = 19.6$; $SD = 3.6$ years) and 87 (57.6%) female ($M = 19.1$; $SD = 3.5$ years) participants. Oral Health Impact Profile (OHIP-14) was used to assess oral health - related quality of life. A specially designed questionnaire was used to evaluate socioeconomic status (SE). Gender and socioeconomic status were represented by frequencies and chi-square test. The continuous variable (OHIP) was tested for normality by Kolmogorov-Smirnov test, and represented by the average mean values and standard deviation. Cronbach alpha reliability coefficient was assessed for OHIP. **Results:** socioeconomic status was moderate (55.6%) in the majority as opposed to low (22.5%) and high (21.9%) in the rest of the participants. Cronbach alpha reliability coefficient for OHIP was 0.866. OHIP average mean values for females ($M = 38.57$, $SD = 9.71$) were slightly higher than for boys ($M = 35.86$, $SD = 7.39$), however it wasn't statistically significant ($p = 0.058$). OHIP results showed similar values for high ($M = 40.35$, $SD = 12.00$) and low ($M = 39.06$, $SD = 9.11$) socioeconomic groups. Significantly lower scores were represented in participants with moderate SE status ($M = 35.54$; $SD = 6.70$, $p = 0.012$). **Conclusion:** OHIP results showed a higher oral health-related quality of life in participants with moderate as opposed to low SE status. Overall results indicated somewhat lower oral health-related quality of life in females.

19 Comparison of different methods of education in the adoption of knowledge on prevention of oral health

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Aim: this study aimed to examine the level of knowledge, attitudes, and habits of fifth and sixth-grade primary school children about oral health and determine whether there is a significant difference in the effectiveness of certain materials (lecture, video, pamphlet) used as educational material.

Materials and methods: the study involved 330 children from ages 11 to 13 in Split. Educations were conducted in the classrooms. After completing the questionnaire on habits and attitudes and the questionnaire about oral health knowledge, the children were educated on randomly selected methods: lecture (PowerPoint presentation), pamphlet, or video. After education, the children's knowledge was tested again.

Results: the Wilcoxon Signed Rank test showed a statistically significant difference ($p < 0.001$) compared to results before and after education. The Kruskal-Wallis test comparing knowledge outcomes after three different types of education: video, lecture, and brochure, showed a statistically significant difference in final knowledge between groups ($p = 0.05$). A pairwise comparison between different types of education showed a significant statistical difference between education conducted by pamphlet and video material ($p = 0.003$) and pamphlet and lecture ($p = 0.006$). No difference was observed between the level of knowledge acquired through video material education and lectures ($p = 0.928$).

Conclusion: the lecture, video, and pamphlet have proven to be effective as educational tools in teaching children about oral health. The lecture and video had similar results, while the pamphlet proved less effective.

Session 2

Erosion

20 Anti-erosive and anti-abrasive efficacy of different F/Sn containing commercially available toothpaste formulations on enamel in-vitro

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Stannous ions in combination with fluoride (F/Sn) are outstanding in preventing erosive tooth wear, as proven in numerous studies. Consequently, many new toothpastes with different formulations containing F/Sn and various additional active ingredients have come onto the market. Nine of them were investigated regarding their anti-erosive/anti-abrasive potential on enamel in vitro in comparison to a negative control (toothpaste without F/Sn). These toothpastes contained additional ingredients either for increasing efficacy (e.g. biopolymers, peptides or calcium additives) or for Sn-stabilization (e.g. polyphosphates, gluconate and/or amines).

Human enamel specimens (n=16/group) were subjected to a ten-day cyclic erosion protocol (1% citric acid, 6x2 min per day). Each of ten different toothpaste suspensions was applied to two groups for 2 min, after the first and last erosive challenge every day. One group from each suspension was additionally brushed in an automatic brushing-machine (15 s, 200 g) during immersion time. Specimens were stored in a mineral-salt-solution in-between cycles and over-night. After the last experimental day, tissue loss was measured profilometrically and analyzed statistically with Oneway-ANOVA and Tamehane's post-hoc-test.

All toothpastes except for one significantly reduced erosion compared to negative control ($p < 0.001$). Toothpastes stabilizing Sn with sodium gluconate and polyphosphates achieved the highest tissue loss reduction with 66-75%. These toothpastes were significantly more effective than those stabilizing Sn either with amines or with phosphates only ($p < 0.05$, except for one with $p = 1.000$) with 9-65% reduction. Abrasion after erosion levelled off differences between the groups. Only those toothpastes containing amines for stabilization or peptides performed better than the negative control ($p < 0.01$) with 21-25% reduction.

Conclusively, the efficacy of Sn against erosion seems to differ according to the stabilizers used, while under erosive-abrasive conditions, differences are quite small and efficacies are generally reduced.

21 How conclusive are nutrition questionnaire results in the context of erosive tooth wear research?

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There is experimental evidence that acids from food and drinks can cause erosive demineralisation. In contrast, epidemiological studies are inconclusive regarding diet as factor for erosive tooth wear. However, questionnaires are point surveys of dietary behaviour; to investigate how conclusive such data are, results from repeated nutrition questionnaires were compared. At one-year interval, 76 subjects (21 ± 2.2 years) completed a questionnaire with quantitative (intake frequency of various acidic food/drinks) and qualitative (attitudes towards nutrition; e.g. "I like acidic food/drinks") items twice. Data were collected from 7 Oct 2018 to 15 May 2019 (T0) and from 30 Oct 2019 to 17 June 2020 (T1). The intake frequency of acidic food/drinks was summarized to acid impacts per day (AID) and additionally categorized in low (0-4) and high AID (>4). Qualitative items were recorded with a 5-point analogue scale. AID are given as median (range) and the intra-class correlation coefficient (ICC) was used to compare T0 with T1. Qualitative data were analysed with cross-tabulations using Chi-Square-tests and Cramer-V (phi) coefficients. AID were 3.3 (0.5-14.9) at T0 and 3.4 (1.0-15.3) at T1 (ICC=0.394; $p \leq 0.05$). At T0, 62.3% of the participants had low and 37.7% high AID. At T1, every third subject had switched between high and low AID. There was a significant but only moderate association between scores for most qualitative items obtained at T0 and T1 (phi between 0.302 and 0.530; $p \leq 0.05$ each). The association of nutrition data from questionnaires completed at two different time points was weak (quantitative items) to moderate (qualitative items). Thus, nutrition questionnaire results seem to be of limited conclusiveness. This may explain in part the inconclusive results from epidemiological studies on erosive tooth wear and related dietary factors.

22 Impact of whey protein and whole milk on the protection of enamel against erosion

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The present study aimed at evaluating the effect of whey protein and whole milk on the protection against dental erosion in the presence of salivary pellicle.

We submitted 45 human enamel specimens to 10 cycles of salivary pellicle formation, product application, and erosive challenges. Each cycle consisted of 60 min incubation with clarified whole human saliva, followed by 30 min immersion in one of the test products (Negative control - deionized water, Whey protein and Whole milk; n=15 specimens/group), and then 1 min immersion in citric acid (1%, pH 3.6, shaking). Relative surface hardness (rSH, %) and surface loss (SL, μm) were evaluated. Data were analyzed ($\alpha = 5\%$) with one-way ANOVA (post hoc Tukey test) and Kruskal-Wallis tests, respectively. The rSH results are presented as mean $\pm$ standard deviation and the SL results as median; interquartile range.

For whey protein and milk, we observed reduced erosion, since they showed significantly higher rSH (22.20 ± 3.45 and 24.27 ± 4.50 , respectively) than the negative control (16.67 ± 4.24 ; $p=0.002$ and $p>0.001$, respectively), but with no difference between each other ($p=0.357$). All groups presented SL in the range of 0-2 μm . Although milk (0.53;0.21-0.97) tended to have lower SL values than the whey protein (0.99;0.72-1.19) and the control (0.92;0.74-1.13), there was no significant difference between any of the groups ($p=0.154$).

It can be concluded that whey protein and milk, in this experimental model, can provide some protection of enamel against initial erosion. This may be related to the interaction of the milk proteins with the salivary pellicle, which increases its protective capacity.

23 Measurement of the surface hardness and calcium release of natural unpolished enamel during erosion

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This in vitro study aimed at establishing a method to measure hardness of natural enamel at different erosion times, comparing to polished enamel and assessing the influence of a salivary pellicle on these surfaces.

We prepared 60 specimens from human permanent incisors, 30 each with natural and ground/polished surfaces. Initial Vickers hardness was measured with a hardness tester that measures penetration depth automatically. Half of the specimens from each group was submitted directly to erosive challenges (1% citric acid, pH 3.6). After 1, 2, 3, 5, 10, 15, 20 and 30 min, surface hardness and calcium released to the citric acid were measured and relative surface hardness (rSH) calculated. The other half of the specimens underwent incubation with human whole saliva for 120 min after each measurement, creating a pellicle before each erosive challenge. Differences were analyzed with Kruskal-Wallis and post-hoc Conover tests.

Hardness of natural enamel could be measured reliably, although showing higher variance than polished enamel. Final rSH (median, IQR) was 42.7%, 30.3-50.7; 28.9%, 24.0-34.5; 2.9%, 2.6-3.5; 6.9%, 5.7-8.8, for natural enamel with and without pellicle and polished enamel with and without pellicle, respectively. Natural enamel exhibited higher ($p<0.001$) rSH than polished enamel from the first minute on without a pellicle, and from 2 min on with a pellicle. The effect of the pellicle was only detected on polished enamel from the 10th min on ($p<0.001$). Natural enamel released less calcium than polished enamel ($p<0.001$) from the first min on without pellicle, while in the presence of a pellicle the difference was only significant from the 10th min on.

We conclude that natural enamel could be used for erosion studies investigating the surface hardness with the present method.

24 Modification of salivary pellicle with polyphenol-rich plant extracts and fluoride to protect against enamel erosion

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Some polyphenol-rich plant extracts (PRPE) modify the salivary pellicle, improving its effect against demineralization. This study aimed at verifying how pellicle modification with PRPE and fluoride protect against enamel erosion. We prepared 135 polished specimens from human permanent molars. Initial surface Vickers hardness was measured, and the specimens were incubated in saliva (30 min). The salivary pellicle was then modified according to 9 solutions: water, $\text{Sn}^{2+}/\text{F}^-$ (500 ppm F^- AmF/NaF; 800 ppm Sn^{2+} SnCl_2), 500 ppm F^- (NaF), and PRPE (grape-seed; grapefruit-seed; blueberry) with (500 ppm F^- NaF) and without fluoride. Specimens were again incubated in saliva (1 h) for modified pellicle formation, and submitted to 1 min erosive challenge (1% citric acid, pH 3.6). Surface hardness and calcium released (nmol/mm^2) to the citric acid were measured and relative surface hardness (rSH) calculated (median, IQR). Differences were analyzed with Kruskal-Wallis and post-hoc Mann-Whitney tests with Bonferroni correction. More erosion was observed in the water group: 44.2%, 40.8-47.9 and 23.6, 22.5-26.4 (rSH and calcium, respectively). Fluoride (62.1%, 56.8-65.6 and 17.7, 16.7-18.5) and $\text{Sn}^{2+}/\text{F}^-$ (67.7%, 63.5-70.3 and 13.5, 11.9-14.8) significantly protected against erosion ($p < 0.05$). PRPE without fluoride did not differ to water ($p > 0.05$), but with fluoride generally showed protection against erosion ($p < 0.05$). In rSH results, a synergistic effect was observed between fluoride and grape-seed (74.8%, 70.6-77.4) and blueberry (67.7%, 66.7-69.3) extracts, with better protection than fluoride alone ($p < 0.05$). Grape-seed-extract with fluoride also showed a better protection than $\text{Sn}^{2+}/\text{F}^-$ in rSH ($p = 0.01$). We conclude that salivary pellicle modified with only PRPE did not improve protection, but an increased protection was observed in the presence of fluoride. Our results suggest that some PRPE have a synergistic effect with fluoride, improving protection against acid demineralization.

25 Erosive tooth wear related factors in adolescents: questionnaire validation

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Aim: this study aimed at validating a questionnaire for assessing factors related to Erosive Tooth Wear (ETW) in adolescents. **Methods:** a questionnaire on ETW factors in adolescents was designed based on three questionnaires (Lussi et al: Am J Dent 2006; 19:319. O'Toole et al: J Dent 2017; 67:84-87. Martignon et al: J Dent 2019; 88:103164). It included 73 items into four domains: social-demographic aspects (n=5), general/oral health (n=20), dental-care habits (n=11) and dietary habits (n=37). Content validity was assessed in terms of items' coherence by five external experts. Modifications were agreed by three internal experts, including adolescents (n=10) items' understanding. Construct validity was assessed after applying the resulting questionnaire to 454 12-15-year olds in 16 schools in Bogotá (Colombia). Statistical analyses included exploratory factor analysis (EFA), internal consistency and confirmatory factor analysis (CFA). **Results:** after the content validation 52% (n=35) of the items were excluded (all 5 demographic aspects, 13 general/oral health, 4 dental-care habits and 13 dietary habits). Of the remaining 38 items, 50% were modified. Construct validation: In the EFA items were regrouped into the three persisting domains (KMO=0.68; Bartlett's test: $p < 0.001$). Cronbach's reliability corresponded to $\alpha = 0.67$. Internal consistency of each factor was good (Cronbach's $\alpha = 0.30-0.69$; ICC=0.39-0.62; $p < 0.001$) with a satisfactory model's fit. CFA showed good convergent and discriminatory validity suggesting to further eliminate 14 items ($X^2=238.518$, $df=210$, $p > 0.086$; CFI=0.96; TLI=0.95; RMSEA=0.017, and PRATIO=0.76). Final validated questionnaire corresponded to 24 items (general/oral health: n=5; dental-care habits: n=4; dietary habits: n=15). **Conclusion:** overall the validation of the ETW questionnaire for adolescents was satisfactory, recommending its use in practice/research.

26 Aminomethacrylate copolymer associated to fluoride and stannous on enamel erosive wear

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The promising anti-erosive effect of film-forming polymers has been shown previously, but its efficacy against erosion associated to abrasion needs to be further elucidated. The objective of this study was to investigate if the addition of an aminomethacrylate copolymer (AMC) would potentiate the effect of the sodium fluoride (F) associated or not to stannous chloride (FS) on the control of enamel erosive wear, using an erosion-abrasion cycling model. Polished bovine enamel specimens were randomly allocated into to the experimental groups (n=15/group): C (deionized water-control); F (225 ppm F⁻); FS (225 ppm F⁻ + 800 ppm Sn²⁺); AMC (2%); AMC+F; AMC+FS. After exposition to human saliva (2h) for pellicle formation, specimens were immersed in citric acid 0.3% (pH 2.6 - 5 min) and saliva (1 h), 4x/day. Abrasion was performed with a toothbrush machine (200 g/15 s), followed by exposition to treatment solutions (2 min). The rehardening (%Re) and protective potential against initial erosion (%Prot), indicating the resistance of treated enamel against acid challenges, were evaluated with Knoop surface microhardness after the first and second acid challenges of the first day. The surface loss (SL) was measured by stylus profilometry after 5 days. Data were analyzed with ANOVA and Tukey tests (5%). All the solutions containing fluoride promoted similar %Re potential (p>0.05). The mean±SD values for AMC+F (2.15±6.71) and AMC+FS (1.23±5.76) groups resulted in significantly higher % Prot compared to control (-7.92±4.51). SL (µm) values were: C (7.66±0.92)a; F (6.15±0.38)b; FS (4.80±0.67)c; AMC (3.87±0.92)d; AMC+FS (2.83±0.97)e; AMC+F (2.70±0.56)e. Different letters show significant differences among groups. The cationic aminomethacrylate copolymer increased the protective potential of both fluoride solutions (F and FS) against erosive-abrasive challenges, showing promising results for further development of protective agents.

27 Erosive effect of different beverages on composite materials

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Background: flavored beverages (juices, sodas, teas) consumption has increased among schoolchildren. The most of them are acidic. Erosion is the chemical dissolution of tooth structure and restorative materials in acidic environment. There is a greater adhesion of bacteria on rougher surfaces. The aim of this study was to assess the erosion effect of the most commonly consumed beverages and to measure effect on the surface roughness of composite and giomer materials. Methods: the materials used in this study (Tetric EvoCeram-TEC (IvoclarVivadent), Filtek Ultimate-FU (3M ESPE) and Beautifil Flow Plus-BFP (Shofu)) were immersed in different solutions continuously for 7 or 14 d. pH meter was used to measure the pH at 25°C: Coca-Cola (pH=2.4), iced tea (pH=3.5) and multivitamin soda (pH=3.4). A total of 60 samples were made - 20 from each material, divided into 4 groups and immersed in 4 solutions. Control group was stored in artificial saliva. Surface roughness parameters (Ra, Rp, Rz) were recorded at baseline, and at 7 and 14 d of exposure to beverages. Data were tested using analysis of variance and post-hoc test. Results: extremely low pH of Coca Cola caused a significant increase in surface roughness of all tested materials (FU: Ra_{in} - 0.224, Ra_{7d} - 0.299, Ra_{14d} - 0.367, ($p < 0.05$)). Citric acid from multivitamin soda appears to be more erosive to giomer than composite (BEF: Ra_{in} - 0.209, Ra_{7d} - 0.235, Ra_{14d} - 0.308, $p < 0.05$). Longer exposure to acidic drink showed greater erosion (TEC in Cola: Ra_{in} - 0.183, Ra_{7d} - 0.322, Ra_{14d} - 0.397, $p < 0.05$). Conclusion: all tested beverages showed a significant erosive effect on tested restorative materials due to low pH related to acidic ingredients. Rough surfaces usually wear more quickly.

28 Intraoral circadian pH measurements with a wireless sensor: proof-of-principle study

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Aim: to test if a newly developed pH-sensitive sensor is able to measure throughout one day inside the oral cavity. **Methods:** A screen-printed newly developed pH-sensitive sensor was mounted into an individually 3D printed mould that was attached in the upper jaw of three test subjects, not close to the biofilm. The sensor was wireless and measured every 3 minutes throughout the day. At the beginning of the measurements as well as throughout the day, the sensors were calibrated with test solutions at pH 4 and pH 7. At the end of the day data was collected with a smartphone that was held to the cheek of three test subjects. These test persons followed a strict protocol of drinking and eating throughout one day. Due to the preliminary character of this study no statistics were calculated. **Results:** measurements in 3-min-intervals were possible throughout the duration of the experiment. After 8 h in mouth the sensors showed a shift of 0.5-1 pH units compared to the calibration solutions. The measurements led to similar curves with similar directions but individual slopes. Inter-subject differences were observed. E.g., the individual pH values after consumption of rose hip tea were 3.0, 5.2 and 6.5, respectively. The time of clearance until a neutral pH was reached after consumption of this tea was between 15 and 60 min. Similarly, after the consumption of citrus yoghurt we observed a drop of 1 pH unit in 2 test persons, and 3 pH units in the third test person. **Conclusion:** The newly developed sensor system produced promising results. Further validation is planned.

Summary: a newly developed screen-printed pH-sensitive sensor was able to measure throughout one day inside the oral cavity.

29 The burden of erosive tooth wear and risk indicators in adults: a population-based study

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This study aimed to estimate the burden of erosive tooth wear and risk indicator in an adult population. This cross-sectional study used a multistage sampling strategy to draw a representative sample of 1,023 individuals ≥ 35 years old from South Brazil. Erosive tooth wear was recorded by one calibrated examiner according to the Basic Erosive Wear Examination (BEWE) index. Questionnaires recorded sex, age, educational level, tooth brushing frequency, alcohol consumption, dietary habits, drinking methods, self-reported bruxism, and self-reported reflux. Poisson regression models were used to assess the relationship of erosive tooth wear with predictor variables. The mean age of the individuals included in the study 52.43 years (SD = 11.69). The prevalence of erosive wear was 34.40% [SE = 3.30] and remained stable with increasing age. The mean number of teeth and surfaces affected by erosive tooth wear was 3.16 (SE = 0.35) and 4.23 (SE = 0.44). The prevalence of erosive tooth wear classified as BEWE 1 was significantly lower in the elderly (≥ 60 years) compared to those aged 35-44 years. Erosive lesions recorded as BEWE 3 were found in 28.84% (SE = 2.75) of the sample and lower percentages were observed in the other BEWE scores. Females presented a lower probability of erosive tooth wear (IRR = 0.74; 95% CI = 0.63-0.86). Individuals with self-reported bruxism presented higher likelihood to have erosive tooth wear (IRR = 1.42; 95% CI = 1.05-1.91). The present study showed that erosive tooth wear is highly prevalent among adults. Self-reported bruxism was a risk indicator of erosive tooth wear, and been female presented as a protective indicator for this condition. Federal University of Rio Grande do Sul Research Ethics Committee protocol (19794/11).

Session 3

Microbiology

30 *Lactobacillus reuteri* and *Streptococcus oligofermentans* are efficient colonizers in a multi-species model of cariogenic biofilm

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Background: the probiotic organisms *Lactobacillus reuteri* and *Streptococcus oligofermentans* are known for their inhibitory effect on cariogenic bacteria. Recently, they were shown to reduce *Streptococcus mutans* counts and enamel mineral loss in a three-species biofilm model (*S. mutans*, *Lactobacillus rhamnosus* and *Actinomyces naeslundii*). Here, we aimed to design and validate specific fluorescence *in situ* hybridization (FISH) probes for *L. reuteri* and *S. oligofermentans* and to investigate how both organisms contribute to biofilm architecture in the employed model.

