

UiO : Faculty of Dentistry

University of Oslo

Research Day 2018

September 13th
09⁰⁰ – 14³⁰

Store Auditorium, Institute of Clinical Dentistry
Faculty of Dentistry

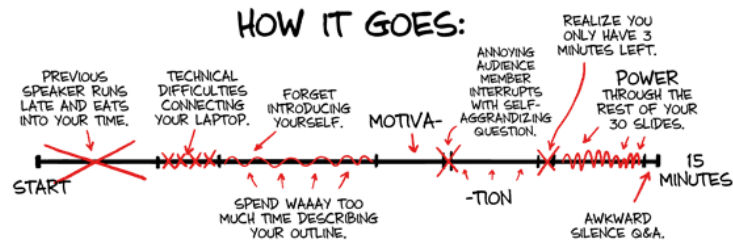


YOUR CONFERENCE PRESENTATION

HOW YOU PLANNED IT:



HOW IT GOES:



©phdcomics.com

Organizing committee:

Kjersti Sturød
Linda Hildegard Bergersen
Natalia Andronova

Layout and editing: Florian Weber
Photography: © Margit Selsjord

UiO : University of Oslo

Dear participants,

Welcome to “Research Day”. The aim of the Research Day is to give each PhD candidate the opportunity to present their research project to a larger audience than their own research group and prepare for presentation at research congresses abroad. Furthermore, it is a good opportunity to get an overview of the Faculty’s ongoing research projects.

The audience will be fellow PhD candidates as well as the Faculty’s scientific staff and teachers. We hope they will support the PhD candidates and attend as many of the presentations as possible.

The abstracts of the research projects that will be presented can be found in this program in order of their presentation time.

We hope you will enjoy the day together with us and take part in exciting presentations and fruitful scientific discussions.

Dean of Research

Linda Hildegard Bergersen

Presentation schedule

- 09:00 Registration and coffee in front of Store Auditorium
- 09:30 Welcome by the faculty's Dean of Research, Professor Linda Hildegard Bergersen

Session 1

Moderator: Rabia Khan

- 09:45 *Grain boundary formation and corrosion in doped TiO₂ scaffolds*
Anne Klemm, Institute of Clinical Dentistry 7
- 10:00 *Interleukin 6 in primary osteoarthritis*
Randi Krog Eftedal, Institute of Oral Biology 8
- 10:15 *Growing artificial bone in rotating bioreactors, a model system for identifying molecular mechanisms of treatment*
Maria Schröder, Institute of Clinical Dentistry 9
- 10:30 *Changes in protein profile in bone marrow extracts and bone biopsies before and one year after gastric bypass surgery*
Safiyye Süslü, Institute of Clinical Dentistry 10
- 10:45 *Coffee break*

Session 2

Moderator: Hanna Tiainen

- 11:00 *Signalling pathways identified in salivary glands from primary Sjögren's syndrome patients reveal enhanced adipose tissue development*
Lara Adnan Aqrawi, Institute of Clinical Dentistry 11
- 11:15 *The effect of a dentist administered cognitive behavioural therapy (D-CBT) in adult patients with dental fear*
Mariann Saanum Hauge, Institute of Clinical Dentistry 12
- 11:30 *Do child characteristics influence recall intervals for Norwegian children?*
Sonja Yr Løken, Institute of Clinical Dentistry 13
- 11:45 *New animal model of extrinsic dental erosion-erosive effect on the mouse molar teeth*
Amela Tulek, Institute of Oral Biology 14
- 12:00 *Lunch served in the Faculty Club*

Session 3

Moderator: Roger Junges

13:00	<i>Attachment and organisation of human mesenchymal stem cells on poly(ethylene glycol) hydrogels</i> Aman Singh Chahal, Institute of Clinical Dentistry	15
13:15	<i>Bacterial attachment to nanostructured surfaces</i> Pawel Kallas, Institute of Clinical Dentistry	16
13:30	<i>The salivary microbiota profile in reduced and normal salivation</i> Shermin Rusthen, Institute of Clinical Dentistry	17
13:45	<i>Increased numbers of Langerhans cells in the epithelium of oral lichen planus are due to recruitment from hematopoietic precursors</i> Maren Bråten Solhaug, Institute of Oral Biology	18
14:00	<i>Antibacterial activity of endodontic sealers against planktonic bacteria and bacteria in biofilms</i> Vasileios Kapralos, Institute of Clinical Dentistry	19
14.15	<i>Concluding remarks</i>	

Abstracts

— in presented order —



Grain boundary formation and corrosion in doped TiO₂ scaffolds

Anne Klemm¹, Patricia A Carvalho², Håvard J Haugen¹, Hanna Tiainen¹

¹*Faculty of Dentistry, Department of Biomaterials, University of Oslo,*

²*SINTEF Materials and Chemistry, PB 124, Blindern, Oslo*

TiO₂ slurries doping with 0.08M CaCl₂ leads to a significant increase in compressive strength with corrosive resistant grain boundary formation.

BACKGROUND:

Porous TiO₂ scaffolds as a bone support structure showed high porosity combined with high compressive strength¹. Doping ceramic scaffolds with Ca or Sr led to even higher compressive strength and formation of impurity rich grain boundaries². Grain boundary (GB) dissolution can occur during bone healing, because of a local pH drop³. To improve the corrosion resistance of cationic doped TiO₂ scaffolds, the objective of this study was to investigate the corrosion depending on doping concentration to evaluate corrosion mechanisms.

METHODS:

Porous TiO₂ bone scaffolds were doped with SrCl₂ or CaCl₂ with increased concentrations (0.02–0.1M). To investigate the influence of corrosion on scaffold strength, the compressive strength before and after corrosion test (37°C in 1mM HCl solution for 4h, 24h and 7d) was measured. The grain boundary corrosion was investigated by using SEM and the grain boundary formation by TEM and EDX.