Materials and methods: biofilms (n=10) were grown for 10 days on bovine enamel slabs and rinsed daily with either *L. reuteri* (LR) or *S. oligofermentans* (SO). Probe sequences (*L. reuteri*: LAROI1 5'-AGCACCATCAATCAGTTGGGC-3'; *S. oligofermentans*: SCRI1 5'-GCTCCTCCTTCAGCGTTCTAC-3') were selected in the hypervariable segment V1 of the 16S rRNA gene and checked for duplex and hairpin formation using Oligo 7. Probe specificity and hybridization conditions were tested *in silico* using Probe Match and mathFISH. Hybridizations were performed at 30% formamide and 46°C. Fixed cells of *L. reuteri*, *S. oligofermentans*, *S. mutans*, *L. rhamnosus* and *A. naeslundii* served as controls. After FISH (n=5), samples were analyzed by confocal microscopy. Total and strain-specific bacterial numbers were assessed by quantitative polymerase chain reaction (n=5).

Results: LAROI1 and SCRI1 specifically targeted *L. reuteri* and *S. oligofermentans*, respectively, and both organisms constituted an important part of the biofilms. LAROI1, however, competed with EUB338 for binding and could not be used concomitantly. LR biofilms showed significantly reduced numbers of *L. rhamnosus* (82%) and *S. mutans* (90%), and *S. mutans* (94%) and *A. naeslundii* (58%) were significantly reduced in the SO group (p<0.05; ANOVA, Dunnett's multiple comparisons test).

Conclusion: *L. reuteri* and *S. oligofermentans* are firmly integrated in multi-species biofilms.

31 Ratiometric analysis of local *S. mutans* biofilm pH on tooth and restoration surfaces

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Confocal microscopy-based pH ratiometry is a powerful tool to study pH at the microscale inside dental biofilms. The aim of the present work was to investigate the influence of different underlying substrates – enamel (E), dentin (D), composite resin (C) and glass ionomer cement (G) – on local pH in highly standardized *Streptococcus mutans* biofilms. Biofilms were grown for 7 days in an artificial mouth model on compound specimens (n=18) consisting of bovine enamel, a restoration (C or G), and dentin. Then extracellular pH in the biofilms was monitored for 45 min after exposure to sucrose in fifteen fields of view (FOVs) in five locations on all specimens: On the enamel surface (E), at the border between enamel and restoration (EC/EG), on the restoration (C/G), at the border between restoration and dentin (DC/DG) and on the dentin surface (D). Mineral loss (ΔZ) in dentin and enamel was assessed by transversal microradiography.

pH in all biofilms dropped rapidly upon exposure to sucrose, and steep chemical gradients with pH differences of up to one unit were observed inside individual biofilms. The mean $\pm$ SD pH on dentin (5.39 ± 0.15) and at the dentin/restoration border (5.47 ± 0.15) was significantly higher than on the other substrates after 45 min (E: 5.21 ± 0.32 ; EC/EG: 5.19 ± 0.25 ; C: 5.25 ± 0.38 ; G: 5.05 ± 0.15 ; $p<0.05$; ANOVA/Tukey HSD). ΔZ was significantly lower in dentin adjacent to G than to C (819 ± 486 vs. 1525 ± 373 ; $p=0.005$; t-test). For enamel, no significant differences in ΔZ were observed between restoration materials (G: 497 ± 448 ; C: 320 ± 137 ; $p=0.253$).

In conclusion, the dissolution of dentin correlates with higher local pH in the overlying biofilm. Restoration borders are not associated with lower local biofilm pH. Compared to C, G restorations reduce ΔZ in the adjacent dentin.

32 Potential anticaries effects of prebiotic fibers: a systematic review of the literature

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Soluble dietary fibers, also called prebiotics, have shown benefits at the gut microbiota, but evidence about their effect on oral health is scarce. Prebiotics may have an effect on dental caries based on the modulation of the dental biofilm, which would restore symbiosis from bacterial dysbiosis. However, the available evidence is contradictory and has not been systematically collected. Consequently, this study investigated the potential effects of prebiotic fibers on dental biofilm, dental caries, or saliva through a systematic review of the literature. A standardized search was performed on three databases (MedLine, SCOPUS, and Web of Science). Both selection and data extraction were performed by 2 researchers, independently, obtaining 1,031 identified titles, of which 18 were selected for full text review. Eight titles (equivalent to nine studies) were included. Studies were *in vitro* (n=6), in animals (n=1), or clinical human studies (n=2). Fructo-oligosaccharides-FOS, galacto-oligosaccharide-GOS, inuline, pectine and short-chain fatty acid-SCFAs were identified as target prebiotics. Outcomes were evaluated at the biofilm (n=7), and saliva (n=2) levels. Study length varied between 16 h to 8 weeks. Most of the studies (n=5) showed potential benefits of prebiotic fibers, mainly due to their capacity to limit growth or bacterial adhesion. Three studies showed lack of effect and one reported no difference between prebiotics and sucrose. Overall, quality of evidence was judged to be moderate. Meta-analysis was not possible. In conclusion, although evidence tends to support an effect on caries from prebiotic fibers through the modulation of dental biofilm, evidence is still scarce and with insufficient clinical support. Further studies may provide support for the use of prebiotics as caries-ecological therapy.

33 Inhibitory effects of S-PRG filler-containing gel paste on *Streptococcus mutans*

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S-PRG filler is a bioactive functional glass that releases six different ions. The purpose of this study is to evaluate whether S-PRG filler containing gel paste for PMTC (PRG gel paste) can reduce the cariogenicity of *Streptococcus mutans*. *S. mutans* strain MT8148 (1.0×10^7 CFU/ml) was cultured in BHI broth in the presence of various concentrations of PRG gel paste (0%, 0.1%, 1%, and 10%) at 37°C. After 10 minutes, all *S. mutans* in the presence of 10% PRG gel paste were dead, while a drastic reduction in bacteria number was observed in cultures with 1% PRG gel paste. Next, *S. mutans* was cultured in BHI broth containing 1% sucrose and PRG gel paste at 37°C for 18 hours to allow for biofilm formation, which was stained with crystal violet and quantified the absorbance at 595 nm. A significantly lower amount of biofilm was observed in the presence of the gel paste containing greater than 0.1% S-PRG filler as compared to without the gel paste ($p < 0.001$). Also, PRG gel paste was used to treat the surface of sliced bovine enamel samples, then, the enamel was immersed in BHI containing 1% sucrose and cultured with *S. mutans* for 18 hours. As a result, the gel treatment drastically reduced the amount of biofilm formation. These results suggest that PRG gel paste is an effective for prevention of bacterial growth and biofilm formation by *S. mutans*.

34 External pH regulates intracellular second messengers in *Streptococcus mutans*

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Dental biofilm plays a crucial role in cariogenesis. Cyclic-di-GMP, cyclic AMP and cyclic-di-AMP are second messengers (SC) that determine biofilm formation and virulence of bacteria. Environmental pH might affect their levels. We aimed to investigate the effects of different pH values on intracellular SCs, biofilm, and growth of *Streptococcus mutans*. *S. mutans* ATCC 35668 was grown in Brain Heart Infusion (BHI) pH 7.5 until stationary phase then exposed to new BHI pH 4.5, 5.5, 7.5, or 8.0 for 3 hours. The same number of bacteria was obtained for SC extraction by heat and ethanol, while cell pellets were used for total cellular protein quantification by Quant-iT[®] assay. SCs were determined and quantified by HPLC-MS/MS and normalized by dividing with total protein levels. Additionally, *S. mutans* was incubated in BHI with above-mentioned pH series, and the OD was measured at 16 and 24 h. Biofilm formation was determined by crystal violet assay at the same time points. C-di-AMP levels at pH 7.5 were 109.6 ± 5.5 pmol/mg protein. At pH 4.5 and 8.0, they were smaller than at pH 7.5 by 35.4% ($p=0.002$) and by 41.5% ($p<0.001$), respectively, which were parallel with bacterial growth. However, biofilm formation at pH 8.0 was not different from pH 7.5. C-di-GMP changes had the same tendency as c-di-AMP after pH alterations, while cAMP decreased in a stepwise manner from pH 5.5 to 8.0. In conclusion, pH 7.5 provides the optimal condition for *S. mutans* growth, biofilm formation and SC homeostasis. We speculate *S. mutans* may lack acid tolerance after a single exposure to acidic shock resulting in low growth and biofilm formation. Our results support c-di-AMP in *S. mutans* are related to biofilm formation among other functions.

35 Fluorescence technology differentiates bacterial microbiome from deep dentin carious lesions in vivo.

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AIM: the purpose of this study was to determine, *in vivo*, if the degree of fluorescence detected by fluorescence-aided caries excavation (FACE) correlates with dentin bacterial microbiome diversity, as assessed by 16S rRNA gene amplicon sequencing.

METHOD: we selected 25 patients with one tooth having a primary caries lesion at least two thirds (2/3) into the dentin (radiographically) with a functional, asymptomatic pulp. Clinical sequence was: (1) fluorescence was observed using FACE technology (SIROInspect; Sirona, Bensheim, Germany) and classified as pre-operative red-fluorescing dentin (PO-RF) or pre-operative non-fluorescing dentin (PO-NF); (2) dentin sample was obtained using a spoon excavator; (3) caries excavation and cavity preparation was performed by an independent provider, (4) immediately prior to restoration placement the study examiner conducted a second FACE assessment of the cavity preparation, classifying dentin as post-operative red-fluorescing dentin (PT-RF) or post-operative non-fluorescing dentin (PT-NF) and collected another dentin sample with a microbrush. Samples were stored on dry ice immediately, then transferred to -80⁰ C storage prior to analyses at the UNC Microbiome Research Core.

RESULTS: the 25 teeth selected rendered 63 dentin samples (25 PO-RF, 2 PO-NF, 15 PT-RF, and 21 PT-NF). Ranked analysis showed that *Rothia dentocariosa* and *Lactobacillus sp.* were among the top 10 most abundant species found in fluorescent dentin samples, while *Streptococcus mutans* and *Veillonella dispar* were ranked among the top 10 in all samples. Shannon diversity indices were lower in fluorescent samples. Beta diversity analysis showed that PO-RF community was significantly different from PT-RF and PT-NF samples (Permanova $p = 0.01$).

CONCLUSION: fluorescence as clinically detected by fluorescence-aided caries excavation (FACE) is associated with a shift in the bacterial microbiome composition and abundance from deep dentin carious lesions.

36 Detection of treptococcus mutans serotypes in biofilm and dentin caries lesions from children with early childhood caries

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Early childhood caries (ECC) is considered a serious public health problem worldwide. One of the main microorganisms related to dental caries, *Streptococcus mutans*, has four clinical known serotypes. However, the distribution of different *S. mutans* serotypes and their association with dentinal caries in Brazilian children remains scarce. This study aimed to investigate the presence of the *S. mutans* serotypes *c*, *e*, *f*, and *k* in biofilm and dentin caries samples from Brazilian children with ECC. In addition, the prevalence of these serotypes in enamel and dentin was compared. The population consisted of preschool children that were clinically evaluated using ICDAS and Nyvad criteria. A total of 18 dentin caries samples (D) and 17 biofilm samples (B) were analyzed using polymerase chain reaction (PCR) to identify different *S. mutans* serotypes. Serotype *c* was the predominant serotype detected in the studied samples (22; 62.5%), followed by serotype *f* (11; 31.4%), *k* (11; 31.4%) and *e* (3; 8.5%). No statistical significant differences were found for the serotypes *c* (B-76.5%, D-50.0%, $p=0.10$), *e* (B-17.6%, D-0.0%, $p=0.062$), and, *k* (B-17.6%, D-44.4%, $p=0.087$) percentages in both biofilm and dentin caries samples. On the other hand, serotype *f* was more prevalent in dentinal samples (50.0%) compared with the biofilm ones (11.76%); $p=0.014$. These results suggest that different serotypes of *S. mutans* may play an important role in dentinal caries in ECC.

37 Effect of sweeteners on the development of dental caries under a microcosm biofilm model

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This study compared the effect of commercial sweeteners (stevia, aspartame and xylitol, Finn trademark) and sucrose on the development of dental caries under a microcosm biofilm model. For that, 144 bovine enamel and 144 bovine dentin samples (4 mm x 4 mm) were submitted to microcosm biofilm formation using human saliva (10 donors) and McBain saliva for 5 days. From the 2nd to the 5th day of biofilm cultivation, each sample was daily exposed to McBain saliva supplemented with 0.2% of the respective sweeteners/sugar (biological triplicate, n final = 15) at 5% CO₂ and 37°C. Lactic acid production (mmol/l) and colony forming units (CFU) counting for total *lactobacilli*, total *streptococci* and *Streptococcus mutans*/*Streptococcus sobrinus* (log₁₀ CFU/ml) were quantified. The degree of tooth demineralization was analyzed using transverse microradiography-TMR. Data were statistically compared (ANOVA/ KW). All commercial sweeteners, except xylitol, and sucrose presented similar lactate production [median(II): 0.44(0.17) and 0.63(0.27) mmol/l for sucrose in case of enamel and dentin, respectively, p<0.0001]. The lactate production was reduced in 92% for xylitol. All analyzed species did grow similarly for stevia, aspartame and sucrose. The only exception happened in dentin, where *lactobacilli* did not grow in stevia group neither. On the other hand, the species did not appear in xylitol and control groups (no sugar/sweetener). Enamel and dentin demineralization were significantly reduced in xylitol group (> 84% reduction, respectively) compared to the commercial sweeteners (stevia and aspartame) and sucrose, which in turn did not differ from each other [median(II): 2835(967.5) and 3660(825) %vol.µm for sucrose for enamel and dentin, p<0.001]. Commercial sweeteners based on stevia and aspartame, containing lactose either, proved to be as cariogenic as sucrose in this experimental model.

38 Effect of drops containing *Lactobacillus reuteri* on various caries-related variables in orthodontic patients

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Funding: Saudi Cultural attache, Ministry of higher education, Saudi Arabia

Aims: to investigate the short-term effect of probiotic drops on biofilm acidogenicity and on the number of salivary *Streptococcus mutans* and lactobacilli in orthodontic patients.

Material and Methods: the study group comprised 28 young adults who were undergoing orthodontic treatment. The short-term prospective clinical trial lasted for three weeks. The subjects randomly allocated to either test or placebo groups. Plaque-pH, saliva and dental biofilm samples were obtained at baseline, one week post intervention and three weeks post intervention. Plaque acidogenicity was assessed in the inter-proximal area between the upper lateral incisors and canines on both sides using the “strip method”, the numbers of salivary *Streptococcus mutans* and lactobacilli by regular plating, while the presence of the two *Lactobacillus reuteri* strains in the dental biofilm was evaluated using qPCR analysis.

Results: only one drop-out has been reported. A statistically significant increase in plaque pH at three weeks post-intervention was found for the test group in comparison to the placebo group. In addition, the AUC_{7.0} showed a significant difference at three weeks between the test and placebo. The three-week samples of stimulated whole saliva showed a statistically insignificant difference in the number of *S. mutans* and lactobacilli between the two groups. The qPCR analysis showed the ability of the two strains to get colonized in the dental biofilm without a significant effect on the microbial counts.

Conclusion: a mixture of *Lactobacillus reuteri* in the form of drops has the ability to reduce the pH fall at the three-week follow-up. However, the short-term use of probiotics does not appear to have an effect on the number of salivary *Streptococcus mutans* and lactobacilli in saliva and on dental biofilm.

39 Demineralization prevention with a new antibacterial restorative composite containing QASi nanoparticles in an in situ study

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Funding: fFunding was provided by Nobio Ltd., Petach Tikva, Israel, through the University of California San Francisco Industry Contracts & Grants Division

Objective: to investigate whether a new dental composite with incorporated quaternary-ammonium-silica-dioxide (QASi) nanoparticles offers antibacterial activity demonstrated by reducing enamel demineralization in an in situ gap-model simulating conditions of a wall lesion.

Methods: the 4-weeks in situ study (IRB #18-26344) included 20 subjects wearing lower removable partial dentures (RPD) with acrylic flanges on both sides of the mouth (ClinicalTrials.gov NCT04059250). Participants used 1,100 ppm Fluoride-toothpaste to brush their natural teeth. The gap-models consisting of an enamel slab placed next to a composite separated by a 38 μm space were incorporated into the flanges. In this split-mouth design study, one side of the RPD was randomized to harbor the Nobio Infinix composite (Nobio Ltd., Kadima, Israel) and the contralateral side a control composite (Dentsply EsthetX-HD, Dentsply Sirona Ltd, Milford DE). Each participant received enamel slabs from one single tooth. The gap-model was located recessed into the RPD buccal flanges, allowing microbial plaque to accumulate within the gap. After four weeks of continuous wearing, decalcification (ΔZ mineral loss) of the enamel slabs adjacent to the gap was determined by cross-sectional microhardness testing in the laboratory.

Results: seventeen participants completed the trial. Mineral loss ΔZ ($\text{vol}\% \times \mu\text{m}$) for the Nobio antibacterial composite test side averaged 235 ± 354 (Mean $\pm$ Standard Deviation [SD]) and was significantly lower compared to ΔZ of the control side (774 ± 556 ; Mean $\pm$ SD) (paired t-test, $P < 0.0001$; mean of test minus control: -539, 95% confidence interval: -741, -338).

Conclusion: this clinical study using an in situ enamel gap-model showed that composites with QASi antibacterial nanoparticles significantly reduced demineralization in enamel adjacent to a 38 μm gap over a 4-week period in comparison to a conventional composite. Composites with QASi nanoparticle technology have the potential to reduce the occurrence of secondary caries.

Session 4

Nathan Cochrane Junior Scientist Award

40 Interplay between brushing, slurry diluent and dilution ratio on erosive tooth wear

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This in vitro study investigated the influence of different hand brushing movements, slurry diluent and dilution ratios on the progression of erosive tooth wear (ETW). Bovine enamel specimens were distributed in 12 experimental groups (n=10), according to the following study factors: (1) hand-brushing movement (horizontal or circular); (2) slurry diluent (mineral solution or distilled water); (3) toothpaste dilution ratio (1:2, 1:3 or 1:4). We performed a 5-d erosion-abrasion cycling model, consisting of 4 erosive challenges (0.3% citric acid, pH=2.6) followed by 1 h exposure to mineral solution. Brushing with fluoride toothpaste (1400 ppm F) was performed after the first and last erosive challenges of the day (15 s and 2 min of slurry exposure). Surface loss (SL, in μm) was assessed by optical profilometry. Data were analyzed with three-way ANOVA and Tukey tests ($\alpha=0.05$). There were differences between the levels of the factor brushing movement ($p=0.044$), slurry diluent ($p<0.001$), and in the interaction of slurry diluent and dilution ratio ($p=0.009$). There were no differences in the factor dilution ratio and in the other interactions ($p>0.05$). The horizontal movement showed significantly lower SL than the circular. For mineral solution, dilution ratios did not differ ($p>0.05$). For distilled water, 1:2 dilution presented higher SL than 1:3 and 1:4 dilutions ($p<0.05$). For the 1:2 dilution, diluents did not differ ($p=0.967$). For the 1:3 and 1:4 dilutions, the mineral solution presented higher SL than distilled water ($p<0.01$). In conclusion, the horizontal movement caused less SL. Additionally, our study exposes the complex interplay/association between brushing movement, slurry diluent and dilution ratio, demonstrating the difficulties in drawing direct comparisons between different ETW studies, and expressing the dire need for authors to fully describe these details in their publications.

41 The action of 1450 and 5000 ppm of sodium fluoride on the erosion/abrasion of dentine

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Funding: The Saudi Arabian Cultural Bureau

The effect of the concentration of the fluoride ion on dentine erosion remains unclear. The aims of this study were to (1) evaluate the effect of sodium fluoride (NaF) on dentine erosion/abrasion and (2) compare the step height obtained using profilometry or digital microscopy. Dentine specimens ($n = 60$) sectioned from the coronal aspect of extracted human molars were randomly divided into three groups of 20 samples each and fully immersed into deionised water (control), or solutions of 1450 ppm (F1450) or 5000 ppm (F5000) NaF for 3 min. The samples were then immersed in artificial saliva for 30 min. They were then eroded for 25 min with 0.3% citric acid at pH 2.7. Then, samples were subjected to either 120 or 240 brushing strokes. Results were analysed using 3-way ANOVA, with $\alpha=0.05$. The mean step height with no fluoride and 120 or 240 strokes using profilometry or digital microscopy ranged from 9.87-9.89 to 12.24-12.34 μm , respectively, for F1450, were 8.95-8.97 to 11.35-11.37 μm , respectively, and for 5000 were 7.97-8.05 to 10.53-10.58 μm , respectively. There were statistically significant differences ($p<0.05$) in the mean step height between the no fluoride group and F5000 at all times, regardless of the number of strokes, but there were no statistically significant differences with F1450. The mean step height of dentine loss using the confocal non-contact white light laser profilometry compared to the digital microscope showed that there were no statistically significant differences ($p<0.05$) between both methods of surface analysis. Within the limitations of this in-vitro study, only 5000 ppm NaF was able to reduce dentine step height. Moreover, there was no difference between using profilometry or digital microscopy to analyse the step height.