RESULTS & DISCUSSION:

SrCl₂ scaffolds showed an increased compressive strength by increasing the dopant concentration. The corrosion increased as well, which resulted in a significant decrease in compressive strength with a concentration ≥ 0.06 M. CaCl₂ scaffolds showed a significant decrease in compressive strength due to corrosion in grain boundaries with Ca concentration of 0.1M. Ca doped scaffolds showed amorphous GB rich in Ca, Al and Si. Sr doped scaffolds showed the formation

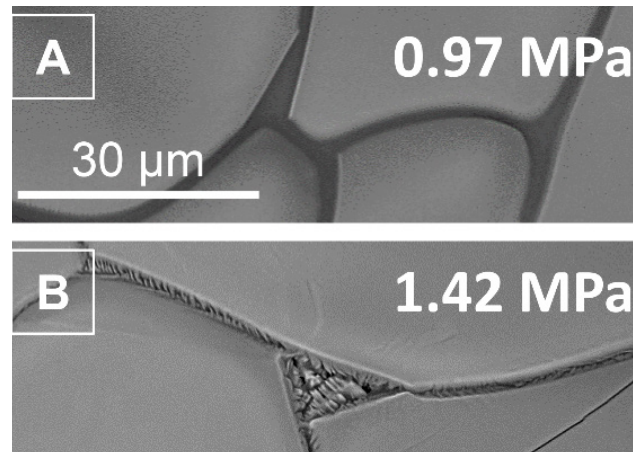


Fig. 1: Corroded grain boundaries in 0.08M (A) and 0.1M (B) CaCl₂ doped TiO₂ scaffolds.

of SrTiO₃ in GB and an amorphous phase rich in Si and Al.

CONCLUSIONS:

Sr doping leads to SrTiO₃ formation in grain boundaries. Grain boundary corrosion is concentrated in amorphous region in Ca and Sr doped scaffolds. With a concentration of 0.1M both scaffolds showed a significant decrease in strength. By using 0.08M CaCl₂, this effect did not occur and leads to corrosive resistant scaffolds with high compressive strength.

REFERENCES:

- ¹H. Tiainen, D. Wiedmer, H.J. Haugen (2013), *European Ceramic Society* **33**: 15–24.
- ²A. Klemm, H. Tiainen (2018), *Ceramics International* **44**(6): 6265–6271.
- ³B. Müller, H.J. Haugen, H. Tiainen (2016), *European Ceramic Society* **36**: 179–188.

Interleukin 6 in primary osteoarthritis

Randi K Eftedal¹, Zdravko Jotanovic², Zlatko Dembic¹

¹*Department of Oral Biology, Faculty of Dentistry, University of Oslo, Oslo, Norway*

²*School of Medicine, University of Rijeka, University Hospital for Orthopedics and Traumatology
Lovran, Rijeka, Croatia*

The aim of this study was to investigate associations between a single nucleotide polymorphism (SNP) in the IL6 gene, and development of primary osteoarthritis of the hip (HOA) and knee (KOA). The allelic and genotypic frequencies of IL6 SNP (rs1800795) showed statistically significant differences between controls and patients with HOA, but not KOA.

BACKGROUND:

Osteoarthritis (OA), as the most common joint disease, has risk factors that include polygenic inheritance among which Interleukin 6 plays a role in its development.

METHODS:

Included in this study were 260 HOA patients and 240 KOA patients after total joint arthroplasty. The control group consisted of 597 healthy individuals with no clinical signs of primary HOA or KOA. DNA was isolated from blood, and genotyping was conducted by quantitative real-time Taqman PCR.

RESULTS & DISCUSSION:

Analysis of the IL6 SNP (rs1800795) in HOA patients compared to controls showed statistically significant differences, suggesting that the G allele may be a possible protective factor against developing HOA. The C allele may be a marker for predisposition in developing HOA. We found no statistically significant differences between KOA patients and controls.

CONCLUSIONS:

Our findings suggest an association between the rs1800795 polymorphism and the susceptibility to osteoarthritis of the hip.

Growing artificial bone in rotating bioreactors, a model system for identifying molecular mechanisms of treatment

Maria Schröder¹, Elisabeth Riksen¹, Janne E Reseland¹

¹*Faculty of Dentistry, Department of Biomaterials, University of Oslo*

Ex vivo-derived 3D bone constructs represent new potential models for physiological studies of bone formation, remodeling and function.

BACKGROUND:

Rotating bioreactors on a clinostat system create an environment that allows bone cells to aggregate into 3D multicellular spheroids and form bone-tissue like structures^{1,2}. These 3D in vitro analogs of human bone represent a new potential model for testing of various stimuli on bone formation and remodeling². The active vitamin D metabolite 1,25(OH)₂D has a known function in bone homeostasis. Vitamin K₂ is a cofactor of gamma-carboxylase, and essential for the pathway of gamma-carboxylation of osteocalcin (OC)³. Studies showed a stimulating effect of a combined administration of vitamin D₃ and K₂ on osteoblast mineralization^{4,5} and bone mineral density in vivo^{6,7}.

In this study, the effect of vitamin K₂ alone and in combination with vitamin D₃ is tested in two different rotary culture systems in the 3D bone model. Results are compared to each other and to effects in a 2D culture system.

METHODS:

3D mineralized bone constructs were generated either in the rotary cell culture system (RCCS) (Synthecon, Inc., Houston, TX) or the BioArray Matrix drive BAM v4 (CelVivo, Blommenslyst, Denmark) with human primary osteoblasts (hOBs) and osteoclast precursor cells. Vitamin D₃ and K₂ (both MK-4 and MK-7), alone and in combination, were administered. Untreated cells were used as control.