42 The effect of hematopoietic stem cell transplantation on caries and hyposalivation

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Funding: KWF (dutch cancer society)

Background and aim: hematopoietic stem cell transplantation (HSCT) preceded by a conditioning regimen is an established treatment option for many (mostly) malignant blood diseases. Previous studies reported a decreased salivary flow rate after HSCT, and therefore HSCT recipients may have a high caries risk. This study aims to report on caries progression observed in adult HSCT receivers and to assess the influence of altered salivary flow rate on the development of caries lesions.

Methods: a multi-center prospective observational study has been conducted, in which patients receiving HSCT were followed from baseline to 18 months post treatment. Stimulated whole mouth saliva samples were collected and full caries charts (according to the ICDAS criteria) were made before HSCT, and after 3, 6, 12 and 18 months. A negative binomial regression model was built to determine the influence of stimulated hyposalivation (<0.7 mL/min) at baseline and after 3 months on caries progression.

Main results: two academical medical centers in the Netherlands included 112 patients. During the follow-up 17% of the HSCT receivers developed at least 2 new dentine lesions or lesion progression into dentine (ICDAS $\geq$ 4). The median number of affected surfaces was 3 (maximum: 12) per patient with caries progression. Stimulated hyposalivation 3 months after HSCT was a significant risk indicator for caries progression (IRR: 5.26, CI: 2.07 - 14.27, $p < 0.001$), while hyposalivation at baseline was not.

Conclusions: caries progression is a common oral complication in patients after HSCT and stimulated hyposalivation after treatment is a significant risk indicator for caries progression. Dentist should be aware of the oral risks in this specific patient group and additional preventive strategies must be considered in patients with hyposalivation.

43 ¹H-NMR fingerprinting of parotid saliva low-molecular-weight organic components for caries-risk prediction

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Aim: parotid saliva (PS) is a sterile serous fluid contributing over 50% of salivary secretion under stimulated conditions, but only 20% otherwise. PS contains low-molecular-weight components which influence caries pathogenesis by impacting; tooth chemical composition, bacterial adherence, and/or microbial growth. The PS metabolome reflects physiological status, but *without* interference from oral bacteria, and confounders. ¹H-NMR (Proton-Nuclear-Magnetic-Resonance) allows simultaneous identification of metabolites in samples of biological fluid. The aim was to qualitatively associate PS low-molecular-weight components with ICDAS scores in healthy adults.

Experimental approach: stimulated PS was collected from 21 adults using a Lashley cup. Each subject was assigned to the high or low mean ICDAS score group (dividing the total ICDAS scores by number of teeth). PS low-molecular-weight components were identified using ¹H-NMR (Bruker600MHz-spectrometer). ¹H-NMR spectra were qualitatively analysed using Bruker-TopSpin software to assign each peak (ppm) which was used to associate for each subject ICDAS score presence or not of metabolite peaks. Differences between groups were assessed by t-test (p<0.05).

Results: mean ICDAS scores were 0.03-2.48. ¹H-NMR PS spectra included peaks from; fatty and organic acids; polysaccharides; urea; ammonia-based protein derivatives; citrates; and amino acids. Spectral analysis demonstrated differences in the low-molecular-weight component for subjects with different ICDAS score. Spectra from subjects in the low ICDAS group (0.03-0.46) were characterised by, no significant proline peak (t=2.05;p<0.05), and significant peaks for fatty acids (t=9.51;p<0.05), lactate (t=4.47;p<0.05), acetate (t=4.49;p<0.05), citrate (t=6.01;p<0.05), and polysaccharides (t=3.42;p<0.05). Subjects in the high ICDAS group (0.53-2.48) had a significant proline peak (t=2.05;p<0.05), but no significant peaks for fatty acids (t=9.51;p<0.05), lactate (t=4.47;p<0.05), acetate (t=4.49;p<0.05), citrate (t=6.01;p<0.05), and polysaccharides (t=3.42;p<0.05).

Conclusions: differences in PS ¹H-NMR spectrum peak intensity patterns are associated with caries score.

44 Microbial indicators of dysbiosis prior the early childhood caries

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Introduction: a transition of the oral microbiome from a symbiotic state to an imbalanced oral ecosystem prior the clinical manifestation of early childhood caries (ECC) is understudied. **Aim:** to characterize the dental plaque microbiome of 4-year-old children with ecological dysbiosis towards ECC. **Materials and methods:** this research is part of the “Predicting Caries Risk in Underserved Toddlers in Primary Healthcare Settings” study. Caries status (dmft, ICDAS) was determined at the age of 1, 2.5, 4, and 6.5 years. Children (n=215) were assigned to the following groups: 1) healthy (n=50, ICDAS=0 throughout age 1-6.5 years); 2) dysbiotic plaque but healthy teeth (n=38, ICDAS=0 age 1-4 years but ICDAS $\geq$ 1 at 6.5 years); 3) early caries (n=75, at least 1 tooth with ICDAS=1-2 at 1-4 years) and 4) advanced caries (n=52, at least 1 tooth with ICDAS $\geq$ 3 at 1-4 years). The microbial composition of pooled plaque, collected at 4 years of age was assessed using 16S rDNA amplicon sequencing. The reads were denoised, mapped to zero-radius operational taxonomic units (zOTUs), and assigned a taxonomy. The dataset was assessed by Principal Component Analysis and PERMANOVA, by the “global test” and an empirical-Bayes regression model (ShrinkBayes). **Results:** dental plaque profiles of children in dysbiotic plaque but healthy teeth group differed significantly from the plaque of children who were healthy (p<0.001) or had early (p<0.001) or advanced caries lesions (p<0.05). Bacterial diversity in the dysbiosis group was significantly higher compared to healthy children and children with caries lesions (p<0.05). Various species of the genera *Prevotella* and *Leptotrichia* were associated with dysbiosis compared to other groups. **Conclusion:** the dysbiotic state has a dental plaque microbiome that differs from both a dentally-healthy ecosystem and children with caries lesions.

45 Detection of uncommon bacterial diversity of dental caries in adults by Next Generation Sequencing

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Dental caries is one of the most common diseases seen in the oral cavity. The detection of oral microorganisms by culture method, besides being time consuming, remains inadequate most of cases due to unculturable nature of oral bacteria. A comprehensive study of the oral microbiome is required to understand its polymicrobial etiology. The aim of this study was to reveal uncommon microbiome in carious dental plaque. A total of 52 samples were collected from 26 caries-active patients and 26 caries-free controls. Dental supragingival plaque samples were collected from each subject and the bacterial 16S rDNA, expanded V3-V4 region, was amplified using Next generation Sequencing. The core microbiome was defined with 235 shared bacteria in genus level, and among all microbiome 14,8% of all bacteria showed significant difference ($p < 0,05$). The bacteria responsible of caries may be listed as *Anaeroglobus* (0,032%), *Atopobium* (0,028%), *Bifidobacterium* (0,023%), *Centipeda* (0,0098%), *Cryptobacterium* (0,002%), *Desulfobulbus* (0,002%), *Filifactor* (0,26%), *Howardella* (0,0024%), *Megasphaera* (0,042%), *Mycoplasma* (0,0114%), *Olsenella* (0,23%), *Phocaeicola* (0,004%), *Propionibacterium* (0,032%), *Pseudoramibacter* (0,0116%), *Scardovia* (0,008%), *Schwartzia* (0,0035%).

The present study provides comprehensive knowledge of the uncommon microbiological etiology of caries in adults.

Session 5

Fluoride

46 TOF-SIMS as an alternative to the microbiopsy technique for determining enamel fluoride uptake

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The aim of this study was to explore the potential of time-of-flight secondary ion mass spectrometry (ToF-SIMS) to determine the enamel fluoride uptake (EFU) for fluoride solutions in comparison to the established microbiopsy technique (microdrill method).

Three randomly assigned polished human enamel specimens were immersed into three fluoride solutions (all 250 ppm F⁻, pH 4.5), respectively, prepared from sodium fluoride (NaF), stannous fluoride (SnF₂) and amine fluoride (AmF) under static conditions (30 min, room temperature).

The fluoride content was determined using the microdrill technique by collecting and dissolving (20 µL HClO₄, 40 µL citrate/EDTA buffer, 40 µL DI water) enamel powder from four approx. 100 µm-deep drill holes and comparing the fluoride concentration to a similarly prepared standard curve. ToF-SIMS investigations were conducted on the same specimens in a M6 device (Iontof, Münster, Germany) using Ga⁺ ions. Depth profiling of the near surface region (approx. 10 µm) was performed by measuring and sputtering in an alternating mode. Spectra were collected and normalized to total F⁻ ion intensities. The association among ToF-SIMS and EFU measurements was evaluated with Pearson's r.

Measurements with both methods showed clearly interpretable data with high correlation (r=0.95). Fluoride could be detected for all samples with clear differentiation between all fluoride groups. AmF group showed the highest F⁻ content (microbiopsy/ToF-SIMS (mean±sd): 4.29±0.67µg/cm²/0.0061±3.0E-4 F⁻-intensity), followed by SnF₂ (2.66±0.22µg/cm²/0.0018±2.6E-4 F⁻-intensity) and NaF (2.24±0.21µg/cm²/0.0013±3.5E-5 F⁻-intensity). ToF-SIMS investigation leads to better differentiation between all test groups which can be due to the lower data scattering than the microbiopsy technique.

ToF-SIMS is an appropriate alternative and complementary technique to the microbiopsy technique. An advantage of ToF-SIMS is that beside fluoride other chemical compounds can be detected and used for analyzing the enamel surface composition, e.g. Ca/P-ratio.

47 Fluoride concentration of commercially available toothpastes in the Dominican Republic: a pilot study

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Funding: the Indiana University, the University of Copenhagen and Universidad Iberoamericana

Aim was to determine the total fluoride (TF) and total soluble available fluoride (TSAF) concentration of commercially available toothpastes in the Dominican Republic (DR).

Fourteen commercially available toothpastes (6 for children and 8 for adults) with declared fluoride concentrations of 1,000, 1,100 and 1,450 ppm were included in the study. Eight contained Sodium Fluoride (NaF), two Stannous Fluoride (SnF) and four Sodium Monofluorophosphate (SMFP). Analyses were conducted using USFDA Tests #1 and #29 for NaF and SnF, and #3 and #16 for SMFP. All tests were performed using an Ion Specific Electrode (ISE) and a pH/ISE meter. Standard curves were prepared and analyzed at the time of toothpaste slurries' analyses.

The mean ($\pm$ SD) TF in NaF toothpastes labeled as 1,100 and 1,450 ppm were $1,099.49 \pm 2.28$ ppm and $1,452.15 \pm 3.91$ ppm, respectively. TSAF means ($\pm$ SD) were $1,101.24 \pm 4.34$ ppm and $1,448.83 \pm 3.91$ ppm for 1,100 ppm and 1450 ppm-labeled toothpastes, respectively. SnF toothpastes with 1,000 ppm on their label had a mean ($\pm$ SD) of $1,003.42 \pm 8.11$ ppm for TF; and 998.41 ± 5.39 ppm for TSAF.

The means ($\pm$ SD) of SMFP toothpastes labeled as 1,000 ppm were $1,003.04 \pm 8.73$ ppm for TF and $1,012.85 \pm 5.88$ ppm for TSAF. For 1450 ppm-labeled SMFP toothpastes, means ($\pm$ SD) were $1,442.42 \pm 8.37$ ppm for TF and $1,432.82 \pm 12.48$ ppm for TSAF. Two toothpastes had a fluoride concentration slightly below the minimum required for dental caries prevention and control (1,000 ppm).

In conclusion, the TF and TSAF concentrations of the toothpastes were very similar to those declared on each product's label. All of the toothpastes had a fluoride concentration below the maximum of 1,500 ppm permitted by regulations in the DR.

48 Effect of silver diammine fluoride on bond strength of restorative materials to natural carious dentin

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This study's aim was to compare shear bond strength (SBS) of glass ionomer (GIC), and composite bonded with one-step (SU) and two-step self-etch adhesive (CF) to natural carious dentin with and without silver diammine fluoride (SDF) treatment, and chlorhexidine and ethylenediaminetetraacetic acid (Chx/EDTA) preconditioning.

Carious teeth (N=90) scored ICDAS 4-6 were sliced longitudinally exposing carious dentin on one side and sound dentin on the other. Samples were randomly grouped for SDF treatment (n=30): A-No SDF; B-38% SDF (Advantage Arrest™, Elevate Oral Care, USA)(AA); C-SDF+potassium iodide (Riva Star, SDI, Australia)(RS). Each group was subcategorized randomly into 6 subgroups based on Chx/EDTA preconditioning and adhesive system (n=5): 1-GIC (GC Fuji IX GP®, GC America, USA); 2-SU (Scotchbond™ Universal, 3M-ESPE, USA); 3-CF (Clearfil™ SE bond 2, Kuraray, Japan); 4-Chx/EDTA+GIC; 5-Chx/EDTA+SU; 6-Chx/EDTA+CF. One week after SDF treatment, Chx/EDTA was applied if assigned, and a GIC or composite (Filtek™ Supreme, 3M-ESPE, USA) button was bonded to both surfaces of samples using designated adhesives. SBS was tested after 1-month storage in artificial saliva at 37°C.

Mean SBS of carious surfaces ranged from 0.31 MPa (Group-C1) to 16.31 MPa (Group-A6). Mixed ANOVA analysis revealed no significant difference in SBS of restorative materials on SDF-treated and non-treated carious dentin (p=0.479). Chx/EDTA-preconditioned surfaces had significantly higher SBS (7.78MPa) than non-preconditioned surfaces (5.58MPa)(p=0.022). With SDF, SU showed significantly higher SBS (AA:11.31MPa; RS:12.31MPa) than CF (AA:6.02MPa; RS:8.41MPa)(AA:p=0.008; RS:p=0.046); SBS of GIC (AA:0.54MPa; RS:1.27MPa) was significantly lower than SU (AA:p<0.0001; RS:p<0.0001) and CF (AA:p=0.010; RS:p=0.001).

In conclusion, SDF did not significantly impact shear bond strength of glass ionomer and self-etch adhesives to carious dentin. One-step self-etch adhesive showed highest shear bond strength to SDF-treated carious dentin; glass ionomer showed the least. Chx/EDTA preconditioning increased shear bond strength.

49 Nocturnal salivary fluoride bioavailability after brushing with high-fluoride dentifrice

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This study aimed to evaluate the bioavailability of F in saliva after the use of high-fluoride dentifrice during the nocturnal period. After ethical approval (opinion 483,913), fifteen healthy adults participated in this in vivo and crossover study in which the concentration of fluoride in their saliva was determined after brushing with approximately 1 g of the tested dentifrices: a conventional (1,450 ppm F⁻) or with high-fluoride concentration (5,000 ppm F⁻). Before brushing, the participants collected the non-stimulated saliva (baseline), immediately after brushing (time zero) and after 5 min, 2 h, 4 h, and 8 h, during the nocturnal period (between 10:00 pm and 06:00 am). The salivary F⁻ concentration was determined using a specific F-ion electrode. Regarding statistical analysis, a paired t-test was used to compare dentifrices with p fixed at 5%. At baseline, there was no significant difference between groups. Immediately after brushing, both dentifrices increased the F⁻ salivary concentration, with the highest concentration reached in time zero (mean ± SD, µg F/ml: 5.8 ± 2.5 and 26.1 ± 10.7 for the dentifrices with 1,450 and 5,000 µg F/g, respectively), however, the use of 5,000 ppm F⁻ dentifrice maintained the higher F⁻ salivary concentration at all times evaluated (p<0.001), remaining higher until 8 h after brushing. Furthermore, this treatment showed higher F-bioavailability in relation to time, evaluated by the area under the curve (mean ± SD, µg F/ml × min⁻¹: 161.4 ± 38.0 and 542.0 ± 117.7 for the dentifrices with 1,450 and 5,000 µg F/g, respectively, p<0.001). Thus, it can be concluded that the high-fluoride dentifrice increased the bioavailability of salivary F⁻ during the nocturnal period, being an option for the control of caries in high-risk patients.

50 Fluoride uptake by enamel after use of fluoride varnishes

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Aim of this study was to evaluate ultrastructural changes in the enamel after topical application of fluoridated varnish using scanning electron microscopy (SEM).

Materials and methods: the research was done on impacted third molars. After extraction, we removed the soft tissue and separated the crown from the root section. The teeth were polished and divided into two groups of 10 teeth each and were stored in plastic recipients containing deionized water. The teeth (experimental group) were stained with fluoride 5% sodium fluoride varnish (Duraphat®). Ten molars (control group) did not receive any varnish application. After the treatment, samples were stored in deionized water until SEM analysis. The samples were coated with 40 nm to 60 nm gold using a sprayer and then observed under a microscope (VEGA3 LMU; TESCAN, a.s., Brno, Czech Republic). The magnification goes from x2000 till x3000.

Results: SEM examination of enamel surfaces revealed CaF_2 deposition material as a product of topical fluoride application. Samples treated with fluoride showed a nearly smooth surface, with complete obtusion of inter-rod spaces in some fields. The rods appeared as if they were fused together with some globules deposited on the surface, relatively no evidence of porosities or irregularities. SEM images showed that none of the samples from the control group had CaF_2 deposited on their surface. In samples treated with fluoride, there was a variable amount of plaque.

Conclusion: the use of fluoride provides a cariostatic effect by the adsorption of calcium fluoride and release of ions during the decrease of the plaque pH. The group of teeth treated with a fluoride varnish had the highest amount of calcium fluoride deposits on the enamel.

51 Correlation between the dmft/DMFT index and fluoride in drinking water from the North Macedonia

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The aim of the study is to determine the correlation between the dmft /DMFT index of 6-year-olds and the concentration of fluoride in drinking water. The ethics committee of the Faculty of Dentistry at the University of St Cyril and St Meth approved the study and parental consent was obtained for each child.

The survey covered 95 students, from 1 central and 4 regional primary schools, at which the dmft/ DMFT index was determined. Children live in the city of Strumica and four different villages. The fluorine concentration was determine by using the pH / ISE meter-Thermo-Orion with a special F-electrode (Thermo Orion Ion Plus Fluoride Electrode) at the Institute of public health. A Spearman method was used to determine the correlation between the specified variables.

The total number of children in the examined sample was 95, out of which 52 (54.7%) were female and 43 (45.3%) were male. The average dmft index in this group of children was 5.29, with a standard deviation of ± 4.3 , and an average DMFT index of 0.07 ± 0.3 . Maximum concentrations of fluorine in drinking water of 0.14 ppmF were determined in the village of Veljusa and the village of Vodocha (0.11 ppm F), while the minimum (0.08 ppm F) in the city of Strumica and in the villages of Dobrejci and Banica. The correlation between the dmft/DMFT index and the concentration of fluorine in drinking water, was a negative, indirect correlation with the value of the coefficient $r = -0.149$ for primary teeth and $R = -0.085$ for permanenth teeth.

The correlation between the dmft /DMFT index and the concentration of drinking water is negative, indirect correlation, but statistically, this correlation is insignificant ($p > 0.05$).

52 Fluoride concentration in *Camellia sinensis* teas from Argentina

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Objectives: to evaluate the fluoride concentration and pH of *Camellia sinensis* derived-teas from Argentina. **Methods:** forty-eight varieties of tea [black (n=16), green (n=21), red (n=7) and white (n=4)] commercialized in the form of leaves (n=15) or tea-bags (n=33) were analyzed. To prepare the teas, one bag or 2.0 ± 0.05 g of each product were infused for 5 min in 200 ml of boiled water (distilled and tap water). The F⁻ concentration on infusions was determined using an ion-selective electrode and pH was measured using a pH meter. The mean ($\pm$ sd) of F⁻ concentration and pH were calculated for each group. ANOVA was performed followed by the t-test for paired analysis. Pearson's correlation test was performed to verify a correlation between the pH and the concentration of F⁻ found in the samples. **Results:** the fluoride concentrations found on the different brands and types of teas, ranged from 0.2 to 13.8 µg/ml. A higher fluoride concentration was observed in the leaves group (4.29 ± 4.30 µg/ml) compared to tea-bags (2.32 ± 1.43 µg/mL) ($p < 0.05$). Regarding the type of tea green (2.9 ± 3.39 µg/ml) and black tea (2.2 ± 1.29 µg/ml) were more rich in F⁻ than red (1.8 ± 0.85 µg/ml) and white tea (0.8 ± 0.44 µg/mL). The pH ranged between 2.6 to 5.6. The samples prepared with fluoridated water had a significant additive effect of fluoride (2.9 ± 0.36 µg/ml, $p < 0.05$). Fluoride and pH appeared not to be correlated (Pearson test). **Conclusion:** all the studied tea samples presented fluoride concentrations. The pH proved to be low and it can increase the risk of erosive tooth wear. The preparations with fluoridated water had an additive effect to the fluoride released.