After 21 days, osteospheres were characterized in terms of mineralization by Alizarin Red S staining, Alkaline Phosphatase activity and expression of collagen type I. The secretion of

cytokines and bone factors to the medium was analyzed by Luminex.

RESULTS & DISCUSSION:

In a 2D culture system, the secretion of OC from hOBs was highest by a combined treatment of vitamin K₂ form MK-4 (10 µM) and vitamin D₃ (0,01 µM). In the 3D bone model, vitamin treatment distinctly reduced osteosphere stiffness compared to the untreated control.

CONCLUSIONS:

Ex vivo-derived 3D bone constructs may be utilized in physiological studies of bone formation, remodeling and function.

REFERENCES:

- ¹S. R. Facer et al. (2005) *J. Dent. Res.* **84**: 542-547
- ²M. S. Clark et al. (2013) *Acta biomaterialia* **9**: 7908-7916
- ³P. A. Price, M. R. Urist and Y. Otawara (1983) *Biochem. Biophys. Res. Commun.* **117**: 765-771
- ⁴Y. Koshihara et al. (1996) *Calcif. Tissue Int.* **59**: 466-473
- ⁵C. C. Poon et al. (2015) *Eur. J. Pharmacol.* **767**: 30-40
- ⁶T. Ushiroyama, A. Ikeda and M. Ueki (2002) *Maturitas* **41**: 211-221
- ⁷J. Iwamoto, T. Takeda and S. Ichimura (2000) *J. Orthop. Sci.* **5**: 546-551

Changes in protein profile in bone marrow extracts and bone biopsies before and one year after gastric bypass surgery

Safiyye Süslü¹, Ingvild K Blom-Høgestøl², Erik F Eriksen^{2,3}, Janne E Reseland¹

¹Department of Biomaterials, Institute of Clinical Dentistry, University of Oslo

²Department of Endocrinology, Morbid Obesity and Preventive Medicine, Oslo University Hospital,

³Institute of Clinical Medicine, University of Oslo

The long-term skeletal changes after bariatric surgery are largely unknown, and identifying molecular mechanisms related to reduced bone health after long-term weight loss may reveal novel approaches for reducing the burden of these changes. Our results from bone marrow aspirates shows a reduction in the level of leptin and vascular endothelial growth factor (VEGF), and an enhanced level of osteopontin (OPN) and interleukin-1 β (IL-1 β) after the surgery.

BACKGROUND:

Bariatric surgery results in weight loss and improvement of obesity related comorbidities, however changes in load, nutrition and hormonal status might affect the bone health such as fracture risk, changes in bone turnover markers, bone mineral density and bone strength. Bone health is generally identified using blood samples and/or various x-ray techniques.

We aimed at identifying changes in the protein profiles in bone biopsies and bone marrow aspirates after weight loss due to gastric bypass surgical intervention.

METHODS:

Proteins in bone marrow aspirates and bone biopsies from 30 patients before and 1 year after gastric bypass surgery (2013/1159/REK Sør-Øst B) were isolated using Trizol (Thermo Fisher Scientific).

Total protein content was identified using the BCA Assay (Thermo Scientific). The amounts of specific proteins, such as cytokines (HCYP2MAG-62K; Millipore Merck) and bone markers (HBNMAG-51K) in various samples, were determined by the Luminex 200 system

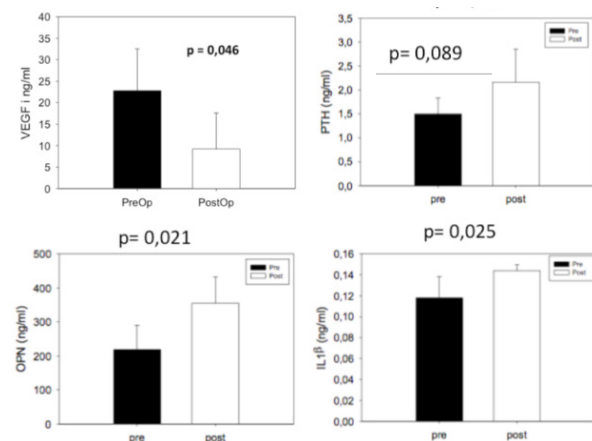


Fig. 1: Average and standard deviation of VEGF, PTH, OPN and IL-1 β in bone marrow aspirates before and after bariatric surgery.

where acquired fluorescence data were analyzed using the 3.1 xPONENT software (Luminex).

RESULTS & DISCUSSION:

Analysis of the protein content in bone marrow aspirates from a smaller group of non-identical patients before (n=5) and after (n=5) surgery indicate that the level of VEGF was reduced by more than 60% and leptin by 50%, whereas the level of OPN and IL-1 β were enhanced after surgery, by 60% and 20%, respectively.

CONCLUSIONS:

Our current results shows differences in the protein profiles in bone marrow aspirates, before gastric bypass surgery and one year after the surgery.

Signalling pathways identified in salivary glands from primary Sjögren's syndrome patients reveal enhanced adipose tissue development

Lara A Aqrabi¹, Janicke L Jensen¹, Gunnvor Øijordsbakken², Ann-Kristin Ruus¹, Ståle Nygård¹, Marit Holden¹, Roland Jonsson², Hilde K Galtung¹, Kathrine Skarstein^{2,3}

¹*Affiliations at UiO, OUH, and Norwegian Computing Centre*

²*Affiliations at the University of Bergen*

³*Haukeland University Hospital, Bergen*

Adipocytes can occupy a large portion of the salivary glands in primary Sjögren's syndrome patients, although little is known about their significance. Through microarray analysis on salivary gland tissue from patients and controls, we identified signaling pathways leading to prominent adipose tissue development, interferon production, inflammatory responses, and lymphoma development.