Session 6

Hard tissues and pulp reactions

53 Secondary caries adjacent to bulk or incrementally filled composites placed after selective excavation *in vitro*

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For deep carious lesions, selective caries excavation (SE) is recommended. Bulk fill composites (BF) may be considered to restore SE-cavities. We compared the susceptibility for secondary caries adjacent to BF versus incrementally-filled composites (IF) in SE and non-selectively-excavated teeth (NS) *in vitro*. In 72 extracted human premolars, artificial lesions were induced on pulpo-axial walls of standardized cavities. Lesions were left (SE) or removed (NS) and teeth were restored using two BF, GrandioSO x-tra/Voco (BF-Gra) and SDR/Dentsply (BF-SDR), and an IF, GrandioSO/Voco (IF-Gra) (n=12/group for SE and NS). In all groups, universal adhesive (Futurabond U, Voco) was used as self-etch bonding agent. After thermo-mechanical cycling (5-55°C, 10,000 c.), teeth were submitted to a *Lactobacillus rhamnosus* biofilm model with cyclic loading for 10 d. Mineral loss (ΔZ) of enamel surface lesions (ESL), dentin surface lesions (DSL) and dentin wall lesions (DWL) was analyzed using transversal microradiography. Z was highest in DSL (median; 25/75th percentiles: 5221; 4111/6502 vol% μm), followed by ESL (4160; 2572/5532 vol% μm), and significantly lower in DWL (379; 102/1163 vol% μm ; <0.01). There were no significant differences in Z between groups in DSL (BF-Gra: 4917; 3920/ 5667 vol% μm , BF-SDR: 5680; 4275/ 6819 vol% μm ; IF-Gra: 5039; 4240/ 7173 vol% μm), ESL (BF-Gra: 4196; 2851/ 5492 vol% μm , BF-SDR: 4151; 2419/ 5705 vol% μm ; IF-Gra: 3962; 1828/ 5532 vol% μm) and DWL (BF-Gra: 379; 196/1255 vol% μm , BF-SDR: 159; 28/ 1031 vol% μm ; IF-Gra: 441; 203/ 1107 vol% μm) (>0.05), respectively. Regardless of lesion location, Z did not differ between SE and NS (>0.05). Both BF and IF showed low risks for DWL (i.e. true secondary caries) after SE *in vitro*, and also surface lesion risk was not significantly different between

54 To evaluate the caries inhibitory potential of 810 nm diode laser

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Aim: to evaluate and corroborate the caries inhibitory potential of 810 nm-diode laser.

Methodology: clinical study: institutional ethical clearance was obtained for the single-blind designed study. Adults of age 18-25 years were screened for non-cavitated bilateral carious lesion on mandibular molars by Ekstrand visual-radiographic criteria. 104 patients recording values of 20-35 as per Lussi-criteria with laser-fluorescence (LF) device (DIAGNOdent) were included in the study. Group A (test) was irradiated with 3.5 watts-30 s-810 nm diode laser followed by CPP-ACP-F application. By random-allocation, contralateral teeth in group B (control) were treated with only CPP-ACP-F application. LF values were recorded serving as baseline values. Follow up was done at 7 days and after 1-3-6-9-12 months by LF scanning. Decreased values from baseline indicated remineralization. Data were statistically analysed by parametric tests student-unpaired and paired-t-test, and Chi-square-test. For standardization of protocol, in-vitro studies were conducted on enamel samples prior to the clinical study to ascertain the optimum wattage and time to be employed in the study. To corroborate the clinical research, in-vitro studies were conducted for micro-hardness evaluation, FTIR-spectroscopic-analysis for compositional changes evaluation, SEM-EDAX-Analysis for surface analysis and X-Ray-Diffraction-analysis for phase change.

Results: significant differences between test-control at all time intervals were observed with p-values <0.001 at 99% confidence level. In the control group 51% required operative intervention whereas it was 2.9% in the test group. In controls, 36.5% required repetition of treatment whereas it was 4.8% in the test group.

Conclusion: clinical and in-vitro studies ratified that 3.5 watts-810 nm diode laser irradiation protocol for 30 s brings about caries-inhibition.

55 Do minimally invasive cavity principles really reduce volume loss?

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The aim of this in vitro study is to compare traditional (TP) and minimally invasive (MIP) cavity preparations in terms of volume loss. Sixty extracted lower molar teeth with ICDAS 3, 4, and 5 scores were included in the study. The teeth with decay only on the occlusal surface were selected to provide standardization. In MIP groups, only infected layers were aimed to be removed. The caries-infected tissues were removed using #14 diamond and #14 ceramic round bur. Fluorescence evaluation was made with DIAGNOdent Pen (KaVo, Germany) at the point that the ceramic bur does not work and the number 20 was determined as the threshold. In TP groups, all layers were removed, but no extension was made for prevention. In these groups, #14 diamond and #14 steel round bur used for cavity preparation. All samples were scanned with Cerec Omnicam (Sirona, Germany) before and after preparation and coronal volumes were calculated in Meshmixer 3.5 (Autodesk). The data were analyzed using the Mann Whitney U and Spearman's Correlation Test. The level of significance was set at $p=0.05$. For ICDAS 3, MIP caused $2.42\pm0.84\%$ and TP caused $6.72\pm4.91\%$ volume loss ($p=0.001$). For ICDAS 4, MIP caused $8.47\pm5.52\%$ and TP caused $15.86\pm7.91\%$ volume loss ($p=0.015$). For ICDAS 5, MIP caused $20.15\pm8.89\%$ and TP caused $25.36\pm10.93\%$ volume loss ($p=0.226$). Consequently, it has been observed that minimally invasive preparation causes less loss of dental tissues, especially in small and medium sized carious lesions. As the caries volume increases, the effect of the minimally invasive approach on volume loss decreases.

56 Comparison of DIAGNOdent™ with SEM-EDX for chemical composition of primary and permanent enamel: in-vitro study

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Background: the chemical, morphological, and physical characteristics varies between primary and permanent teeth attributing to various factors such as the presence and absence of enamel prism structure, enamel thickness, and mineral density. Thorough knowledge of the chemical composition primarily calcium and phosphorus content becomes imperative for the diagnosis of demineralization in its preliminary stages.

Aim: to compare the effectiveness of DIAGNOdent™ (Laser Fluorescence) with SEM-EDX (Scanning Electron Microscopy-Energy Dispersive X-Ray Spectroscopy) in determining the chemical composition of primary and permanent enamel

Methodology: 25 enamel samples of dimension 5mm X 5mm were prepared using primary and permanent teeth each stored in suitable media and polished with different grades of silicon carbide paper. After calibration, DIAGNOdent™ values were recorded from 5 different points of each sample and the average values were considered. The Calcium and Phosphorus values of the same were measured using SEM-EDX.

Results: the mean DIAGNOdent™ score of primary teeth was 4.5 and permanent teeth were 4.6. SEM-EDX mean values of the calcium in the case of primary teeth were 39.12% and 39.16% in permanent teeth while that of phosphorus was 18.710% and in permanent teeth was 19.631%. Values of DIAGNOdent™ were corelated with SEM EDX values.

Conclusion: the study concluded that DIAGNOdent™ fairly determined the fluorescence status and SEM-EDX values were able to assess Ca and P levels. With increasing values of DIAGNOdent™, values of Ca and P decreased.

57 DEHP causes enamel and dentin hypo-mineralization: a mouse model of low-dose exposure

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Molar Incisor Hypo-mineralization (MIH) is usually described as demarcated hypomineralized enamel. In case of severe lesions, the deep enamel as well as dentin were also affected. Severe dental decay is frequently observed in MIH, predisposing patients to loss of teeth at young ages. MIH etiology is unclear with possible combinatory action of several causal factors. Among them, endocrine disrupting chemicals (EDCs) have been shown to generate enamel defects. Our previous published data showed that rodents exposed to bisphenol A, vinclozolin and DEHP have enamel defects.

C57BL/6 mice were daily exposed to low-dose DEHP of 0.5, 5 and 50 µg/kg/d during 8 weeks. Enamel and dentin structures were analyzed by scanning electron microscopy (SEM) and micro-CT, and mechanical properties by nano-indentation. Gene expression modulations in dental mesenchyme secreting dentin and epithelium secreting enamel were analyzed by RT-qPCR.

Alterations in both, dentin and enamel, were observed by SEM. Hypomineralization of both tissues was quantified by micro-CT and the severity of all defects was dose-dependent. Nanoindentation showed altered mechanical properties of the affected dentin with a slight decrease in hardness, and an important reduction, about 20-40%, in elasticity. These properties were recorded throughout all dentin thickness, from the dentin-enamel junction to the pulp chamber. RT-PCR analyses showed significant modulations of expression of numerous genes involved in dentin and enamel mineralization.

In conclusion, our data show that DEHP can cause enamel and dentin defects, increasing the list of environmental toxicants with endocrine disrupting activity able to disrupt dental development and possibly contributing to acquired dental defects in human.

Evaluation of contamination levels by EDCs can be a marker of vulnerable population for MIH and caries, and possibly for pathologies associated to exposure to such toxicants.

58 The fate of 4 teeth treated with the Hall technique: histological and radiographic examination

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Funding: this study has been supported by the Pediatric Dentistry Department of Greifswald University, Germany

The Hall technique (HT) is a biologically based, effective option for treating asymptomatic carious primary molars. This study reports on the baseline characteristics, and histologic/radiographic outcomes of four molars treated with HT.

Materials and methods: for two physiologically exfoliated (a/b) and two extracted (c/d) primary molars collected from different patients (age: 4-6 years, mean dmft 7 ± 3.7), clinical and radiographic baseline characteristics were retrieved from the patient charts. The extracted teeth were examined using digital volume tomography (DVT) and histological examination (HE, 1000 μ m: depth of carious lesion, presence of dentin bridge [DB]).

Results: teeth (a/b) were maxillary first primary molars (54,64) with inactive dentin lesions (ICDAS 5), no pain was reported. Baseline radiographic examination showed for both teeth a clear dentin bridge (D2), and no signs of pathology. Physiological exfoliation took place 7-years after HT. Both DVT and HE confirmed the presence of a DB.

Tooth (c) was a mandibular second primary molar (75) with an active dentin lesion (ICDAS 5), and no history of pain. Radiographically the lesion reached the middle of dentine (D2), and a periodontal ligament slightly widened along the mesial root was noticed. 8-months later the tooth was extracted with a submucosal abscess. Baseline radiographs and DVT showed no clear DB; however, the HE showed the presence of a DB.

Tooth (d) was a maxillary second primary molar (65) presenting with an active dentin lesion (D3; ICDAS 5). At baseline no pain or pathological radiographic findings were reported. 11-months later the tooth was extracted with a submucosal abscess. Both DVT and HE showed a deep lesion with pulpal involvement.

Conclusion: an accurate clinical, radiographic examination, and pain history are essential for the success of the HT.

59 Pulpal response to the caries process in human teeth

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In order to investigate the histopathology of the dental pulp as a sequel of caries, we have studied the distribution of inflammatory cells in association with the development of the carious lesion.

We have examined 150 human teeth from patients at the age of 9 to 14 years old who needed orthodontic therapy. The condition of the pulp was classified into five groups according to the progression of the carious lesions from stages S0 (non-carious teeth), S1 (caries superficialis), S2 (caries media), S3 (caries profunda) and S4 (exposed pulp). The depth of each caries lesion was determined by the pigmentation on the sections.

Teeth were extracted and immediately cut longitudinally; pulp tissue was extirpated and fixed in formalin for 24 h at 4 °C. The specimens were embedded in paraffin, according to standardized laboratory procedure. Sections were cut at 5 µm thicknesses and stained by the standard laboratory staining H&E (Haematoxylin Eosin) and morphologically examined at light microscope level.

Light microscopic examinations of the pulp, show mild inflammatory response in superficial caries and caries media, in the projection of the carious lesion. Inflammatory cells that are present in the tissue are rare lymphocytes and macrophages. With the progression of the carious lesion, the inflammatory component is more pronounced and accumulates a large number of lymphocytes, macrophages, plasma cells and granulocytes, ($p < 0.05$). Inflammation of the pulp tissue is strongly expressed with inflammatory component consisting of a very large number of lymphocytes, macrophages, plasma cells and granulocytes, ($p < 0.01$).

All these observations indicate that the processes occurring inside the caries lesion are deeply affecting the pulp tissue and early treatment will be the only biologically rational approach.

Session 7

Epidemiology

60 The effect of MI Varnish™ on caries increment among 6 and 12 years old children in Riga, Latvia. A 3 year study

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Aims: the study investigated the effect of MI Varnish™ (5% sodium fluoride/CPP-ACP) and dietary habits on caries increment in 6- and 12-year-old children in Riga, Latvia within 36 months period. **Methods:** forty-eight 6-year-old (Group 1) and 48 12-year-old (group 3) children received quarterly varnish application, while 47 6-year-old (Group 2) and 37 12-year-old (group 4) children did not have varnish applied. No caries preventive programs in Riga; however, all children/parents received the same preventive advice. All children were examined visually using ICDAS II criteria. Questionnaires on dietary habits were completed by children/parents at baseline and after 36 months. ICDAS data were used to calculate the DMFS/dfs. Statistically analysis was performed ($\alpha=0.05$) using chi-square test, t-paired test (Welch test) and correlation with Pearson coefficient. Ethics Committee approval (#22/17.12.2015) was obtained. Written informed consent and assent were obtained from parent and child respectively. **Results:** in Group 1 vs. Group 2: DMFS (Baseline/36 months): $5.02 \pm 5.85 / 13.21 \pm 6.67$ ($p < .001$) vs. $2.65 \pm 4.54 / 10.81 \pm 6.14$ ($p < .001$); dfs (Baseline/36 months): $36.75 \pm 12.96 / 24.04 \pm 12.9$ ($p < .001$) vs. $33.67 \pm 12.74 / 23.88 \pm 11.91$ ($p < .001$). In Group 3 vs. Group 4: DMFS (Baseline/36 months): $48.62 \pm 23.18 / 70.96 \pm 23.28$ ($p < .001$) vs. $34.73 \pm 17.99 / 54.95 \pm 16.09$ ($p < .001$); dfs (Baseline/36 months): $1.7 \pm 4.4 / 0$ ($p = .011$) vs. $2 \pm 6.39 / 0$ ($p = .065$). Caries prevalence (dfs+DMFS) decreased by 4.52 ($p < .001$) and 1.63 ($p < .001$) in Groups 1 and 2 respectively, but increased by 20.64 ($p < .001$) and 18.22 ($p < .001$) in Groups 3 and 4, respectively. Questionnaires analysis indicated habitual frequent consumption of sugary diet by the children. A significant correlation ($r=0.321$; $p=0.026$) between sugar consumption and frequency of daily intake of sugary snack, soft drinks and tea-with-sugar at baseline in only Group 1. **Conclusions:** quarterly application of varnish containing CPP-ACP/fluoride reduced caries increment in 6- and 12-year-old children in Riga, Latvia.

61 A social/behavioural gradient in dental health among preschool children: data from the second Italian pathfinder

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This study presents the second Italian pathfinder on children's oral health, reporting caries prevalence and severity in 4-year-olds. The ICDAS (International Caries Detection and Assessment System) for each tooth and the gingival bleeding score were recorded at school on 6,825 children (52.8% females). Caries frequency and severity was expressed as a proportion, using the tooth as the unit of analysis and recording the most severe ICDAS score observed. A standardized questionnaire regarding dietary and oral behavioral habits of children and smoking, educational level and occupational profile of the parents was filled-in by parents. A social/behavioral gradient was generated as the sum of the worst circumstances: cariogenic diet, brushing teeth less than twice/daily, lowest educational level, smoking habits and lowest occupational profile. Subjects were stratified into four levels: "best," up to two worst options; "good," with three; "bad," with four; and "worst," with five or more worst options. The association between the different risk categories and ICDAS scores (caries-free teeth, enamel scores, pre-cavitated and cavitated lesions) was calculated. The nonparametric test for trend across ordered groups as an extension of the Wilcoxon rank-sum test was also calculated. Separate multinomial logistic regression models were estimated using ICDAS scores as dependent variables. Overall, 54.4% ($_{95\%}$ CI 46.7–58.3%) of the children were caries-free (ICDAS score 0), 16.5% ($_{95\%}$ CI 12.3–19.7%) had at least one enamel caries lesion (ICDAS scores 1/2), 8.4% ($_{95\%}$ CI 7.1–10.1%) presented one or more pre-cavitated lesions (ICDAS=3/4) and only 20.8% ($_{95\%}$ CI 17.4–25.6%) had cavitated lesions (ICDAS=5/6). A statistically significant trend was observed for ICDAS 5/6 score and the worst social/behavioural level ($Z=5.24$, $p < 0.01$). The proposed gradient was clearly able to identify children with the worst dental conditions.

62 Is cariology a topic of scientific interest today? Analysis of the references available on PubMed in the last 20 years

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Scientific research on caries is far from having clarified all aspects. Epidemiology, risk factors, prevention, diagnosis and treatment/management are the main topics of clinical, review and *in vitro* studies. This paper aimed to evaluate and assess the frequency of papers published during the last two decades on Cariology using the PubMed. The following keywords were searched: “dental caries”, “caries risk”, “caries prevention”, “caries epidemiology”, “caries diagnosis” and “caries treatment/management”. No limits were imputed except for the time frame (from 2001 to 2020) and papers published in dental journals. In addition, papers found using each keyword were divided in clinical studies (including clinical studies, clinical trials of each phase, controlled clinical trials, randomized, observational studies and case reports), review articles (including reviews, systematic reviews and meta-analyses) and, finally, other type of studies.

Overall 20.721 papers were identified using “dental caries”. The analysis between the two decades (2001-2010 and 2011-2020) showed a statistical difference between numbers of papers published (8.449 and 12.272 respectively $z=37.57$ $p < 0.01$). The number of papers published were statistically significant higher in the second decade for all the keywords. A not statistically significant trend of decrease ($z=1.51$ $p=0.13$) in clinical studies was observed starting from 2018 to 2020 for all topics searched, with “caries diagnosis” showing the widest reduction (47.37%). A statistically significant trend of reduction was observed regarding the number of review papers ($z = 4.26$ $p<0.01$) except those on “caries risk” that increased by 13.83%. A further reduction can be expected during this year, especially for clinical research, as the majority of funds will be probably allocated to the COVID-19 pandemic research, subtracting resources from other research topics and limiting the possibility of performing clinical studies.

63 Oral health behavior change of Moscow students during distance education due to Covid-19 epidemic

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Coronavirus disease (COVID-19) has caused daily life changes, moving students to distance education. It could have an influence on daily oral health and dietary behavior among young population.

Aim: to identify change in diet and oral health behavior during Moscow students distance education.

Methods: 770 university students aged 19-26-yrs-old were interviewed about their oral health and dietary habits before and during their distance education. An online questionnaire containing 35 questions was used. Differences in answers were compared using chi-square test.

Results: All interviewed students supposed their lifestyle had changed, however only 20% of students thought that it had influenced oral health; 83% of students admitted daily schedule changes; 70% - dietary habit changes. No significant differences in daily toothbrushing habits in terms of frequency, duration, toothpaste and toothbrush choice, were observed. The number of students using additional hygiene devices decreased from 85 % to 72% ($p<0.00001$); 16% of students changed their toothbrush more often. The number of students with 1-3 meals a day decreased from 88% to 77%, simultaneously increasing to more than 4 meals a day ($p<0.00001$). Snacking between meals more than 3 times a day increased from 25% to 43%, with increase of non-stop eaters during computer work from 1% to 5% ($p=0.006$). Eating during computer work increased from 38% to 42% ($p<0.00001$). Soft drink consumption increased on 23%. The number of students eating before bedtime after toothbrushing increased from 8% to 12% ($p=0.003$).

Conclusions: The results of our study showed significant changes in oral health behavior in terms of dietary habits during distance education. This data could be used to suggest new communication directed towards specific oral disease prevention for students.

64 Child feeding practice and psychosocial risk factors associated with early childhood caries

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Objectives. The purpose of this study was to identify child's feeding practice, some psychosocial and behavioural risk factors associated with appearance of early childhood caries (ECC). The aim was also to analyse role of parental behaviour and mother - child interaction with their children. **Methods.** The sample comprised 102 pairs of children with ECC aged from 2 to 5 years (mean age of 3.6 years). The control group represented 81 caries-free children aged from 2 to 5 years (mean age 3.8 years). Mothers were interviewed and answered structured questionnaire to collect data on family characteristics and child feeding practice. Hollinshead Two Factor Index of Social Position was used as an objective measure of family social position. Differences between samples were tested by χ^2 Yates Corrected test or Fisher's Exact Test. **Results.** Falling asleep with bottle and nighttimes bottle feeding were strongly associated with appearance of ECC ($P < 0.001$). Family lower socioeconomic status (SES) was significantly associated with ECC ($P < 0.02$; OR = 5.119; 95%CI = 1.615-16.230). Toothbrushing performed by the help of parents was more frequent in caries-free subjects (42.0%) than in children with ECC (24.5%; $P < 0.02$). Parental assistance in bottle feeding was established in 96.3% of caries-free children, and only in 7.8% of children with ECC ($P < 0.001$). **Conclusions.** Bottle feeding before bedtime and during nighttimes play the most important role in the aetiology of ECC. Assistance in bottle feeding and child toothcleaning indicates differences in mother-child interactions between subjects with ECC and caries-free children. SES and mother - child interactions are important factors that significantly contribute to the occurrence of ECC.

65 Effect of COVID-19 on the frequency of paediatric dental treatment in general anesthesia in Latvia

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Funding: funded by "Impact of COVID-19 on health care system and public health in Latvia; ways in preparing health sector for future epidemics", project nr. VPP-COVID-2020/1-0011

The study aims to identify and to describe the effect of restrictions during the COVID19 on dental care requiring general anaesthesia (GA) in the year 2020 compared to previous years. A descriptive study of patients records (Riga_Stradins_University(RSU)-Ethics Committee app-Nr.6-1/01/140) attended from 2010 to 2020 in RSU university clinic, in Latvia (1920000 inhabitants) was performed. We calculated descriptive statistics for two periods (2010-2014 and 2015-2019) to compare them with the year 2020 to evaluate trends and changes in the number of patients treated and type of treatment under GA to assess the effect of restrictions due to COVID19. We fitted a linear model, estimated using ordinary least squares regression (OLS) to detect the changes by periods with a significance level $p=0.05$. During the period 2010-2020, 14211 patients were treated under GA (1291 average per year). Patients treated on average (standard deviation) from 2010 to 2014 were 1098 (139.8), from 2015 to 2019 were 1418 (133.1), and in 2020 (total) were 1633, with no evidence of significant variation from 2020 ($p=0.08$). About treatments during restrictions, in April 2020, the total number of filled teeth decreased significantly for all children, and for children aged 1-3 years, extractions increased significantly ($p<0.05$). We observed the lowest number of treated teeth per patient compared to previous periods: 4.59 (2.55) in 2020; 5.13 (2.26) in 2015-2019; $p<0.05$. The sustained increase in patients observed for the period 2010-2019 was held during 2020, but a change in the type of treatments, with increased dental extractions, and the less number of treated teeth per patient were observed during the first COVID wave in Latvia 2020.

66 Oral health in Macedonian geriatric population associated with prosthetic status and comorbidity

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Aim. Comorbidity is one important factor for perception of oral health. Aim of the study was to evaluate oral health associated with prosthetic status and present comorbidity (hypertension, cardiovascular diseases, diabetes, nephrological diseases) in Macedonian geriatric population.

Materials and methods. An epidemiological study covered 165 patients at Gerontology Institute (study group-SG), 170 patients from the Dental Clinic (control group-CG) older than 65. Study was approved by the Ethical Commission for research on human participant at the University Dental Faculty. WHO and GOHAI questionnaires for oral health were used. SPSS for Windows ver 13.0 was used for statistical processing.

Results. The distribution of age in the tested patients is as follows: 26,27% age 65-69, 29,55% age 70-74, 21,49% age 75-79, 18,21% age 80-84 and 4,48% age >85. The mean total GOHAI score was 29,79-SG and 28,28-CG (maximum 48, the higher the score the worse the oral health and quality of life). Patients with upper and lower total dentures were dominant (43,6% from SC and 26,5% from CG). Patients from both groups with chronic diseases had highly significant higher total GOHAI scores than those without ($30,26 \pm 3,9$ vs $27,27 \pm 5,06$ at SC and $28,0 \pm 3,8$ vs $23,86 \pm 1,06$ at CG). Tested difference among the SG patients with and without comorbidity is statistically significant to physical component ($p=0.01$) and psycho-social component ($p=0.002$), insignificant to pain/discomfort ($p=0.13$). Difference among the SG patients with and without comorbidity is statistically significant for all components of quality of life with $p=0.000003$, $p=0.005$ and $p=0.000001$.

Conclusion. Quality of life and oral health in geriatric denture wearers are at unsatisfactory level in Macedonia. Comorbidity has a significant influence on all three dimensions of quality of life .

67 Caries experience in elderly people consuming a milk-based drink nutritional supplement: a cross sectional study

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Funding: Interdisciplinary Excellence Research Program on Healthy Aging (PIEI-ES), University of Talca, Talca, Chile

Nutritional supplements are often recommended to overcome nutritional deficiencies in elderly people. In light of this needs, the Chilean government has implemented a Supplementary Nutrition Program (PACAM) to freely distribute a milk-based drink (MBD) food supplement to older persons. This MBD contains 8% sucrose which makes it potentially cariogenic. **Objective:** to determine whether older people who consume MBD have a greater experience of tooth decay than older adults not consuming MBD.

Methods: a cross-sectional study was conducted with a representative sample from the Maule Region, Chile. Ethical approval from University of Talca (#2014-009-RC). The sample comprised two groups: a) MBD consumers subjects (CS) and b) Non-consumers (NCS), (n=120, 60 per group). Participants received intraoral examination and coronal caries lesions (DMFT/DMFS) and root caries lesions (RCI index; using ICDAS as diagnostic criteria) experience were recorded and scored. A validated questionnaire was applied, to assess the knowledge, acceptability and consumption habits regarding PACAM products. A 24-hour diet recall and food frequency questionnaire were applied. Data were analyzed using non-parametric Mann-Whitney and binary logistic regression, with a p-value<0.05 considered significant.

Results: no differences were detected in food consumption patterns between study groups ($p>0.05$), except for an increased dairy products consumption in CS. CS group showed higher DMFS (85.35 ± 39.0) compared with NCS (77.28 ± 28.9), ($p=0.043$). Binary regression showed that CS (adjusted OR=3.78; 95% CI=1.53-9.27, $p=0.004$) had greater likelihood of being more affected by coronal caries than NCS. Multivariate analysis showed that not consuming the milk-based program ($b=-0.17$, $p=0.02$) predicts lower RCI.

Conclusion: daily consumption of the MBD seems to increase both coronal and root caries risk. Further research appears needed to modify composition and raise awareness of the potential deleterious effect of nutritional programs based on consumption of sucrose-containing products.

68 Estimating and comparing the burden of coronal and root caries in adults: a population-based study

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Funding: Coordination for the Improvement of Higher Level Education (CAPES)

The aim of this study was to estimate and compare the prevalence, extent, and intra-oral distribution of coronal and root caries in Brazilian adults. A multistage sampling strategy was used to draw 1,023 individuals aged ≥ 35 years. Questionnaires recorded age, sex, educational level, and access to dental services. Gingival recession measures were recorded. Coronal and root caries were diagnosed at cavity level by visual-tactile method. Pair-wise comparisons of the crude estimates were performed using the Wald test. Prevalence of coronal and root caries was 99.31% (SE = 0.22) and 40.59% (SE = 1.49), respectively. Mean of coronal DMFT, root DFT, and RCI equaled 16.73 (SE = 0.25), 1.15 (SE = 0.08), and 9.39% (SE = 0.81), respectively. Mean of coronal DMFS and root DFS was 62.78 (SE = 1.45) and 1.49 (SE = 0.10), respectively. The mean of coronal DT/S (DT/S = 1.36/2.82 [SE = 0.06/0.18]) remained stable with increasing age, while the mean of coronal DMFT/S and MT/S (MT/S = 8.99/62.78 [SE = 0.36/1.45]) increased with increasing age. The mean of coronal FS (mean = 15.02 [SE = 1.18]) increased significantly from the 35-44 to 45-59 age group followed by a significant decrease in the elderly. Prevalence and extent of root caries increased significantly from the 35-44 to 45-59 age group. Molars and premolars were the most frequently teeth affected by coronal and root caries, respectively. In conclusion, not only root caries is emerging as a significant chronic disease, but coronal caries remains a public health concern in adults. University of Rio Grande do Sul Research Ethics Committee approved the study protocol (19794/11).

Session 8

Diagnosis

69 Diffuse Reflection Spectroscopy used for the detection of dental caries

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Objective: Diffuse Reflection Spectroscopy (DRS) is based on the principle of measuring the interaction of light with biological tissue. Light is clinically useful because it can detect biological changes of the monitored tissue. Currently, this method is used clinically for perioperative detection of tumor boundaries. Modern diagnostic methods such as laser fluorescence or the near-infrared transillumination technique are reliable, but in practice they are not very widespread and are used more as complementary methods.

Aim of the study: the aim of this study was to determine if the DRS method is suitable for the detection of dental caries.

Experimental approach: 85 extracted teeth (molars, premolars and incisors) were divided according to the classification of the International Caries Detection and Assessment System (ICDAS-II). 60 teeth were selected. Teeth with extensive caries were excluded because they are clinically easily recognizable. Points of interest were measured using a DRS probe and 600 measurements were obtained. The presence of caries (Y / N) was detected by data analysis using a neural network with an accuracy of 98.4%. The evaluated areas of interest were histologically verified on 150 µm thick slices.

Results: according to histological verification, there were 40 teeth with caries and 20 teeth without caries. The diffuse reflection spectroscopy method achieved an accuracy of 96.7% of the detection of dental caries in comparison with the histological image.

Conclusions: the principle of the DRS method has proven to be a suitable tool for the detection of dental caries. However, it will be important to perform further measurements using the DRS method and compare them with existing methods of instrumental detection of dental caries.

70 Concordance between visual ICDAS criteria, stereomicroscopy and micro-CT

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This study aimed at determining the correlation between visual ICDAS criteria, stereomicroscopy and micro-CT for root caries diagnosis.

A trained examiner selected 24 human permanent teeth stored in 0.5% Chloramine from an IRB approved bank (n= 230). Teeth were selected using root-ICDAS visual criteria (with air-drying and round-tip probe) and were distributed as follows according to severity: Sound surfaces: n=3, Initial lesions (anatomical contour loss -ACL: <0.5mm): n=7; Moderate lesions (ACL: 0.5 to ≤2mm): n=7; Extensive lesions (ACL: >2mm): n=7.

Micro-CT and stereomicroscopic samples' images were then obtained. Micro-CT (Micro-Photonics Inc., USA) 375-792 tooth-reconstruction slices (SkyScan NRecon software) were obtained (CTAn-Shortcut software) and after external randomised re-codifying of samples, the deepest slice of each tooth was assessed by the same examiner. Radiolucency in the root was classified as: 0-Sound (absence); 1-In the outer third; 2-In the middle third; 3-In the inner third. For the stereomicroscopic (Olympus SZ-61TRLED, Japan) assessment, tiff-format 1X images of 80-120mm transverse sections were obtained and after randomised external re-codifying of samples, the histologic depth was classified by the same examiner in the same manner described for micro-CT. The correlation between visual ICDAS, stereomicroscopy and micro-CT was determined using Kendall's tau-b statistic.

Stereomicroscopy and micro-CT distribution of the sample was: 0: n=3, 1: n=8, 2: n=4, 3: n=9, and 0: n=3, 1: n=7, 2: n=4, 3=10, respectively. Kendall's tau-b concordance results were: Stereomicroscopy vs. micro-CT: 0.95; ICDAS vs. Stereomicroscopy: 0.85; ICDAS vs. micro-CT: 0.80.

Within the limitations of the sample size, high concordance was found for root caries diagnosis between root-ICDAS visual criteria, stereomicroscopy and micro-CT.

Summary: There was a high Kendall's tau-b concordance for the diagnosis of root caries between ICDAS visual criteria, stereomicroscopy and micro-CT.

71 How can caries lesion progression be predicted by severity clinically assessed? A network meta-analysis

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Funding: Capes/CNPq (448013/2014-2)

The purpose of this study was to evaluate caries lesion severity, assessed clinically and used as threshold for decision-making guideline/consensus, can be associated with lesions progression to frankly cavitations into dentin, using direct and indirect data comparison (PROSPERO42017062388). Longitudinal in vivo studies that reported data regarding caries progression in primary teeth according to different clinical severity stages were included. Clinical severity was classified as sound surfaces, initial, moderate and severe lesions. New Castle Ottawa was used for risk of bias assessment. Meta-analyses were performed using direct and indirect comparisons. Direct comparisons meta-analyses used inverse variance method and DerSimonian-Laird estimator for τ^2 . Indirect comparisons were estimate by Markov-Chain Monte Carlo simulations, the effect measures were the Risk Relative (RR) with 95% confidence intervals. Fixed and random effects were chosen through comparison of competing models based on the Deviance Information Criteria. Heterogeneity was accessed with Cochran's Q test and inconsistency with I-squared. Expected progression ranking based on the posterior probabilities of all lesions was calculated. Different dental surfaces (occlusal surfaces vs.smooth surfaces) were considered as subgroups for comparisons. From 1.735 potentially eligible studies, 07 were selected. At a 2-year follow-up, initial lesions presented approximately 6-fold higher risk of progressing than sound surfaces (RR=5.6;95%CI:2.1-15.0;I²=11%) while, for moderate, increased to 19-fold progression risk (RR=19.0;95%IC:6.9-51.0;I²=11%) compared to sound ones. Moderate lesions presented highest probability of progressing (97%). No differences were found for any subgroup, being the moderate lesions the one with highest probability of progressing than initial conditions, (83%) in occlusal and (97%) in smooth surface. Therefore, clinical assessment of caries lesions severity may predict lesions that present different risks of progression to frankly cavitation being an evidence-based resource to be considered in clinical decision-making.

72 Diagnostic methods for root caries lesions. A systematic review of the literature

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With a global increase in recent years, root caries lesion detection and assessment is a challenge in clinical dentistry. Different methods have been proposed to diagnose root caries lesions, but it is unclear whether they have been scientifically validated for clinical use. Therefore, the present review aimed to verify the scientific validity of the diagnostic methods reported for root caries lesions and to identify those with the best specificity and sensitivity and the highest intra- and inter-examiner reproducibility. The review was registered in PROSPERO (CRD42020221968), following the PRISMA criteria. Medline, SCOPUS and Web of Science databases were searched, using predefined criteria based on the P.I.C.O question. Article selection and data extraction were carried out independently by two researchers. Risk of bias was analyzed by a modified strategy including Rob 2, TorxTool and Maske tools. A total of 1,242 articles were found and reviewed for title and abstract, of which 82 were reviewed in full text. Finally, 16 observational studies were included, 14 cross-sectional and 2 cohort studies. The selected studies showed a moderate risk of bias. Conventional diagnostic methods (e.g. visual-tactile and bite-wing radiographs) demonstrated significant variability in the reported reliability, sensitivity and specificity values, whereas non-conventional methods (e.g. laser fluorescence) values were homogenous across the studies. Nevertheless, evidence confirmed that visual-tactile and laser fluorescence diagnostic systems had high reliability, sensitivity and specificity to diagnose root carious lesions.

In conclusion, the visual-tactile and the laser fluorescence method seem to be duly validated instruments for the detection of root caries lesions. Visual-tactile assessment provides excellent reliability without the need for special equipment. Further evidence seems needed to validate and recommend the use of other methods with digital technologies.

73 Generalizability of deep learning models for caries detection in Near-Infrared Light Transillumination images

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Objectives: the study assessed the generalizability of deep learning models for Near-Infrared-Light Transillumination (NILT) imagery, generated in in vivo or in vitro settings.

Methods: in vitro study 226 extracted posterior permanent human teeth (113 premolars, 113 molars) were setup in a validated simulation model and mounted in a dummy head. In vivo 1319 teeth (508 premolars, 811 molars) from 56 patients had been assessed. NILT imagery was generated (DiagnoCam, Kavo), toothwise segmented and proximal caries lesions annotated independently by two dentists and reviewed by a third. Segments were transformed into binary labels and Res-Net classification models trained and 10-fold cross-validated. Performance generalizability and explainability were explored.

Results: models trained and tested on in vivo data performed significantly better (mean $\pm$ SD accuracy: 0.78 ± 0.04) than those trained and tested on in vitro data (accuracy: 0.64 ± 0.15 ; $p < 0.05$). When tested in vitro, the models trained in vivo showed significantly lower accuracy (0.70 ± 0.01 ; $p < 0.01$). Similarly, when tested in vivo, models trained in vitro showed significantly lower accuracy (0.61 ± 0.04 ; $p < 0.05$). In both cases, this was due to decreases in sensitivity.

Conclusions: deep learning models showed limited generalizability for imagery from in vitro versus in vivo settings.

74 Prediction of coronal and root caries progression based on caries activity classification at individual level

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This study evaluated the reliability of the classification of a patient's caries activity based on lesion activity assessment in adults and the elderly. This prospective cohort study followed 414 individuals aged ≥ 35 years for 4 years in southern Brazil. Data collection included the application of a questionnaire and a clinical examination (coronal caries, root caries, and gingival recession). The primary outcome of this study was caries progression, defined as the presence of a cavity or a filling at the follow-up exam. The main predictor variable was the status of the surface at baseline: coronal caries (sound, inactive non-cavitated lesion, active non-cavitated lesion, or filled surface); root caries (unexposed, exposed sound, or exposed filled surface). Individuals were classified as caries-inactive or caries-active (at least one active lesion). Negative binomial regression models (unadjusted and adjusted) were used to assess the association between baseline surface status and the outcomes (coronal and root caries progression) among caries-inactive and caries-active patients. The overall progression rate of coronal caries was 6.2% and 6.6% in caries-inactive and caries-active individuals, respectively ($p=0.18$). However, coronal filled surfaces showed a higher progression rate in caries-active patients ($p<0.001$). The overall progression rate of root caries was 2.4% and 3.0% in caries-inactive and caries-active individuals, respectively ($p=0.02$). In addition, unexposed root surfaces showed a higher progression rate in caries-active patients ($p<0.001$). The risk for caries progression among caries-active patients was 70% higher on coronal filled surfaces (adjusted IRR=1.7, 95%CI=1.3-2.4) and two-fold higher on unexposed root surfaces (adjusted IRR=2.0, 95%CI=1.2-3.3) than among caries-inactive individuals. The classification of a patient's caries activity based on lesion activity was able to predict lesion progression on the coronal and root surfaces more prone to caries development.

75 Prevalence of hidden caries in premolars at a dental clinic in Japan

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Funding: the author received no specific funding for this work

Introduction: hidden caries is defined as a dentine caries in missed on visual inspection but detected radiographically or with other detection devices. Although there have been some hidden caries studies of molar, very few of premolar. We have experienced some hidden caries cases in premolars.

Aim: the aim of the study was to report hidden caries in premolars in Sugiyama Dental Clinic (SDC). **Methods:** We searched the patient database of SDC on December 26, 2020 (n= 15,123) based on the following criteria: received premolar hidden caries treatment after 2005 when they were between 10 and 19 years old.

Results: 7 subjects (one male and six females), 8 premolar hidden caries lesions were selected from SDC database. The prevalence by age: 10-year-old (1/93, 1.1%), 11-year-old (3/164, 1.8%), 12-year-old (1/269, 0.4%), 13-year-old (1/279, 0.4%), 19-year-old (1/115, 0.9%). The tooth type and number of hidden caries: upper first premolar was one, upper second premolar was five, lower first premolar was zero, lower second premolar was two. Six of seven subjects (86%) were received treatment within three years of premolar eruption. Four of seven subjects (57%) had premolar and molar hidden caries. Three of seven subjects (43%) found hidden caries lesion when rechecking clinical records after oral examination and we contacted the patient.

Conclusion: the prevalence of premolar hidden caries was 0.4~1.8% in SDC, presented in upper first, upper second and lower second premolars. We have to consider other hidden caries when we detected hidden caries in premolars.

76 Radiographic indicators for caries diagnosis in adolescents with high prevalence: a cross-sectional study

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This study assessed the accuracy of commonly used indicators for caries in identifying adolescents who would benefit from radiographs in a high-caries population. A total of 356 adolescents with a mean ($\pm$ standard deviation) age of 13.7 ($\pm$ 0.8) years were clinically and radiographically examined for caries and answered a questionnaire on socio-demographics and oral health behaviour (ethical approval number 091900-000016-16, Ethics Committee, School of Dentistry, University of the Republic/Uruguay). The outcome was the benefit from radiographs, defined as the number of surfaces clinically classified as sound but presenting radiolucency. 169 students benefited from radiographic examination (47.5%). One third (33.4%) of approximal lesions were detected clinically whereas two thirds (66.6%) were detected radiographically only, being mostly initial lesions. The contribution of radiographs to the diagnosis of occlusal lesions was reduced (3%). Adolescents with a $D_1MFS \geq 12$ (RR=2.82, 95%CI=2.05-3.89), $D_5MFS \geq 1$ (RR=1.90, 95%CI=1.35-2.68), and caries-active (RR=1.80, 95%CI=1.15-2.83) were more likely to be benefited from radiographs ($p < 0.05$). Predictive power of the consumption of sugar-sweetened food and the presence of caries activity showed moderate (0.74) and high (0.86) sensitivity, respectively. The presence of clinically diagnosed approximal lesions showed moderate specificity (0.72). None of them showed satisfactory predictive values or accuracy. By grouping indicators associated with a $p \leq 0.05$ (caries experience, caries activity, clinically diagnosed approximal lesions, consumption of soft drinks and sugar-sweetened food), the specificity increased importantly, reaching 0.90, but the sensitivity was extremely low (0.20). The accuracy of indicators (isolated or combined) have never achieved 0.60. This study shows that the possibility of correctly identifying children who would benefit from radiographs using commonly used indicators is limited. For screening purposes, patient's caries activity could be used due to its high sensitivity.

77 Additional information from dental radiographs to clinical diagnosis of primary and secondary caries and restorations

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Objective: to identify additional information obtained by x-rays used in connection with clinical examination concerning primary/secondary caries and quality of restorations.

Material and methods: 240 adult patients equally distributed in gender and six age groups were randomly selected from an original study population of 4402 subjects [Kongstad et al: Acta Odont Scand 2013;7:1560-1569]. Clinical and radiographical registrations on occlusal and approximal surfaces in posterior teeth were categorized into unrestored (sound/primary caries) and restored (without/with secondary caries). Restorative material (composite/amalgam/gold/metal-ceramic) and quality of restoration (under/over-extended) were also recorded. Chi-square and Fisher-exact tests were used for statistical analyses.

Results: of the potential 11520 surfaces, 3015 occlusal and 5112 approximal surfaces could be analyzed. Occlusal surfaces: Of the 907 unrestored surfaces, 110 had primary caries of which 53% were detected radiographically exclusively. 183 of 2108 restored occlusal surfaces had secondary caries, and 99% were found radiographically exclusively. 190 restorations were over/under-extended, and 89% were registered radiographically exclusively. Approximal surfaces: Of the 2649 unrestored surfaces 648 had primary caries, of which 92% was registered radiographically exclusively. 565 of the 2463 restored approximal surfaces had secondary caries, and 99% were found radiographically exclusively. 638 restorations were over/under-extended, and 98% were found radiographically exclusively. For both occlusal and approximal restorations, restorative material and restoration depth influenced quality of restorations and incidence of secondary caries. At least one of the independent variables gender, age group, tooth type, jaw, side, mesial-distal influenced frequencies of primary caries, secondary caries, and quality of restorations.