BACKGROUND:

A characteristic feature of primary Sjögren's syndrome (pSS) is the destruction of salivary and lacrimal glands mediated by mononuclear cell infiltration. Adipocytes can also occupy a large portion of the salivary gland (SG) tissue area, although little is known about their significance in pSS. We have previously investigated adipose tissue infiltration in SG biopsies from pSS patients and non-SS sicca controls¹. Our findings indicated distinct incidence of adipose tissue replacement in pSS patients, where adipocytes were detected in interleukin (IL) 6 rich regions. We now aimed to examine the development of adipocytes in the SG microenvironment, and delineate their possible involvement in immune reactions.

METHODS:

A microarray analysis was performed on SG from 6 pSS patients and 6 non-SS controls, where the expression levels of genes involved in adipose tissue development, inflammatory responses, and lymphoma development were assessed. Real-time PCR was carried out on SG from 14 pSS patients and 15 non-SS controls to account for IL6, IL10 and IL17 mRNA levels.

Immunohistochemical staining of frozen SG tissue using IL17 was also conducted.

RESULTS & DISCUSSION:

Our results indicate signalling pathways identified in SG of pSS patients displayed genes leading to prominent adipose tissue development and reduced mitochondrial fatty acid beta-oxidation (ARID5B, OXCT1, BDH1, SOX8, HMGCS2, FTO, ECHS1, PCCA, ACADL and ACADVL), inflammatory responses (IL1R1, IL7R, IL10RA, IL15, IL18RAP, CCL2, CCL5, CCL22, CXCR6, CD14, and CD48), and lymphoma development via JAK-STAT signalling (STAT2, TYK2, EBI3, FAS, TNFRSF1B, MAP3K8, HMOX1, LTB, TNF, STAT1 and BAK1). Genes involved in interferon production and signalling were also detected (IRF1, IRF9, IRF7), in addition to IL6, IL10, and IL17. Higher mRNA levels of IL6, IL17 and IL10 were observed in the SG of pSS patients compared to controls. Moreover, IL17 positive cells were detected mostly interstitially in the SG and around adipocytes, also within the focal infiltrates.

CONCLUSIONS:

Adipocyte development seems to be more prominent in the SG of pSS patients, where adipose tissue replacement is also evident. Whether this is due to disease progression, or the repair process, remains to be investigated. Detection of IL17 positive adipocytes in the target organ suggests their involvement in immune reactions.

REFERENCES:

¹Skarstein K, et al. (2016), *Autoimmunity*. 49(5):338-46

The effect of a dentist administered cognitive behavioural therapy (D-CBT) in adult patients with dental fear

Mariann S Hauge¹, Tiril Willumsen¹, Bent Storå¹

¹*Universitetet i Oslo, Tannhelsetjenestens Kompetansesenter Sør*

The present study means to develop and test a method for the treatment of dental fear designed to be used by a dentist (D-CBT -dentist administered cognitive behavioural treatment) and compare it to a combined pharmacological common-sense approach. This is done through a randomized controlled trial performed in a general dental practice. Treatment effect will be measured in dental fear levels. There will also be an assessment of quality of life, oral quality of life and ability to receive dental treatment. Follow-up studies will be done 1 and 3 years following treatment.

BACKGROUND:

Dental fear is common in adults and has a prevalence of about 10-25%³. There are several studies that demonstrate reduced oral health in people with dental fear compared to the general population².

Psychological interventions -usually in the form of cognitive behavioural therapy (CBT) performed mainly by psychologists have proved to be useful in the treatment of dental fear in several studies¹, and also when performed by dentists the treatment results are promising⁴.

METHODS:

80 patients will be included in the study. The inclusion criteria are self-reported strong dental anxiety that affects the patient's ability to go through dental treatment and age over 18. The author will perform all treatments in both groups. Manuals detailedly describe both methods have been developed, and videos taken of all treatments to ensure adherence to manuals.

RESULTS & DISCUSSION:

An effective treatment method designed for a regular dentist general practice could make dental

fear treatment more easily accessible to people suffering under the condition.

CONCLUSIONS:

D-CBT could be incorporated into the curriculum of dental students. This has potential not only to increase their ability to help people which have already developed dental fear, it would probably also enhance their abilities to prevent fear from arising, due to better skills in treating fearful patients and in addition better knowledge about what provokes – and what prevents – anxiety during dental treatment.

REFERENCES:

- ¹Armfield, J. M., & Heaton, L. J. (2013), *Aust Dent J*, **58**(4), 390-407
- ²Hakeberg, M., & Berggren, U. (1993), *Community Dent Health*, **10**(1), 23-29
- ³Oosterink, F. M., de Jongh, A., & Hoogstraten, J. (2009), *Eur J Oral Sci*, **117**(2), 135-143
- ⁴Willumsen, T., Vassend, O., & Hoffart, A. (2001), *Acta Odontol Scand*, **59**(6), 335-340.

Do child characteristics influence recall intervals for Norwegian children?

Sonja Y Løken¹, Tov I Wigen¹, Nina J Wang¹

¹*Department of Paediatric Dentistry and Behavioural Science, Institute of Clinical Dentistry, UiO*

Recall routines in dental care have consequences for patients, dental personnel and policy-makers. Since the 1990s, intervals between routine examinations in the dental services have gradually been extended and individualized in Norway concurrent with improvements in oral health. The aim of this longitudinal study was to explore changes in recall intervals for children aged 5 to 12 years, and study associations with caries experience, parents' national background and education and recall intervals.

BACKGROUND:

There is lack of information about recall intervals between dental examinations practiced in child dentistry and whether the recall routines influence the dental health in children¹. Recently it has been suggested in many countries that standardized recall intervals are inappropriate and that recall intervals should be individualized based on risk assessment²⁻⁴.

METHODS:

This study included 2960 children in one county in Norway monitored from 5 to 12 years of age. Data were collected at clinical examinations, from dental records and by parental questionnaires. Length between recall intervals was dichotomised into short (shorter than 18 months) and long (18 months and longer). Data were analysed using Chi-square statistics and logistic regression. Informed consent was obtained from parents and the study was ethically approved.

RESULTS & DISCUSSION:

The main results were that recall intervals were individualised, varied from 4 to 24 months, mean 18.2 (SD 4.2) at 5 years of age, and mean 17.2 (SD 3.8) at 12 years of age. Among the 704

children with short recall intervals at 5 years of age half (366) still had short intervals at age 12 years. Among the 2256 children with long recall intervals at age 5 years, the majority (1613) had long intervals at 12 years of age. Multivariate logistic regression analyses controlled for caries experience and characteristics of children showed that the probability of having short interval was higher in children having caries experience than in caries-free children at both 5 years (OR 12.6 CI 9.9-16.0) and 12 years (OR 2.7 CI 2.3-3.1). In addition, at 5 years of age, length of recall intervals was associated with parents' national background (OR 1.8 CI 1.4-2.4) and parents' education (OR 1.3 CI 1.0-1.5).

CONCLUSIONS:

In the population studied, the majority of children had long recall intervals at both ages. The results indicated that recall intervals were associated with caries prevalence and that family characteristics influenced recall intervals in preschool children more strongly than in older children.

REFERENCES:

- ¹P. Riley, H.V. Worthington, J.E. Clarkson and P.V. Beirne (2013), *The Cochrane Database of Systematic Reviews*.
- ²*American Academy of Pediatric Dentistry* [http://www.aapd.org/media/Policies_Guidelines/G_Periodicity.pdf]. Accessed 13 August 2018.
- ³*National Institute for Clinical Excellence* [<https://www.nice.org.uk/guidance/cg19>]. Accessed 13 August 2018.
- ⁴S.M. Lahti, H.W. Hausen, E. Widstrom, A. Eerola (2001), *International Dental Journal* 51(2):57-61.

New animal model of extrinsic dental erosion-erosive effect on the mouse molar teeth

Amela Tulek¹, Muhammad Saeed¹, Aida Mulic²,
Kjersti R Stenhagen³, Tor P Utheim^{1,4,5}, Hilde K Galtung¹, Cuong Khuu¹,
Minou Nirvani¹, Marthe S Kristiansen¹ and Amer Sehic^{1,2}

¹Department of Oral Biology, Faculty of Dentistry, University of Oslo,

²Nordic Institute of Dental Materials (NIOM AS), Sognsveien 70A, Oslo

³Department of Cariology, Institute of Clinical Dentistry, University of Oslo

Dental erosion is caused by frequent contact between the tooth surface and acids. Consumption of acidic food and drinks are considered as important risk factors. The aim of this study was to create an animal model of extrinsic dental erosion, which may serve as a suitable standard for future studies.

BACKGROUND:

Several chemical and mechanical impacts contribute to the wear of the dentition. Dental erosion has been accepted to be a multifactorial condition caused by various extrinsic and intrinsic acid source¹. Extrinsic acids are mainly acidic drinks and food. There are only few studies that have investigated the influence of certain risk indicators related to dental erosion in animal models²⁻⁵.

METHODS:

Two acidic drinks, sports drink and cola drink, were given to young mice for six weeks. Experimental and control (water) molars and incisors were dissected out and observed by scanning electron microscopy (SEM). Mandibular first molars were subsequently ground transversely and observed again by SEM. The tooth height and enamel thickness were measured on the SEM images

RESULTS & DISCUSSION:

The lingual surface of the mandibular molars was most eroded after consumption of acidic drinks. The cola drink exhibited higher erosive effect on mandibular molars compared to sports drink. The lingual tooth height, compared to control, was about 34% and 18% lower in the cola drink

and sports drink molars, respectively. Compared to the control molars, the lingual enamel was about 23% thinner in the sports drink molars and totally eroded on the certain lingual areas of the cola drink molars.

CONCLUSIONS:

This new animal model of extrinsic dental erosion and the presented method with ground molars observed in SEM are suitable for further studies, which will gain deeper insights into the erosive disease.

REFERENCES:

- ¹Lussi, A., & Carvalho, T. (2014), *Monogr Oral Sci.*, **25**, 1-15.
- ²Aldosari, M. et al. (2018), *Oral Dis.*, **24**(3), 355-362.
- ³Sorvari, R. (1989). *Proc Finn Dent Soc.*, **85**(1), 13-20.
- ⁴Sorvari, R., & Kiviranta, I. (1988), *Arch Oral Biol*, **33**(4), 217-220.
- ⁵Sorvari, R., Pelttari, A., & Meurman, J. (1996), *Caries Res.*, **30**(2), 163-168.

Attachment and organisation of human mesenchymal stem cells on poly(ethylene glycol) hydrogels

Aman S Chahal¹, Manuel Schweikle¹, Catherine A Heyward¹, Hanna Tiainen¹

¹*Faculty of Dentistry, Department of Biomaterials, University of Oslo*

hMSCs seeded on soft hydrogels clustered irrespective of RGD concentrations and attached in lower numbers with reduced spreading area in comparison to cells on stiff hydrogels.

BACKGROUND:

Poly(ethylene glycol) (PEG) hydrogels have previously been used for tissue engineering and mechanobiology studies^{1,2}. In order for PEG to support cell attachment, strategies typically involve the incorporation of extracellular matrix (ECM) proteins or synthetic peptide fragments such as RGDs. In this study, we investigated the effects of varying RGD concentrations (0.05–2.5 mM) and the stiffness of 4-arm and 8-arm PEG hydrogels on the attachment and organisation of human mesenchymal stem cells (hMSCs).