Conclusion: X-ray examination contributes significantly to diagnostics of primary and secondary caries as well as over/under-extended restorations that are over-looked in clinical examination. X-rays are also valuable in assessing the depth of caries lesions and restorations.

78 3-D imaging with intraoral scanners is a valid tool for dental plaque planimetry

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Detecting and monitoring dental plaque is essential for many purposes and an objective quantitative method (e.g. planimetry) would be desirable. Planimetry is not established so far because conventional imaging of dentition is difficult and time-consuming. Intraoral scanning could be a promising solution to the problem. Aim of the present study (approved by Ethics Committee) was to investigate whether images taken from an intraoral scanner can reliably detect and monitor amounts of plaque in comparison to images taken with an intraoral camera.

Twenty volunteers (27.5 ± 1.2 years) were included. Plaque was disclosed (Mira-2-Tone) and intraoral photos and scans (intraoral-camera CS1500, intraoral-scanner CS3600; Carestream Dental, Germany) of the vestibular surfaces of upper right first molars were taken at baseline (habitual plaque; T1), after 72h without oral hygiene (T2) and after subsequent habitual tooth brushing (T3). The percentage of plaque covered of the total tooth surface (median (range)) was planimetrically determined on both the photos and scans (P%P and P%S resp.) Statistics: Kolmogorov-Smirnov-Test, Wilcoxon-Test, Mann-Whitney-Test, Spearman-Rho-correlation-coefficient.

P%P and P%S increased significantly from T1 to T2 (6.3 (2.2-29.0) to 27.8 (3.3-76.1) and 13.7 (3.6-47.7) to 43.7 (5.2-78.4) resp.; $p \leq 0.001$ each), and decreased at T3 to 7.5 (1.6-41.6) and 10.3 (3.2-26.4) resp. ($p \leq 0.001$ each; n.s. to T1 each). P%S was always significantly higher than P%P (T1: $p \leq 0.001$; T2: $p \leq 0.01$; T3: $p \leq 0.05$), but the correlation between them was high ($\rho = 0.876$; $p \leq 0.001$).

Scans were able to visualise proximal areas more clearly than photos, which often did not show these areas well due to the convexity of the teeth. This may explain that higher amounts of plaque were found on scans.

Intraoral scanning seems to be a valid and promising tool for detecting and monitoring plaque with planimetric procedures.

Session 9

De- and Remineralisation

79 Influence of viscosity and thickening agent of bleaching gels on enamel demineralization and color change

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Objective: this study investigated the influence of viscosity and kind of thickener in 35% hydrogen peroxide gels on the tooth enamel demineralization and bleaching effect.

Methods: 240 enamel/dentin bovine discs were divided into groups of bleaching gels with different thickeners (CAR- carbomer; ASE- alkali swellable emulsion, MSA- modified sulfonic acid polymer, SSP- semi-synthetic polysaccharide, PAC- particulate colloids) in three viscosities (low: 50.000 cP; medium: 250.000 cP; high: 1.000.000 cP). The gels were applied over the enamel surface for 45 min. Knoop microhardness (KHN) and color (CIELab) were analyzed before and after the treatment. The percentage of microhardness reduction (%KHN) and color change (ΔE_{ab}) were calculated. Data were analyzed by two-way ANOVA (factors viscosity and kind of thickener) and Tukey's test.

Results: significant differences were observed for all analysis for both factors ($p < 0,05$). In relation to %KHN the results for the factor viscosity were: low - 22.22(4.40)a, medium - 18.56(5.42)b, high - 15.39(8.52)c. For the factor kind of thickener the results were: PAC - 11.73(3.98)a, ASE - 14.71(3.79)b, SSP - 17.00(4.01)c, MSA - 22.13(4.43)d, CAR - 28.06(2.59)e. In relation to ΔE_{ab} the results for the factor viscosity were: low - 3.27(1.0)a, medium - 3.02(0.84)b, high - 2.90(0.78)c. For the factor kind of thickener the results were: SSP - 2.80(0.78)a, ASE - 2.81(0.8)a, PAC - 3.13(0.8)ab, CAR - 3.24(1.05)ab, MSA - 3.32(0.89)b. Groups followed by the same letter do not present significant differences.

Conclusion: the increase of bleaching gel viscosity reduced enamel demineralization but also the bleaching effect. The PAC was the less aggressive thickener to enamel, while the MSA was the most effective on bleaching.

80 Caries-preventive effect of varnishes differing in fluoride compounds on artificial enamel caries in vitro

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There is a lack of data on the optimal use of professionally applied fluoride agents combined with the daily use of regularly or highly fluoridated dentifrices. Thus, the aim of this study was to compare the caries-preventive effect of various fluoride varnishes (22,600, 35,400 and 45,200 ppm F [ppm]) on artificial enamel caries-like lesions.

Bovine enamel specimens (n=264) with one artificial caries lesion were prepared and randomly allocated to twelve groups. Interventions before pH-cycling were: no intervention ([N₁/N₅]), application of a varnish containing NaF (22,600 ppm; Duraphat [NaF₁/NaF₅]); NaF+tri-calcium phosphate (22,600 ppm; Clinpro White Varnish [TCP₁/TCP₅]); NaF+CPP-ACP (22,600 ppm; MI Varnish [CPP₁/CPP₅]); silver diammine fluoride (35,400 ppm; Cariestop 30% [SDF₁/SDF₅]) and NaF+calcium fluoride (45,200 ppm; Biophat [CaF₁/CaF₅]). During pH-cycling (28 d, 6x120 min demineralization/d) half of the specimens in each group were brushed (10 s; 2x/d) with either 1,450 (NaF; groups named e.g.: TCP1) or 5,000 ppm (NaF; e.g.: TCP5) dentifrice slurry. Differences in integrated mineral loss ($\Delta\Delta Z$) and lesion depth (ΔLD) were calculated between values after initial demineralization and after pH-cycling. After pH-cycling N1/N5 showed significantly increased mean (95%CI) $\Delta Z/LD$ values $\Delta\Delta Z$: N1: -1,997 (-2,851;-1,102); N5: -1,072 (-1,591;-554); $p < 0.05$, two tailed paired t-test), indicating further demineralization. Decreased ΔZ values could only be observed in CaF1/CaF5 ($\Delta\Delta Z$: CaF1: 127(-465;719); CaF5: 103 (-367;573); $p > 0.05$). However, additional use of all fluoride varnishes significantly decreased $\Delta\Delta Z$ and ΔLD compared to N1/N5 ($p < 0.05$, ANCOVA). A significant and moderate correlation between $\Delta\Delta Z$ & fluoride concentrations was observed for varnishes in combination with 1,450 ($r = 0.493$, Spearman rank correlation) or 5,000 ppm ($r = 0.404$). For comparison between 1,450 and 5,000 ppm a significant difference could only be observed for N1/N5 ($p < 0.05$). Under the conditions chosen all fluoride varnishes significantly reduced demineralization compared with brushing with fluoride dentifrices alone. However, only CaF varnish remineralized artificial enamel caries-like lesions under net-demineralizing conditions. Furthermore, there was no difference in the remineralizing capacity of fluoride varnish when combined either with standard or highly fluoridated dentifrices.

81 Fluorescence changes in artificial enamel lesions after exposure to sodium fluoride toothpastes of different compositions

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Fluoride toothpastes have amply demonstrated their potential in reducing demineralization or induce remineralization. Next to fluoride other active ingredients have been tested in order to reduce fluoride content or to obtain synergistic effects. In this study the fluorescence behaviour was tested as outcome variable on the remineralizing effects of NaF toothpastes with different fluoride concentration and composition.

The buccal surface of human enamel samples ($n = 15$ per group) were demineralized (lactic acid, pH 4.6, 14 d) and the samples were exposed to toothpaste/water slurries using a pH- cycling model afterwards. Fluorescence behaviour (ΔF , %) was determined using the QLF (Qraycam with Q4 Research software v. 1.08, Inspektor Research Systems B.V., The Netherlands).

The toothpastes all contained NaF: A = 530 ppm with a bioactive glass formulation; B = 5000 ppm and C = 1450 ppm).

QLF measurements were performed after demineralisation and after 7, 30, 60 and 90 d. Non-parametric tests (Kruskal-Wallis test with post-hoc tests according to Conover) were used for analysis ($\alpha = 0.05$).

Significant differences in the fluorescence behaviour between the groups was found after 7 and 90 d. Median (IQR) ΔF values after 7 d were: A = $-9.90\% \pm 2.50$; B = -7.10 ± 3.43 , C = $-6.60\% \pm 2.28$. ΔF in group A was significantly lower than in group B and C ($p=0.01$). After 90 d median ΔF values were: A = $-8.60\% \pm 1.97$; B = -6.40 ± 2.28 , C = $-6.20\% \pm 1.80$. At this time, ΔF in group A was significantly lower than in group B ($p=0.04$), while no significant difference was found between groups B and C.

In conclusion, lowering the fluoride content in a toothpaste could not be compensated by bioactive technology in terms of remineralization.

82 Is enamel more permeable in patients with type-2 Diabetes Mellitus? - An in-vivo SEM evaluation.

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Aim was to study the enamel permeability in patients with type-2 Diabetes Mellitus (DM) compared to healthy individuals. Following clearance from the institutional review board, 15 patients diagnosed with type-2 DM for a minimum period of 3 years or more, with a glycosylated haemoglobin value of 6.5 mmol/ml or more, aged between 35 to 70 years were included in the study. Caries free, age and gender-matched subjects were included as controls. Polyvinyl siloxane impression of their dental arches were made. Labial surfaces of maxillary central and lateral incisors (incisal, middle and cervical regions); occlusal surfaces of first and second maxillary premolars and; buccal surfaces of first and second mandibular molars were viewed under scanning electron microscope (SEM). A total of 300 SEM images were scored for porosities expresses as droplets. The data were dichotomised as acceptable scores (low porosity) and not acceptable scores (moderate-high-intense porosities). In the DM group, 33-60% of teeth showed increased enamel porosities (not acceptable scores) compared to the control (6-13%) and the difference was statistically significant (Chi-square, $p < 0.001$). In the DM group, 60% the cervical third of labial surfaces of maxillary lateral incisors and occlusal surfaces of first maxillary premolar had increased porosities. The DM group had an unadjusted odds of 1.135 (95%CI 0.93, 34.4) of developing enamel permeability ($p = 0.029$). Inter-observer agreement was good ($k = 0.81$). The enamel permeability was significantly higher in patients with type-2 DM. The possible correlation of increase enamel permeability and development of dental caries in these patients needs to be explored.

83 Hydroxyapatite toothpaste for root caries prevention: a pH-cycling study

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The present study compared the effectiveness of a hydroxyapatite (HAP)-based toothpaste and a fluoride toothpaste in preventing root tissue demineralization (root caries) in an established pH-cycling caries model. 60 dentin blocks were produced from the root tissue of extracted human teeth. The blocks were randomly assigned to three test groups (n=20/group): 10% hydroxyapatite toothpaste (HAP), 1450 ppm fluoride toothpaste (Fluoride), and artificial saliva (Artsaliva). Groups were subjected to 4 d demineralization for development of early root caries lesions using a pH-cycling caries model. The daily cyclic treatment regimen consists of two 2 min toothpaste-slurry treatment periods, one 6 h acid challenge using acidified gel (pH 4.5), and then storage in remineralizing solution (Artsaliva) for the rest of the time. Demineralization was assessed as the amount of mineral loss (Δz) using Transverse Microradiography (TMR). All pairwise comparisons (between treatments) were performed using Analysis of Variance (ANOVA), and then Tukey's HSD for multiple comparisons. All p-value are considered significant if <0.05 . Both ANOVA and Tukey's HSD indicated no significant (ANOVA; n=20) difference in mean Δz among the groups, with least Δz ($\pm Sd$) in the HAP (1117 ± 366) compared to fluoride (1392 ± 334) and Artsaliva (1406 ± 223). Relative to control, HAP and Fluoride inhibited root demineralization by 21% and 1% respectively. In conclusion, the present study demonstrated toothpaste containing 10% HAP as an effective caries control tool. The study further demonstrated toothpaste containing 10% HAP to be more slight effective in preventing tooth demineralization than 1450 ppm fluoride provided as sodium fluoride. Thus this study shows that HAP toothpastes can serve as an effective alternative to fluoride toothpastes for root caries management.

84 Effects of zinc ions on enamel demineralisation at the ultra-structural level

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Zinc salts are formulated into dentifrices to reduce calculus formation. Zn^{2+} retards enamel demineralisation, possibly by lattice-incorporation, deposition of a protective deposit, or both. Thus, zinc has the ability to influence the de/remineralisation balance.

Aim: to identify the mechanism(s) via which Zn^{2+} reduces enamel demineralisation in vitro.

Method: unpolished, sound enamel specimens were demineralised (0.1 mol/l acetic acid, 24h, 37°C, pH 4.0). Samples were then transferred to either a 0 ppm Zn^{2+} (control), or 3565 ppm Zn^{2+} (test) acid solution (Zn-acetate, 96 h). Subsequently, ultra-low energy SIMS (uleSIMS) was used to measure Zn as a function of enamel depth (O_2^+ primary beam of 500 eV, incident angle 30°, 450 min). Grazing incidence X-ray diffraction (GIXRD) was used for crystallographic identification of any zinc mineral phase formed on the demineralised enamel (incident angle 3°), SEM analyses were also conducted on specimens after demineralisation and treatment (gold-coated, 2kV, 50-200k magnification).

Results: uleSIMS showed highly elevated surface Zn concentration (relative ion yield 1 (counts/s) to a depth of 2 nm, declining rapidly and approaching background concentrations (relative ion yield > 0.1 (counts/s)) at 5 nm (test), and no increase in Zn concentration (control). SEM showed etch-patterns corresponding to images typical of demineralised enamel, and extensive deposition of flat, orthorhombic crystals, similar to those of alpha-hopeite, subsequent to post-demineralisation treatment. GIXRD confirmed that this was the predominant phase. Hence both lattice incorporation/penetration and surface deposition occurred.

Conclusion: These data suggest that Zn^{2+} exerts its anti-demineralisation effect via complementary, and possibly concurrent, mechanisms.

85 Rinsing with statherin-derived peptide alters the proteome of the acquired enamel pellicle

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Changes in the proteomic profile of the acquired enamel pellicle (AEP) formed for 3 min or 2 h after rinsing with a phosphorylated peptide containing the 15 N-terminal residues of statherin (StatpSpS) were evaluated. After ethical approval, nine volunteers participated in 2 consecutive days. Each day, after prophylaxis, they rinsed for 1 min with 10 mL of phosphate buffer containing 1.88×10^{-5} M StatpSpS or phosphate buffer only (control). The acquired pellicle formed on enamel after 3 min or 2 h was collected and analyzed by quantitative shotgun label-free proteomics. In the 3-min AEP, 19 and 131 proteins were uniquely identified in the StatpSpS and control groups, respectively. Proteins typically found in the AEP were only found in the latter. Only two proteins (neutrophil defensins) were increased upon treatment with StatpSpS, while 65 proteins (several typical AEP proteins) were decreased. In the 2-h AEP, 50 and 108 proteins were uniquely found in StatpSpS and control groups, respectively. Hemoglobin subunits and isoforms of keratin were only found in the StatpSpS group, while *Cystatin C*, *Cathepsin D* and *G*, isoforms of heat shock 70 and protocadherin were exclusively found in the control group. In addition, 23 proteins, were increased upon treatment with StatpSpS, among which are *Histatin-1*, *Serum albumin* and isoforms of neutrophil defensin and keratin, while 77 were decreased, most of them typical AEP proteins. In both evaluated periods, rinsing with StatpSpS profoundly changed the proteomic profile of the AEP, which might impact the protective role of this integument against carious or erosive demineralization. This study provides important insights on the dynamics of the protein composition of the AEP along time, after rinsing with a solution containing StatpSpS.

86 Effect of different toothpastes containing either bioactive glass with low fluoride or high fluoride on artificial root caries

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The objective of this laboratory-based study was to compare the efficacy of toothpastes containing different fluoride concentrations either with fluorine containing bioactive glass (BG) or sodium fluoride (NaF) alone on artificial root caries (ARC). The crowns of 23 extracted sound teeth were cut by leaving the root surfaces and divided into four pieces (n=90). 75 samples were used to develop ARC for pH4.8 demineralisation solution whilst 15 samples were left untreated as baseline. The pH cycling including pH 4.8 and pH 7 remineralisation solution for 13 d with standard toothbrushing twice daily with assigned toothpastes were applied to the 60 out of 75 samples with ARC: Group 1. BG with 540 ppm F, Group 2. 5,000 ppm NaF, Group 3. 1,450 ppm NaF, and Group 4. deionised water. Knoop micro-hardness surface measurements (HK) were carried out. ICP-OES and F-ISE were used to analyse the ion changes in calcium, phosphate and fluoride.¹⁹F MAS-NMR analysis was then performed. HK results showed significant surface changes for each group ($p<0.001$). Mean $\pm$ SD values for baseline and ARC without treatment were 406.09 $\pm$ 109.44 MPa and 123.66 $\pm$ 37.66 MPa respectively. Following the 13 d pH cycling, HK results were 182.31 $\pm$ 49.92 MPa for Group 1, whilst Group 2 had 168.97 $\pm$ 47.95 MPa, 165.34 $\pm$ 43.54 MPa in Group 3 and Group 4 had 128.27 $\pm$ 41.87 MPa. Non-significant changes in calcium, phosphorus and fluoride ions were observed in all groups ($p>0.05$).¹⁹F MAS-NMR revealed pure fluorapatite formations in Groups 2 and 3. In conclusion, within the limitations of this study, both BG with low fluoride and toothpaste containing high fluoride rehardened root dentine on artificial initial root carious lesions. However, these toothpastes need to be assessed with a large sample size on natural root carious lesions.

87 Enamel demineralization incidence in youth after 6 months treatment with braces

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Background. Fixed appliances are now used in most stages of orthodontic treatment. Difficulties in removing dental plaque from the area of braces increase the risk of development of white spot lesions (WSL). **Objectives.** The present study aimed to evaluate the occurrence of enamel demineralization in young patients treated with fixed appliances. **Material and Methods.** The research was made in 144 patients aged 12-18 years, divided in 2 groups: orthodontically treated and control which were assessed: before treatment, at 1 month, and at 6 months. The ICDAS code 1 and 2 has been used for visual assessment of white spot lesions. Intense instructions of oral-cavity hygiene status and frequently repeated motivation was given to all patients. The study has been approved by the Ethical Committee of the MUL. The results were presented as descriptive analysis and U-test relations. **Results.** After 1 month any new WSL was observed. After 6 months new lesions were observed in 5% of the orthodontic patients and in 6% of the patients in the control group. New decalcifications were located on the proximal surfaces of the central incisors (1,66%), first premolars (1,66%) and first molars (1,66%) in the orthodontic group and on the lateral incisors (1,2%), first premolars (1,2%) and first molars (2,7%) in the control group. We also observed new WSL on the vestibular surfaces of the canine (1,66%) and first premolar (1,66%) in the study group. **Conclusions.** In this study, the placement of fixed orthodontic appliance did not significantly affect teeth with the presence of new enamel decalcification lesions compared to the control group during 6 months of observation. In patients treated with fixed appliance change in the location of enamel decalcification was recorded.

88 The effectiveness of black and green tea on remineralisation of artificial enamel lesions *in situ*

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Aim of this study was to investigate the effect of black and green tea on progression/regression of artificial enamel lesions under cariogenic challenge *in-situ*, using Quantitative Light-Induced Fluorescence (QLF) analysis (QLF-D Biluminator™ 2 Inspektor Research Systems BV, The Netherlands). In a controlled, randomised, 4-arm crossover, single-blinded *in-situ* study, 17 participants wore an intra-oral appliance with a sterilised bovine enamel slab with subsurface artificial lesion for 21 d per each study arm. Participants used fluoride(F)-free toothpaste, and the cariogenic challenge comprised of five/ 2 min dippings per day in a 12% sucrose solution and in 50 ml of one of test solutions; (≈ 5.0) ppm F black, or (≈ 5.0) ppm F green tea, or 5.0 ppm F water, or 0 ppm F water twice per day for 3 min. Also, participants drank 50 ml of the same test solution twice per day. All study groups showed a statistically significant regression of artificial enamel lesions ΔF (%) in comparison to baseline ($p < 0.05$; Wilcoxon), 0 ppm F water (Mean difference $\pm$ SD: 2.919 ± 1.87), 5.0 ppm F water (8.018 ± 2.68), (≈ 5.0) ppm F black tea (4.298 ± 3.58), (≈ 5.0) ppm F green tea (5.431 ± 5.03). The 5.0 ppm F water and (≈ 5.0) ppm F green tea groups showed a statistically significant higher remineralisation compared to 0 ppm F water group ($p < 0.05$; Kruskal-Wallis with pairwise comparisons). The remineralisation efficacy was greater in the (≈ 5.0) ppm F black tea group but this was not significant when compared to the negative control. In conclusion, all fluoride containing groups (black and green tea, fluoridated water) demonstrated high efficacy in remineralising artificial enamel lesions. Compared with black tea, green tea has the potential to promote greater remineralisation of artificial enamel lesions.