METHODS:

hMSCs were seeded on hydrogels for 48 hrs prior to image analysis via confocal laser scanning microscopy. R-values were determined from images to deduct the degree of hMSC clustering (n=60). Atomic force microscopy was implemented to measure the stiffness of hydrogel substrates with varying concentrations of RGD.

RESULTS & DISCUSSION:

Atomic force microscopy (AFM) results indicated no significant changes in stiffness upon RGD tethering for both soft ($E = 7.4 - 11.2$ kPa) and stiff ($E = 27.3 - 36.8$ kPa) hydrogels. However, hMSCs exhibited differences in attachment numbers and organisational morphologies in response to stiffness changes and ligand availability. hMSCs seeded on soft hydrogels attached in lower numbers with reduced spreading area in comparison to cells on stiff hydrogels. Furthermore, hMSCs on soft hydrogels clustered irrespective of RGD concentrations. In contrast, cells seeded on stiff

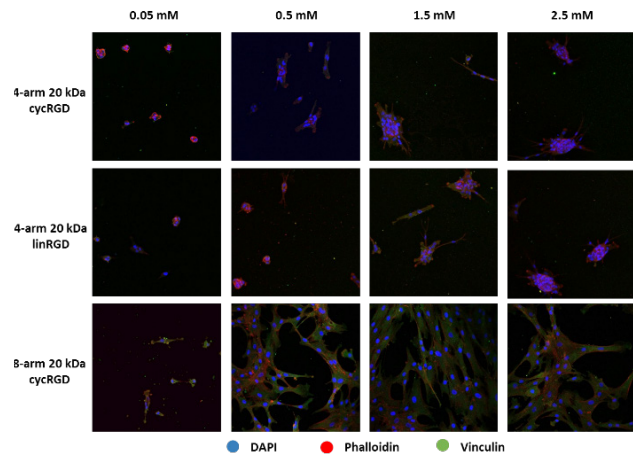


Fig. 1: hMSC morphology on PEG hydrogels with varying stiffness and RGD concentrations via confocal laser scanning microscopy.

hydrogels with RGD concentrations of 0.5 mM or more, exhibited spread morphologies. Our results highlight an interplay between substrate stiffness and ligand availability of RGD ligands that contribute to the organisation and attachment of hMSCs on PEG hydrogels.

CONCLUSIONS:

This study expands our current knowledge regarding tissue engineering and mechanobiology templates by providing an understanding of how hMSCs initially interact and colonise the surface of PEG hydrogels.

REFERENCES:

- ¹M.P. Lutolf, et al. (2003), *Advanced Materials* **15**(11) 888-892.
- ²W.G. Herrick et al. (2013), *Biomacromolecules* **14**(7) 2294-2304.

Bacterial attachment to nanostructured surfaces

Pawel Kallas¹, Mats Hulander², Håkon Valen³, Martin Andersson², Håvard J Haugen¹

¹Department of Biomaterials, Institute of Clinical Dentistry, University of Oslo

²Department of Chemistry and Chemical Engineering, Chalmers University of Technology, Sweden

³Nordic Institute of Dental Materials, Sognsveien 70A, 0855 Oslo

Our experiments aim at characterizing attachment of bacteria present in oral cavity and those that are prevalent species associated with infections of medical devices to surfaces coated with nanoparticles, and observing whether the distance between the nanoparticles has any significant influence on bacterial adhesion.

BACKGROUND:

Oral cavity is populated by more than 700 prokaryote species. Some of them play no significant role in our daily life, but presence of the others may lead to gum disease, such as periodontitis, or tooth decay, which could result in tooth replacement with dental implant¹. That gives the opportunities to bacteria to colonize new areas (e.g. surface of the implant) and as a result - infect host's body^{2,3}.

Nowadays, many implants are coated with nanoparticles, which might present different properties, such as antimicrobial activity. The influence of distance between nanoparticles on bacteria adhesion is not well known yet.

METHODS:

Nanostructured surfaces were fabricated by functionalizing substrates, so negatively charged nanoparticles could attach to them. To perform bacterial studies within a single experiment, nanoparticle gradients were formed. The gradients have been characterized by using scanning electron microscopy (SEM). Bacteria were injected on the nanostructured surfaces. Following bacteria species were examined: *Streptococcus mitis*, *Staphylococcus aureus* and *Staphylococcus epidermidis*. Number of bacteria attached to the surface was calculated using ImageJ.

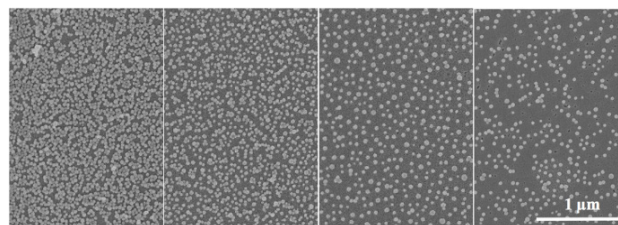


Fig. 1: SEM images of nanoparticle gradient.

RESULTS & DISCUSSION:

The nanoparticle gradients were obtained. The change of the density and distribution of nanoparticles is presented on Fig. 1. We could observe that the density of nanoparticles is gradually changing over a given distance. Different behavior during attachment to the gradients was observed between tested bacteria species.

CONCLUSIONS:

Three different types of bacteria were tested towards their ability to attach to nanostructured surfaces. The differences observed between their attachment could lead us to the conclusion that distribution of nanoparticles has influence on bacterial adhesion to nanocoated surfaces. Future tests will be focused on different time points of attachment.

REFERENCES:

- ¹J. A. Aas, et al. (2005), *Journal of Clinical Microbiology* **43**(11): 5721–5732.
- ²A. Buddula (2013), *Journal of Dental Implants* **3**(1): 58-61.
- ³M. Shahabouee, et al. (2012), *Dental Research Journal* **9**(2): 215-220.

The salivary microbiota profile in reduced and normal salivation

Shermin Rusthen¹, Anne K Kristoffersen², Alix Young¹, Hilde K Galtung²,
Morten Enersen², Janicke L Jensen¹

¹*Institute of Clinical Dentistry, Faculty of Dentistry, University of Oslo*

²*Department of Oral Biology, Faculty of Dentistry, University of Oslo*

The major aim of this study was to examine the salivary microbiota in primary Sjögren's syndrome (pSS), dry mouth patients (non-SS) and healthy controls. We detected altered microbiota profile in pSS and non-SS samples indicating dysbiosis.

BACKGROUND:

Primary Sjögren's syndrome (pSS) is an autoimmune disease characterized by reduced lacrimal and salivary secretion, fatigue, and muscle and joint pain, negatively impacting on quality of life. Furthermore, the reduction in salivary secretion may disrupt the oral microbial homeostasis. The Dry Mouth Clinic at the Faculty of Dentistry was established to evaluate and care for dry mouth patients and search for salivary disease biomarkers^{1,2}. The aim of this study was to compare the salivary microbiota from -pSS patients with: (a) patients with sicca symptoms and findings but not fulfilling the classification criteria for pSS (non-SS) and (b) subjects without sicca complaints (healthy controls).

METHODS:

Pellets were prepared by centrifuging chewing-stimulated whole saliva from pSS patients (n=15), non-SS patients (n=15), and healthy controls (n=15). DNA was extracted. Bacterial DNA analysis by PCR and 16S *rRNA* gene sequencing was then performed. Analysis of the acquired sequencing data was carried out by using the human oral microbiome database (HOMD).

RESULTS & DISCUSSION:

The presence of 39, 59, and 37 bacterial genera, respectively, was detected in samples from pSS patients, non-SS patients and healthy controls.

Several genus groups such as *Anaeroglobus*, *Parvimonas*, *Tannerella*, and *Treponema* were only found in pSS and non-SS patients. In contrast, some genera, such as *Peptostreptococcus*, *Campylobacter*, and *Bifidobacterium*, were only detected in non-SS and healthy control samples. At species level, some variations were observed: *Fusobacterium nucleatum subsp. vincentii*, *Porphyromonas endodontalis*, *Prevotella intermedia*, *Tannerella spp.*, and *Treponema spp.* were only detected in pSS samples, while *Porphyromonas pasteri* was most consistently present in control samples (pSS 5 of 15, non-SS 9 of 15, controls 12 of 15).

CONCLUSIONS:

The results from this study indicate signs of dysbiosis in the salivary microbiota of pSS and non-SS patients compared to healthy controls. These findings may constitute a basis for future salivary disease biomarkers.

REFERENCES:

- ¹Fox, RI (2005), *Lancet*, **366**(9482): p. 321-31.
- ²Almstah, IA , et al. (2003), *Oral Microbiol Immunol*, **18**(1): p. 1-8.

Increased numbers of Langerhans cells in the epithelium of oral lichen planus are due to recruitment from hematopoietic precursors

Maren B Solhaug¹, Inger J S Blix^{1,2}, Else K B Hals³, Bjarte Grung⁴, Karl Schenck¹, Espen S Bækkevold^{1,5}

¹Department of Oral Biology, Faculty of Dentistry, University of Oslo

²Department Periodontology, Faculty of Dentistry, University of Oslo

³Tannlegene i Bogstadveien 1, Oslo

⁴Drammen oralkirurgi, Drammen

⁵Department of Pathology, Faculty of Medicine, University of Oslo

In this study we show that a significant fraction of oral mucosal Langerhans cells (oLCs) are dividing in steady state and that it is likely that increased numbers of oLCs in the epithelium of oral lichen planus (OLP) are not a result of local proliferation, indicating that they are replenished by hematopoietic precursors. We have also established a flow cytometric method for future characterization of human oral LCs.

BACKGROUND:

Oral Langerhans cells (oLCs) are antigen-presenting cells residing in the epithelium of the oral mucosa¹. Recent research has greatly extended the knowledge about skin LCs origin and homeostasis², but for human oLCs, this knowledge is lacking³. Several studies have shown increased numbers of Langerhans cells in the epithelium of OLP lesions^{4,6}. The aim of this study was to investigate if the increased numbers of Langerhans cells are a result of local proliferation or recruitment from hematopoietic precursors.

METHODS:

Oral mucosal biopsies from healthy persons and from patients diagnosed with OLP were processed for immunohistology and stained with the markers Langerin, Ki67 and MHC II. Other biopsies were processed, stained and analyzed by flow cytometry.

RESULTS & DISCUSSION:

We found that a significant fraction of Langerhans cells are Ki67+ in steady state. We also found that the fraction of Ki67+ LCs was statistically

significantly lower in OLP, which indicates that the increased numbers of LCs are not a result of local proliferation, but rather of recruitment from hematopoietic precursors.

CONCLUSIONS:

Our results suggest that oLCs constitute a self-renewing population in steady state, and that the increased numbers of LCs in OLP are not a result of increased local proliferation, but rather caused by recruitment from hematopoietic precursors. Further analysis will include staining with classical monocyte- and dendritic cell markers to elucidate the origin of the cells.

REFERENCES:

- ¹Romani, N et al. (2012), *J Invest Dermatol*, **132**: 872-81.
- ²Collin, M and P Milne (2016), *Curr Opin Hematol*, **23**: 28-35.
- ³Capucha, T et al. (2015), *Immunity*, **43**: 369-81.
- ⁴Gueiros, L A, et al. (2012), *Oral Surg Oral Med Oral Pathol Oral Radiol*, **113**: 661-6.
- ⁵Devi, M et al. (2014), *J Pharm Bioallied Sci*, **6**: S146-9.