Session 10

Epidemiology

89 Loss of dental tissue after restoration or sealing of occlusal caries lesions: 3-4-year results

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Funding: the study protocols were approved by the Ethics Committees of the Federal University of Rio Grande do Sul, Brazil (Protocol number 01/08) and of the Catholic University of Louvain, Belgium (Protocol number B40320083999). Funded by the Brazilian National Council of Technological and Scientific Development (CNPQ), Ivoclar/Vivadent (São Paulo, Brazil) and Caulk/ Dentsply (Rio de Janeiro, Brazil).

This study aimed to measure the radiographically visible loss of dental tissue after conventional restoration and sealing of caries lesions. It is a secondary analysis of two randomized controlled clinical trials, one conducted in Porto Alegre/Brazil, and another in Brussels/Belgium, evaluating different therapies for the treatment of occlusal caries lesions in permanent teeth: sealant (SE), without previous carious tissue removal; or restoration (RE), with total removal of carious dentin. The relative depth and width of caries lesions (baseline), restorations and sealed lesions at 10-20-months and 25-46-months follow-up periods were compared (independent T test - intergroup comparisons; paired T test - intragroup comparisons). All measurements were performed blindly by a single researcher in triplicates. Depth measures were expressed as the percentage of the total length of the coronary dentin whereas width measures were expressed as a percentage of the total width of the enamel-cement line. Caries lesions of RE and SE groups presented similar measurements at baseline (mean $\pm$ SD range 42% $\pm$ 12.8% -45.6% $\pm$ 16.1%, $p>0.05$). In RE group, restorations were significantly higher than the original lesions in depth (60.6% $\pm$ 18.6% at 10-20-months; 61.1% $\pm$ 12.8% at 25-46-months) and width (51.4% $\pm$ 17.1% at 10-20-months; 55.1% $\pm$ 18.4% at 25-46-months), showing that the restorative treatment resulted in loss of tooth structure. No increase in depth (41.3% $\pm$ 11.4% at 10-20-months; 40.7% $\pm$ 11.9% at 25-46-months) and width (42.7% $\pm$ 15.1% at 10-20-months; 43.2% $\pm$ 12.1% at 25-46-months) was observed in SE group, suggesting no progression of the sealed lesions. Comparing both groups, depth and width were significantly higher in RE than in SE at both time points. In conclusion, sealing caries lesions resulted in greater preservation of dental tissue, that is, maintenance of the size of the lesion. In addition, sealing caries lesions was able to control lesion progression over time.

90 Systematic review on use of SDF varnish for management of dental caries in permanent teeth

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The aim of this systematic review was to assess the literature on the effects of silver diammine fluoride for the treatment of dental caries in permanent teeth (adults and children). The review was conducted according to the guidelines of the Cochrane handbook for systematic review and Interventions. The four-phase diagram of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) was followed. Four main concepts were used for the search strategy: First concept was the inclusion of clinical studies with SDF treatment. The second concept was dental caries, where the outcome assessed any positive effect; remineralisation of dental caries/limitation of caries progression. The third concept was on permanent teeth in adults and children, whilst the fourth concept included teeth with dental caries including root caries. A structured search strategy was used to complete a standard systematic search of the electronic database without any date limit and/or language restriction. Two authors independently assessed the risk of bias in the included studies. Randomised controlled trials and cohort studies were accepted, and systematic reviews, in vitro and case studies were excluded. Data homogeneity was assessed. From the original 1675 studies identified, only seven papers matched the search criteria. Results indicated that the SDF treatment had the greatest preventative fraction and lowest number of new carious lesions in first permanent molars and root caries compared to other topical applications i.e, sodium fluoride, chlorhexidine and ammonium bifluoride. Due to dissimilarities in methods and data collection intervals, further statistical tests were unable to be performed. In conclusion, within the limitation of available evidence SDF is effective in preventing progression of carious lesions for permanent first molars in children and on roots in older adults.

91 The impact of lifestyle change on oral health habits of Moscow schoolchildren during COVID-19 pandemic

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The switch of Moscow schoolchildren to distance education due Covid-19 restrictions caused lifestyle changes.

The aim of the study is to identify the influence of lifestyle change on Moscow schoolchildren's dietary and oral health behavior.

Methods: 248 schoolchildren aged 10-15-yrs-old were interviewed about their oral health and dietary behavior before and during distance education due to the epidemic. An online questionnaire containing 35 questions was used. Differences in answers were compared by chi-square-test. The study was approved by etical committie of MSUMD.

Results: 32% of interviewed children thought that staying at home during distance education influenced their oral health behavior. No difference in answers between boys and girls was observed. Toothbrushing frequency significantly decreased: all interviewed children brushed their teeth at least once a day, however, the number of children brushing their teeth at least twice a day decreased from 48% to 8 % ($p<0.05$). Moreover, toothbrushing before breakfast significantly decreased from 71% to 61% ($p<0.05$), while toothbrushing after breakfast occurred from 30 min up to 2 hours after waking up. The number of schoolchildren with 1-3 meals a day decreased from 45% to 29%, while an increase of meals to 4 or more time a day occurred ($p<0.05$). Snacking between meals more than 3 times a day increased from 29% to 61% ($p<0.05$). The most commonly consumed snacks were bakery, sweets, fruit. The number of schoolchildren eating during computer work increased from 23% to 58% ($p<0.05$).

Conclusion: the results of our study showed a significant change in oral health behavior and diet of schoolchildren during distance education due to epidemic restrictions. This data indicates there is a need to change and strengthen oral health promotion strategies among schoolchildren with particular focus on toothbrushing and dietary behavior.

92 FAMI-PROTECT project: oral health in vulnerable migrants in Lazio, Italy

by corridore denise | palaia gaspare | capocci mauro | cotticelli luisa | covello francesco | muratore valentina | mazur marta | romeo umberto | bossu' maurizio | ottolenghi livia | polimeni antonella | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences | Sapienza" University of Rome, Department of Oral and Maxillofacial Sciences

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Aim: the aim of this study is to report oral health data on the first 500 patients recruited in the PROTECT Project of Sapienza University of Rome, funded within the EU Asylum, Migration and Integration Fund (FAMI), as regards to head & neck health status in vulnerable migrants.

Experimental approach: FAMI-PROTECT Project aims to investigate head and neck health status in migrants in Lazio Region, Italy. A multi-professional team, composed by dentists, ophthalmologists, otorhinolaryngologists and maxillofacial surgeons, conducted a survey in First Help Centers for migrants. Should a treatment need be detected, patient is taken care of by the University Polyclinic Umberto I in Rome for subsequent clinical procedures.

Main results: among the patients, 24% had dental trauma, 51% had current dental pain. 41% of patients referred a high consumption of sugar/day, 61% reported adequate oral hygiene habits, and 24% had recent dental checkup. Clinically, pulp involvements were found in 31% of the sample, while abscesses or fistulas were respectively detected in 2% and 1%. 36% had exposed root surfaces and 60% showed a malocclusion. The most frequent PII value was 1 (38%), as well as CPI, that was 1 in 37% of cases. DMFT was >0 in 67% of patients: 52% had untreated active caries (41% with multiple caries). Missing teeth were observed in 37% of the sample (26% with more than one tooth extracted for caries), while 25% had fillings.

Conclusions: this partial report confirms the absolute importance of the dental care and health in vulnerable populations, in the specific case in migrants, that appear to be in considerable difficulty as regards diagnosis and access to treatment in specialized facilities

93 Caries incidence among dental versus pharmacy students in relation to risk factors. A clinical, radiological and questionnaire study

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Aim: to investigate the incidence of caries in dental (DS) and pharmacy students (PS), in relation to oral hygiene, cariogenicity of the diet and dental care habits. Study period: 18 months.

Sample size calculation: $\beta=80\%$; $\alpha=5\%$ and a caries reducing effect on 3 surfaces among DS, about 30 DS and PS should finish the study.

Materials and methods: both at baseline and the final examination clinical examinations were done by the first author. Bitewing radiographs were taken and a questionnaire concerning dental care habits including a 4 d diet formula was filled out. Primary outcomes: baseline/final plaque- and gingival indexes, and delta caries scored visually and radiographically by means of ICCMS-scores. Secondary outcome: level of cariogenicity of the diet. A total of 34 DS and 32 PS finalized the study.

Results: baseline: overall participants used 1450 ppm fluoridated toothpaste, brushed twice a day, but more PS did not use dental floss at all compared to DS ($p<0.05$). P-values >0.05 were seen with respect to mean age, mean plaque index, mean bleeding index and mean D_{i+m+e} -MFS; cariogenicity of the diet and mean number of detected lesions were DS=3.3 (3.7) versus PS=3.8 (4.4), $p=0.58$ between the two groups.

Final examination: The DS/PS mean plaque index was 3.7(1.9)/12.5(5.7), $p<0.001$; the DS/PS mean bleeding index was 0.9(0.9)/6.9(5.1), $p<0.001$. Delta D_{i+m+e} was for DS -38%, while for PS it was +16% ($p<0.05$). The cariogenicity of the diet among DS was significantly lower than among PS ($p<0.05$). PS did not floss as often as DS ($p<0.05$).

Conclusion: due to a significant improvement in level of oral hygiene, and in cariogenicity of the diet dental, compared to pharmacy students, dental students had a significantly lower caries incidence during a 18 months period.

94 Visual inspection and toothbrush care: a mother-baby paired cross-sectional study

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To evaluate the mothers' knowledge about the care with the toothbrushes used by them and their babies and to evaluate the condition of the toothbrushes used by both. This is a cross-sectional study composed of a convenience sample $n=60$ mother-baby pairs. The mothers answered a questionnaire to evaluate their knowledge regarding to toothbrush care and calibrated dentist performed the visual inspection of toothbrushes. The degree of deformation of the bristles was scored using a modified criteria. Scores 0 and 1 were grouped as “no deformation” and scores 2 and 3 were grouped as “presence of deformation”. Statistical analysis was carried out using chi-square and Fisher tests with significance level of 5%. It was found that 82% of the mothers had never received instructions on how to take care of the toothbrushes after use ($p=0.024$) and most of them believed their toothbrushes (70%) and that of their child (88%) were in good conditions to use ($p=0.043$). However, most of the mothers and babies toothbrushes presented unacceptable deformity of the bristles and presence of residues ($>50\%$). It was observed that there was an association between the lack of instructions received by the mother and the presence of deformity in the mother's toothbrush bristles ($p=0.037$) and the presence of residues in theirs and their baby's toothbrushes ($p=0.003$). Most of the mothers have never received instructions regarding to toothbrushes care and that reflected on their toothbrushes and their babies which presented unacceptable physical conditions with regards to deformation and presence of residues.

95 In situ investigation on the surface morphology of eroded enamel after using hydroxyapatite-containing formulations

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Little is known about the effects of hydroxyapatite (HAP) formulations in the context of dental erosion, particularly in situ. Therefore, aim was to examine the morphology of eroded enamel after the intra-oral use of various HAP-formulations.

The study had a cross-over, double blinded design. Human enamel samples were etched (36% H₃PO₄; 2 min), and cut in halves serving as test/control surfaces. Two test samples each were mounted on vestibular sites of mandibular sample holders. After 48-h washout phases, 5 healthy subjects used each of 5 formulations (3x/1 day with 3 h in between): two HAP-toothpastes, two HAP/fluoride-toothpastes (1450 ppm and 1490 ppm F-) and a HAP mouth rinse. Toothpastes were brushed occlusally for 5 s to produce a saliva-toothpaste-mixture, which was then washed around for 2 min (mouth rinse: no brushing). Afterwards, subjects rinsed for 5 s and cleaned the sample holder for 1 min, both with tap water. The surface morphology was analysed with scanning-electron-microscopy (x4000) and classified as no, slight or distinct change compared to the respective control half. Cross tabulations and Chi-Square-tests were used for statistics. On selected samples, descriptive element analysis was done with Energy-Dispersive-X-Ray-Spectroscopy (mass%).

Morphological changes varied from no change to rounded prisms or mucus like coverings; there was no significant association to test products, but to subjects ($p \leq 0.001$). On rounded prisms, the Ca/P amount was similar compared to control samples ($38.8 \pm 1.7/15.8 \pm 0.8$ and $34.0 \pm 1.8/14.1 \pm 0.2$ mass% resp.); carbon amounts were distinctly higher on mucus like coverings compared to control sites (27.6 ± 3.4 versus 6.4 ± 0.8 mass%); obviously, most morphological changes were due to pellicle formation but not to mineral precipitation.

HAP formulations were unable to cause significant surface changes, which instead depended merely on the individual oral environment.

Session 11

Clinical studies

96 Effect of intensified prevention on caries risk children undergoing dental treatment under general anaesthesia

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Background and aim: early childhood caries is a persistent problem often leading to dental treatment under general anaesthesia (GA). Thus, this study was to investigate the preventive effect of two additional intensive oral hygiene appointments before and after GA.

Subjects and Methods: in this multi-center, randomized, controlled clinical trial, 408 children (age 2-5 years, mean age 4.2 ± 1.04) intended for GA were recruited and randomly assigned to the intervention and control groups with or without two additional intensive oral hygiene appointments including fluoride varnish applications before and after the GA. At baseline and at 6-/12-month follow-ups, plaque, gingivitis and caries indices (API, PBI, idmft/s) were recorded.

Results: 408 children from 12 dental clinics in different cities in Germany took part in the study. All examiners undergone online calibration before the beginning of the study. Test and control group showed equivalent baseline mean values (API: 78 & 77%, SBI: 22.6 & 23.5%, dmft: 8.5 & 8.2 respectively, which continuously improved during the study. The test group exhibited statistically significant greater improvement (mean API: 42%, mean SBI: 7%); than in control (mean API: 54%, Odds ratio: 0.48; $p=0.003$; mean SBI: 12%, Odds ratio=0.44; $p=0.005$). Due to the robust rehabilitation with predominantly crowns and extractions, caries incidence was minimal and, therefore, without statistical significance (mean increasing in dt, test: 0.5, control: 0.6; $p>0.68$), this was also true for new initial carious lesions (mean increasing in it, test: 0.8, control: 0.9; $p>0.55$).

In conclusion, additional oral hygiene appointments for children undergoing dental treatment under GA improved their oral hygiene outcomes (plaque, gingivitis) greatly. This might be associated with reduced future caries incidence.

97 A survey of diabetologists' knowledge and attitudes regarding the association between Diabetes Mellitus and odontostomatological diseases

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Aim: this survey investigated the knowledge of doctors regarding the relationship of Diabetes Mellitus (DM) with odontostomatological diseases.

Methods: a twenty-four item closed-ended multiple-choice questionnaire, was completed by 225 Greek medical doctors. The sample was divided in 3 groups according to specialty: a) Endocrinologists; b) Internists; c) Internal medicine registrars. Bivariate analysis, Fisher test, and Spearman correlation were used for statistical analysis.

Results: most doctors were aware of the bi-directional relationship of periodontal disease and DM. Regarding the relationship between DM and xerostomia, 50% of doctors were not aware whether patients with DM have an increased risk of xerostomia and were not familiar with the relevant studies. Nearly, 50% of doctors agreed that patients with diabetes are at increased risk of developing caries. Age, specificity and years of expertise had an impact on the way of doctors' answers. Finally, 78,6% percentage revealed that doctors treating patients with diabetes should co-operate with dentists to reduce the risk of odontostomatological complications of their patients.

Conclusions: more education about association of diabetes mellitus with odontostomatological disease for medical providers is needed. Interprofessional collaboration between dentists and doctors dealing with diabetes is needed to provide integrated therapeutic and preventive care in patients.

98 *Salvadora persica* extract (miswak) and oral health. A systematic review

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Salvadora persica (SP), also known as miswak or siwak, is a small tree that grows in India and Africa. Its antibacterial property is related to benzyl isothiocyanate contained in the roots of SP. This systematic review aimed to evaluate the effectiveness of miswak on oral health. Randomized and controlled clinical trials, clinical studies, cross-sectional studies, cohort studies, comparative studies, validated studies reporting the use of miswak in relation to oral health indices such as plaque index (PI), bleeding index (BI) or caries and oral health indices (DMFT/dmft-CIPTN) were searched on PubMed, Scopus and Embase, using a search strategy with single keywords and search strings. Only papers published in English on humans and with no age limits up to December 2020 were selected. A total of 576 potentially eligible articles were identified and, after removal duplicates/not-pertinent papers, 68 papers were selected. After reading the full-text format, 19 papers were included. Fourteen papers evaluated the effectiveness of the miswak stick on gingival health and 13 were evaluated (one was discharged as no numerical results was reported). The effect size ranged between 0.00 to 2.40. The sample size of studies ranged between 15 and 240 subjects. Meta-regression model with random-effects displayed a residual heterogeneity of $\tau^2 < 0.01$ with a I^2 statistics of 39.64 and the test of homogeneity equal to $Q = X^2_{(12)} = 36.35$ $p < 0.01$. The majority of the papers investigated the use of miswak after 3 weeks of use. Five papers reported caries data, but the different study designs and the high heterogeneity prevented the comparison of outcomes. Miswak as stick or extracts seems to be effective in plaque and gingivitis control.

99 Short-term xerostomia after hematopoietic stem cell transplantation: preliminary analysis of the Orastem study

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Funding: Dutch Cancer Society

Aim: xerostomia (subjective feeling of dry mouth) affects speech, dietary intake and Quality of Life and is commonly experienced after hematopoietic stem cell transplantation (HSCT). This study aimed to assess xerostomia during hospitalization in relation to the type of HSCT and pre-HSCT stimulated salivary flow rate.

Methods: ethical approval was obtained and pre-HSCT stimulated salivary flow rates of patients included in the multicenter study Orastem were dichotomized as low (≤ 0.7 ml/min) or normal. Xerostomia was scored pre-HSCT (VAS score) and 3/week during hospitalization (CTCAE 3.0 scale: 0-3 and VAS scale: 0-10). Mean scores were calculated and used to evaluate the effect of gender, HSCT type and pre-HSCT stimulated salivary flow rate on xerostomia during hospitalization (Wilcoxon rank-sum test).

Results: in total 277 patients (58% males, mean age 53 years) signed informed consent and were included in this study. Most frequent underlying diagnoses were myeloma (30%) and AML (23%). Mean $\pm$ SD VAS xerostomia score before HSCT was 1.4 ± 2.2 , and 2.6 ± 2.1 during hospitalization. Mean $\pm$ SD CTCAE xerostomia score during hospitalization was 0.69 ± 0.53 . Significantly higher xerostomia scores were found in females and in autologous HSCT recipients (37%) (CTCAE score: 0.61 vs 0.80 females, $p=0.014$; 0.59 vs 0.85 autologous, $p=0.001$; VAS score: 2.3 vs 3.2 autologous, $p=0.002$), while there was no difference found between patients with low (23%) and normal stimulated salivary flow rate at baseline.

Conclusion: xerostomia scores were higher during hospitalization and significantly higher in females and in autologous HSCT recipients.

100 Non-aerosol emergency paediatric dental treatments during the COVID-19 lock-down: a retrospective analysis

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Funding: Pediatric Dentistry Department of Greifswald University, Germany

During the COVID-19 pandemic the use of dental aerosol generating procedures should be minimised. This study evaluates the use of non-aerosol treatment procedures (NATP) provided to children at a paediatric dentistry department in the period of total lock-down in Germany (March-April 2020) with a 6-months follow-up.

Methods: 83 patients seeking emergency dental treatment (e.g., pain, trauma, etc.) attended the department of whom patients visiting the clinic due to dental caries and treated with NATP were included for this analysis. Retrospective data collection of baseline treatments and 6-months follow-up was performed.

Results: the treatments of 22 patients (mean dmft/DMFT $5.75 \pm 3.07 / 2.22 \pm 2.9$) were categorized according to the clinical diagnosis: Category I (n=10; 45.5%, mean age 4 ± 2.6) included patients with active carious lesions (ICDAS 3-5) and reversible pulpitis, mainly ECC. Nine out of ten patients (90%) were treated with silver diammine fluoride (SDF), and one (10%) with the Hall technique.

In the SDF-treated patients, one patient presented shortly after with pain and was medicated. The other 8 cases presented no complications during the follow-up period and affected teeth were later either restored or left with no restoration.

Category II included teeth with irreversible pulpitis or facial swelling of dental origin (e.g. submucosal abscess; n=12; 54.5%, mean age 8.3 ± 3.6). Treatments provided were extraction (n=5; 41.7%), or antibiotics prescription (n=7; 58.3%) of whom five patients received extraction after the lock-down with no patient having recurrence of pain. In one case the primary tooth exfoliated, and in another case endodontic treatment was provided later-on.

Conclusion: non-aerosol treatments are viable options for managing caries related emergency cases in paediatric dentistry and are advantageous to postpone the need of an immediate treatment in case of high risk of infectious transmission.

101 Dentist reproducibility, feasibility and acceptability of clinical classification of neighbour primary molar-teeth surfaces' contour type.

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Funding: Universidad El Bosque (PCI-2017-9604)

Concave proximal surfaces in neighbouring primary molar teeth have been associated with caries likelihood. This study aimed to determine the in-vitro inter/intra-examiner reproducibility, and the clinical feasibility and acceptability, of classifying the concave/convex contour of neighbour primary molar-teeth surfaces. After ethical approval and practitioner- and parent-inform consents, 20 clinicians were invited to participate in: a 2-day training and calibration; the clinical assessment of 6 4-5-year-old patients each, and a 5-item feasibility and acceptance survey. Course: 1st day included theoretical, preclinical and clinical sessions in how to clinically classify from an occlusal view the distal of 1st and mesial of 2nd upper and lower primary molar-teeth surfaces (1-convex; 2-concave), and the dentists' assessment of the contour type of corresponding surfaces on stone models (n=112); 2nd day: repeated exams after one week. Each dentist then clinically assessed in their practice correspondent surfaces on patients and obtained clinical related pictures. Finally, they answered a 5-item feasibility and acceptability questionnaire. A total of 17 clinicians and 102 4-5-yr.-old patients participated. Weighted Kappa values: Inter-examiner reproducibility: 0.71-0.75 (mean $\pm$ SD: 0.72 $\pm$ 0.02); Intra-examiner reproducibility: 0.72-0.81 (mean $\pm$ SD: 0.76 $\pm$ 0.03). The questionnaire disclosed, regarding feasibility that most found conducting this clinical assessment very easy/easy (96.1%), felt very confident (64.7%) and very satisfied with time consumed (82.4%). With respect to its acceptability, most consider it relevant (94.1%), and all felt very satisfied (100%). Finally, there was a very high agreement between dentists' clinical codes and PI's codes in correspondent clinical pictures (88.7%). Conclusion: Substantial inter-/intra-examiner reproducibility of dentists' classification of the contour type of proximal surfaces in the neighbouring primary molar-teeth was found and dentists considered its clinical use highly feasible and acceptable.

102 Selection bias in National Oral Health Survey in 12-year-olds: epidemiological survey results from Saxony-Anhalt/Germany (2008-2018)

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Funding: the authors are grateful to the regional public health offices (Gesundheitsämter) and dentists for collecting the additional data in Saxony-Anhalt and thank the Deutsche Arbeitsgemeinschaft für Jugendzahn flege e.V. (DAJ) for the excellent cooperation in generating the report of the NOHSC in 2017

Objective: caries experience in the WHO reference group of 12-year-olds has been regularly examined in Germany within the National Oral Health Survey in Children (NOHSC), but only for 6th-graders. Therefore, the aim of this study was to assess possible selection bias due to this convenient examination strategy.

Methods: caries data for 12-year-olds regardless of the class level attended was available and analysed for the years 2008-2018 in the federal state of Saxony-Anhalt (n=96,842). This data originated from children who participated in the compulsory (by federal law) annual public health service school examinations in Saxony-Anhalt. For caries data the Mann-Whitney U test was chosen to detect statistically significant differences.

Results: out of 96,842 12-year-olds, 76,456 attended 6th grade (78.9%), while 15,743 attended a lower (≤ 5) and 4,643 a higher class level (≥ 7). Caries experience (DMFT) for 12-year-olds in 6th grade declined from 1.00 (2008) to 0.52 (2018) and for all 12 year-olds from 1.14 to 0.63 DMFT. Pooled DMFT values of 6th-graders are significantly lower than in $\leq 5^{\text{th}}$ -graders ($p < 0.001$) in every year in the time period 2008-2018 and in 7th-graders for all years ($p < 0.05$), but for 2010. Caries levels in 12-year-olds in $\leq 5^{\text{th}}$ grade are 1.69 times higher than in 6th-graders being probably associated with lower learning performance and socioeconomic status. The absolute difference in each examination year ranges from 0.08 to 0.13 DMFT and percentagewise from 10.7% to 21.2% resulting in a mean pooled difference of 0.10 DMFT and 14.2%.

Conclusion: to represent the “real” caries experience for 12-year-olds within the National Oral Health Survey in Germany, the DMFT values for 6th-graders should be adjusted due to selection bias by approximately +15%.

Session 12

Clinical studies

103 Treatment acceptance of hypersensitive carious teeth using two different treatment approaches: An observational cohort study

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Funding: this study was partially funded by SDI Limited

Dentin hypersensitivity is described as a sharp discomfort arising from exposed dentin in response to external stimuli. This study assessed children's behaviour and dentist's acceptability of two treatment approaches for treating hypersensitive carious lesions (ICDAS 5) in primary teeth using the standard treatment of sodium fluoride varnish (5% Duraphat®), and the application of combined silver fluoride and potassium iodide (38% Riva Star®). Ethics approval (No. BB 128/18).

A total of 26 children (13 boys and 13 girls) aged 2-5 years (3.68 ± 1.03) were consecutively recruited at the Preventive and Pediatric Dentistry Department of Greifswald University/Germany and equally categorised into the two study groups: Duraphat® ($n=13$; $dmft=8.00 \pm 3.44$) and Riva Star® ($n=13$; $dmft=8.23 \pm 2.98$) following positive care-giver's feedback of hypersensitivity on cavitated carious teeth. Before, during and after treatment, children's behaviour was recorded using the Frankl scale and dentists' opinions of the treatment techniques (5-point Likert scales). Comparisons between the two study groups were done using the Mann-Whitney U test, and Friedman test.

Children showed no significant change in behaviour in the Duraphat® group in comparison to Riva Star® group before ($p=0.76$), during ($p=0.26$) or after the treatment ($p=0.65$). Moreover, there was no significant behavioural improvement considering the three different time points in each group; Duraphat® ($p=0.07$), Riva Star® ($p=0.11$). Applying Duraphat® and Riva Star® was technically 'very easy' or 'easy' for >90% of dentists. There were no statistical significant differences in dentists' opinions regarding the technical use of the two treatment approaches ($p=>0.05$).

Conclusion: children's behaviour was not influenced by either treatment approaches (Duraphat® or Riva Star®) for treatment of hypersensitive carious lesions in children, and both approaches were well-accepted by treating dentists.

104 Cariogenic potential of commonly used non-nutritive sweeteners: a systematic review and meta-analysis

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Aim. Non-nutritive sweeteners (NNS) are widely used as an alternative to sucrose. Whether they are cariogenic or not is unclear. The aim of this systematic review, therefore, was to analyze the literature to determine whether NNS or NNS-containing foods are anticariogenic or retain certain cariogenic potential, in experimental and clinical studies.

Methodology. The review protocol was registered in PROSPERO (CRD42020215633), following PRISMA-P criteria. Medline via PubMed, SCOPUS, and Web of Science databases were independently searched by two reviewers, using predefined criteria based on a P.I.C.O question, including saccharin, sucralose, aspartame, stevia, or tagatose as NNS. No year or language limits were applied. A random-effect meta-analysis was performed using RevMan for two outcomes; incidence of caries lesions and biofilm acidogenicity.

Results. After removing duplicates, 754 studies were evaluated by title and abstract, 30 for full-text appraisal, and 26 were finally included. Thirty five percent of the selected studies (n=9) were clinical trials, 12% (n=3) *in-situ*, 27% (n=7) animal and 27% (n=7) experimental studies on *in-vitro* caries models. Overall, 43% of the studies concluded that NNS were non-cariogenic, and 43% reported some cariogenicity. Qualitative analysis showed moderate to low risk of bias. Caries lesion onset and acidogenicity were meta-analyzed. Compared to sucrose, NNS significantly reduced caries onset in animals (mean difference -17.47 CI 95% [-20.89, -14.05]; I²: 99%). Non-significant differences were identified in studies assessing acidogenicity in humans (mean difference -0.56 CI, 95% [1.91, 0.78]; I²: 99%).

Conclusion. NNS appear to be less cariogenic than sucrose but maintaining the ability to lower the biofilm pH with the risk of promoting demineralization. NNS consumption as sucrose replacement should be carefully advised as they still retain some cariogenic potential. Further clinical trials are needed.

105 How to extrapolate trial-based economic evaluations to populations? – proposing sensitivity analyses based on national data

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Funding: CNPq (Universal 448013/2014-2, PQ 304319/2018-0, PIBIC), FAPESP (2013/27206-8), Capes

Trial-based economic evaluations sometimes are criticized not to reflect the real-life context. Sensitivity analyses may be helpful in approximate results from the trial to a real-life scenario. This study aimed to propose a methodology to perform sensitivity analyses based on national data (5-year dmft). A trial-based model was used, using data from a 2-year clinical study (Cardec-02-NCT02473107). We used the cost-effectiveness strategy. Incremental costs and effects (new operative treatments) (Δ cost and Δ effect: test-control) were calculated. Monte-Carlo simulations (x10,000) were used and the values plotted in cost-effectiveness plans for the uncertainties inherent in the data. Data from SB-Brasil 2010 were used to simulate different Brazilian scenarios. Regression models were created conditioning cost and effect variables to the caries experience (dmft). Sensitivity analyses were performed, using the same steps as the principal analysis, considering dmft for the Brazilian population and separately, for regions. In Cardec-02, 260 children with mean dmft 2.0 (SD:3.1) were included. In this base-scenario, on average, the implementation of the strategy saved \$9.16 per child and approximately two extra new surgical intervention per child (Δ effect = -2). Considering the Brazilian population, on average, this cost savings were increased (Δ cost=\$ -490.85), but the new interventions increased in test group (Δ effect=+2). Considering the uncertainties, in the national scenario, the test strategy presented a similar potential to be a cost-effective strategy (54%) compared to those simulated cases based on the trial sample (59%). Different patterns were observed in different Brazilian regions. The proposed strategy permits to adjust values to guide a more reasonable decision-making process and also highlights possible differences when decision-makers need to consider different scenarios.

106 Caries OUT COVID-19-adapted CCI multicentre study: baseline description of participants at Uruguay site

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CariesCare International (CCI) promotes a 4D-cycle patient-centred risk-based caries care. Caries OUT -a multicentre single-group interventional study- was planned to assess the 12-month caries-control effectiveness of a pandemic-adapted CCI in children, avoiding aerosol-generation procedures and reducing on-site appointments. Outcomes: individual- and tooth-surface-level caries-progression, children's oral-health-behaviour change, and acceptability to parents and dentists. **Aim:** to describe the 4-D patient- and tooth-surface-level caries diagnosis and care plan in the Uruguayan-centre children. **Methods:** multicentre and local Ethical Board approvals; consents. Six to eight-year old children attending the university community-paediatric-dental clinic participated. A trained examiner conducted baseline examinations. Caries-Risk (1D) and Oral-health-Behaviour and Staging and Activity Assessment of Caries Lesions (2D) were conducted. The Personalized Patient & Dental Care Plan (3D) was done conjunctively with parents. Afterwards, the external-dental practitioner delivered the Prevention and Control Care (4D). **Results:** thirty children participated (7.1 ± 0.80 years old; 53% male). All were high-caries-risk (23%: dental sepsis; 100%: ≥ 1 active-caries lesion; 83%: high daily free-sugar intake). The prevalence of caries experience (ICDAS-merged-Epi dmfs/DMFS) was of 100% with a surface-mean of 11.4 ± 9.4 (ds/DS-Initial: 4.4 ± 3.4 ; ds/DS-Moderate: 2.0 ± 3.1 ; ds/DS-Extensive: 3.9 ± 7.8 ; fs/FS: 0.5 ± 1.4 ; ms/MS: 0.7 ± 2.2). Active caries lesions were mainly Extensive (40.6%), followed by Initial (39.6%) and Moderate (19.8%). Planned care included at the individual-level homecare approaches (100%): increasing to 1500ppmF toothpaste, toothbrushing-instructions with the dental team, oral-health information; clinical approaches (100%): thrice-a-year NaF-varnish application, and diet and toothbrushing short-behaviour-change-tool implementation. At the tooth-surface-level: Active-Monitoring: 17.9%; Non-Operative-Care: 62.2% (NaF-varnish: 47.9%, ART-sealants: 52.1%); Tooth-Preserving-Operative-Care: 15.6% (ART: 53.6%; Hall-Technique: 46.4%); Extraction: 3.8%; Referral: 0.4%. **Conclusion:** the Uruguayan-centre baseline and basic management conducted by October 2020 has been described.

107 Restorations performance after selective removal of soft dentine: a controlled clinical trial – 18 months follow-up

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Funding: Coordination for the Improvement of Higher Level Education (CAPES). The study was approved by the Research Ethics Committee (Protocol 1.016.220) of Federal University of Rio Grande do Sul

This randomized controlled clinical trial aimed to evaluate the clinical performance of resin composite restorations placed after selective removal to soft dentine (SRSD) and after stepwise excavation (SW) over an 18-month period. Inclusion criteria were: patients with permanent molars and/or premolars presenting deep caries lesions ($\geq 50\%$ of the dentin thickness on radiographic examination), positive response to cold test, absence of spontaneous pain and periapical lesions, negative sensitivity to percussion. Teeth were submitted to SRSD ($n=76$) or SW ($n=76$) using a liner material (Calcium Hydroxide [Dycal, Dentsply] or universal adhesive [Universal single bond, 3M Espe) and received direct restorations with composite resin (Filtek Z350, 3M Espe). Evaluations were performed based on FDI (World Dental Federation) criteria. Survival analysis was performed to estimate survival of restorations and relationship between clinical variables and socio-demographic characteristics (adjusted Weibull regression model). Follow-up period ranged from 6 to 18 months (mean $\pm$ SD 490.42 $\pm$ 102.46). Patients' ages ranged from 9-55 years mean $\pm$ SD 29 $\pm$ 10.46. One hundred patients and 134 teeth were evaluated (SCR=72 teeth and SW=62 teeth). There were four restorative failures in the SRSD (2 loss of restoration needing replacement and two marginal fracture needing repair) and one in the SW group (fracture needing repair). One involved one surface SW and four restorations involved ≥ 2 faces SRSD. The association between restoration failure and explanatory variables showed similar success rates for SW (98.5%) and SRSD (95%) ($p=0.16$). The use or not of cavity liner had no influence on the longevity of restorations ($p=0.69$). Patients presenting gingivitis ($GB \geq 20\%$) had 8.50 times more risk of failure in their restorations ($p=0.03$). This study showed that restoration placed after SRSD (over soft dentine) did not interfere with the clinical performance of composite resin restorations.

108 Impact of cavitated caries lesion on self perceived general well-being

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The World Health Organization defines health as a state of complete physical, mental and social well-being and not merely the absence of disease. To investigate Patients Reported Outcome Measures (PROMs) had become an important step to evaluate the real impact of oral diseases. Short General Well-Being Scale (SGWS) is a four-item instrument which measures the general well-being of adults, through a 4-point Likert scale, ranging from 0 (strongly disagree) to 3 (strongly agree). Higher scores indicate higher general well-being. The objective of this cross-sectional study was to evaluate the association of cavitated carious lesions and SGWS scores. The study received approval from the Human Research Ethics Committee of Federal University of Minas Gerais, Brazil (COEP 67189617.2.1001.5149). Data collection took place in dental clinics from two public universities located in Brazil. The sample comprised 209 caregivers of children and adolescents that attended for dental treatment. The SGWS and sociodemographic questionnaire were self-administrated in waiting rooms, followed by dental clinical examination. Two dentists performed oral exams (kappa: .88–.90 for intra- and .83–.90 for inter-examiner agreement). Dental caries experience was evaluated through the DMFT index, and dichotomized in absent or presence of cavitated carious lesions. Bi and multivariate analysis were performed. Most of caregivers' were women (70.3%), mean age were 39 years (SD±12,26) and 78% had less than 3 minimum wages of income. Median SGWS scores were 8 (SD ±3.12, min 0, max 12). Cavitated carious lesions were presented in 53% of study population. On multivariate regression income (p=0.001) age (p=0.001) and presence of cavitated carious lesions (p=0.033) were associated with SGWS scores. The presence of cavitated carious lesions had a significant association with lower Well-being scores.

109 Resin infiltration of proximal caries lesions in permanent teeth: systematic review and scenario analysis

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Objectives: a number of randomized controlled trials (RCTs) found resin infiltration (RI) efficacious to arrest non-cavitated caries lesions. However, the consistency, magnitude and certainty of this evidence is unclear. We aimed to meta-analyse the evidence for RI of proximal carious lesions in permanent teeth.

Methods: RCTs comparing lesion progression in proximal caries lesion in permanent teeth treated with RI + non-invasive measures (NI) versus sham infiltration + NI were included. Three electronic databases (PubMed, Embase, Cochrane CENTRAL) were systematically screened, and hand searches and cross-referencing performed. Trial selection, data extraction, and risk of bias assessment (Cochrane Risk of Bias Tool 1.0) were conducted independently by two reviewers. Fixed- or random-effects meta-analyses were performed for per-protocol (PP), intention-to-treat (ITT), best case (BC) and worst case (WC) scenarios. Trial sequential analysis (TSA) was used to control for risk of random errors.

Results: from 1.686 studies identified, 6 trials (follow-up range 12-84 months) involving 272 patients (812 lesions) were included. Two trials had high, 3 moderate and 1 low risk of bias. Risk of caries progression was consistently and significantly reduced for RI in PP, ITT and BC scenarios [OR (95% CI): PP: 0.15 (0.10-0.25), ITT: 0.36 (0.26-0.49), BC: 0.08 (0.05-0.13)], respectively, but not in WC scenario [0.94 (0.42-2.10)]. According to TSA, firm evidence was reached for all scenarios except WC.

Conclusion: There is firm and consistent evidence supporting RI at moderate certainty.

Saturday Afternoon Symposium

110 Minimally invasive dentistry; where are we with it as a paradigm for dental care

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Although the term minimally invasive dentistry has been used for several decades, the concept has been with us for much longer. Its definition continues to evolve, and varies for different clinicians, researchers and authors. As part of this transition, clinicians in general have started to view it as more mainstream and are beginning to see a role for it as part of everyday practice.

The growing interest in minimally invasive dentistry can be seen in a Scopus (citation index) search of peer reviewed papers that mentioned the term, revealing only three documents in 1994 and a linear increase in its use, culminating in 85 documents mentioning it last year (2020). Despite the evidence of growing interest in minimally invasive dentistry, a systematic review in 2017 found little evidence for changes in dentists' decision-making around the extent of a carious lesion that triggered them to intervene invasively. The review did, however, identify different behaviours associated with clinicians in different countries and there are now several studies investigating barriers and facilitators to adopting minimally invasive behaviours. Further work looking at dental graduates in the UK, has supported the importance of the practice culture, environment and remuneration in influencing new graduates' changes in practice away from an evidence-based contemporary approach taught in their dental school towards less modern, current practices in their new environment.

This presentation looks at the evolution of minimally invasive dentistry, where we are with its adoption into everyday practice and showcases some of the research around implementation of minimally invasive dentistry. This will allow an opportunity for discussion around areas for future research and possible solutions to barriers to adoption of minimally invasive practices.

111 Minimally invasive dentistry; a growing suite of techniques ready for use?

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Initially minimally invasive dentistry pertained only to “early” lesions (those confined to the enamel or outer half of dentine). However, there is growing research showing the success of techniques for managing lesions that have extended further into the tooth. In addition, the advent of the COVID-19 pandemic has enforced a move away from aerosol generation, which many minimally invasive techniques fit well with.

Although the term has various definitions, minimally invasive dentistry generally revolves around several key concepts; avoiding damage to the dental pulp, removing the least amount of tooth substance possible and realigning behaviours that led to the disease in the first place and might compromise any repair to the tooth in the future.

In this presentation, following a brief summary of current management options for primary and permanent carious lesions limited to enamel, the focus will be on an overview of management options for dentine carious lesions (with emphasis on micro-cavitated lesions, cavitated lesions, and occlusal lesions, which appear clinically to be non-cavitated but extend into dentine).

Current options, and evidence, for treating dentine carious lesions will be presented. These will include: selective carious tissue removal (SE); Stepwise carious tissue removal (SW); Sealing using sealant materials (e.g., resins and glass ionomers); The Hall Technique (HT); Non-Restorative Cavity Control (NRCC), including SDF-application.

112 Minimally invasive approaches in dentistry: what's in it for whom?

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The transfer of minimally invasive dentistry to daily practice has been less rapid than would be expected based on the scientific results. Possible reasons for this may be; unfamiliarity with techniques, patient preferences or the financial consequences that choosing a minimally invasive approach may have on the clinician or practice due to differences in reimbursement. Economics may contribute to dentist's treatment decision-making because of the influence of reimbursement regulations.

To explore possible reasons for this phenomenon, a randomised clinical trial on the effectiveness and cost-effectiveness of sealing over caries or restoring for International Caries Detection and Assessment System codes 3 and 4 lesions (ICDAS3-4), was analysed for clinical and economic (from different perspectives) outcomes. Primary and permanent molars (n=161) with occlusal carious lesions (ICDAS3-4), were randomly assigned to receive restorative treatment or a -less invasive- therapeutic sealant. After one year, retreatment (refurbishing, repair or replacement) for therapeutic sealants was 5% and for restorative group was 1%. After two years this was 23% and 18% respectively.

Patients rated treatment comfort on a VAS-scale (0-100). The mean for the therapeutic sealant group was 81.2 and the restoration group was 60.6 ($t=4.3$; $p<0.001$). There were no statistically significant differences in total mean costs on the basis of time used (taking a societal perspective: including accompanying- travel- and treatment-time) at €71.50 in sealant group vs €83.16 in restoration group. When data were analysed from health care professional's perspective, there was a statistically significant difference in total mean reimbursements: €44.77 in the sealant group and €68.02 for the restorations ($t=5.6$; $p<0.001$).

These data suggests that varying reimbursement tariffs might be worth exploring to shift towards less invasive management of carious lesions in the future.

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