Antibacterial activity of endodontic sealers against planktonic bacteria and bacteria in biofilms

Vasileios Kapralos¹, Andreas Koutroulis², Dag Ørstavik¹, Pia T Sunde¹,
Håkon V Rukke³

¹Department of Endodontics, Institute of Clinical Dentistry, Faculty of Dentistry, University of Oslo,

²Department of Restorative Dentistry, School of Dentistry, University of Birmingham, UK

³Nordic Institute of Dental Materials, Oslo

Endodontic sealers should ideally eliminate residual bacteria and prevent reinfection after chemomechanical treatment and obturation of the root canal. The present study investigated the antimicrobial effect of 4 endodontic sealers against gram-positive planktonic and biofilm bacteria

BACKGROUND:

It has been reported that about 35% of the root canal area is left untouched when conventional rotary and hand instruments are used for the mechanical root canal preparation¹. Therefore, bacteria may remain in the root canal system even after mechanical and chemical treatment, which may affect the periapical healing. This creates a “challenging environment” for the endodontic materials and indicate a need for new “anti-biofilm” treatment strategies. Hence, the development of new materials that hold the desired anti-biofilm properties is critical topic in oral diseases control.

METHODS:

The antibacterial activity of the sealers AH Plus, TotalFill BC sealer, RoekoSeal, and Guttaflow 2 was investigated in water or non-water conditions for planktonic grown and 24-hour-old biofilms of *Enterococcus faecalis*, *Staphylococcus epidermidis*, *Staphylococcus aureus*, and *Streptococcus mutans*.

RESULTS & DISCUSSION:

AH Plus had high antibacterial activity toward all species investigated, both planktonic and in biofilms. However, the antibacterial activity was lost after 24 hours. TotalFill BC sealer showed marked antibacterial effect on planktonic bacteria up to 7 days after setting. Guttaflow 2 and RoekoSeal had no antibacterial activity against

planktonic bacteria or bacteria in biofilms. In the present study, monospecies biofilms were used to investigate the antibacterial activity of the selected sealers. However, the infected root canal typically contains only multispecies biofilm communities. Different bacteria share duties and privileges in the biofilm community. Thus, it is reasonable to suspect that multispecies biofilm may have lower susceptibility toward the antibacterial activity of sealers.

CONCLUSIONS:

The presence of a well-established multispecies biofilm model will give new insight into the antibacterial activity of endodontic materials. Further studies investigating the antibacterial effect of sealers should be performed by using multispecies biofilms.

REFERENCES:

¹Peters OA, Schonenberger K and Laib A. (2001), *Int Endod J*, **34**:221–30.

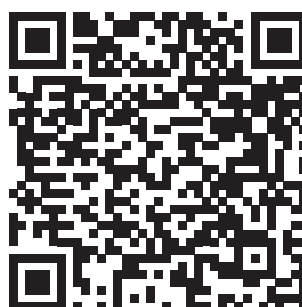
List of abstracts

Anna-Karin Abrahamsson	<i>Regression of erosive osteoarthritis in the temporomandibular joint: a follow-up study of adolescents</i>
Lara Aqrabi	<i>Signalling pathways identified in salivary glands from primary Sjögren's syndrome patients reveal enhanced adipose tissue development</i>
Maria Balta	<i>Resolvin E1 upregulates the mRNA levels of its receptor in whole blood from healthy donors but not from periodontitis patients</i>
Christine Baumgartner	<i>Oral health behaviour and family characteristics in 12-year-olds</i>
Aman Chahal	<i>Attachment and organisation of human mesenchymal stem cells on poly(ethylene glycol) hydrogels</i>
Emily Dahlbo	<i>Study on gene expression level in Porphyromonas gingivalis strains</i>
Sushma Dhakal	<i>Investigation of mutual interaction between Helicobacter pylori (HP) and oral epithelial keratinocytes during oral cancer progression</i>
My Diep	<i>Oral health of 65-year-olds in Oslo</i>
Randi Eftedal	<i>Interleukin 6 in primary osteoarthritis</i>
Mariann Hauge	<i>The effect of a dentist administered cognitive behavioural therapy (D-CBT) in adult patients with dental fear</i>
Sigrid Haugen	<i>Adiponectin reduces bone stiffness: verified in a 3D artificial human bone model in vitro</i>
Øyvind Haugen	<i>Is the lactate receptor HCAR1 regulated by microRNAs?</i>
Erik Hjelkrem	<i>Characterization of cytokines and bone markers in apical lesions from patients with persistent apical periodontitis</i>
Caroline Hol	<i>Disc displacement in the temporomandibular joints: long-term radiological follow-up of patients with surgical repositioning treatment</i>
Jørgen Hugo	<i>An in vitro model for the study of class II furcation defects</i>
Ann Catrin Høyvik	<i>Dental anxiety in relation to torture experiences and symptoms of post-traumatic stress disorder</i>
Pawel Kallas	<i>Bacterial attachment to nanostructured surfaces</i>
Vasileios Kapralos	<i>Antibacterial activity of endodontic sealers against planktonic bacteria and bacteria in biofilms</i>
Anne Klemm	<i>Grain boundary corrosion in Sr and Ca doped TiO₂ bone scaffolds</i>
Sonja Løken	<i>Do child characteristics influence recall intervals for Norwegian children?</i>
Emeline Mandal	<i>18-year follow-up of 160 consecutive individuals born with unilateral cleft Lip or cleft lip and alveolus treated by the Oslo Cleft Lip and Palate Team</i>
Ingvild Midtervoll	<i>The blood microbiome and death from CVD in elderly men</i>
Minou Nirvani	<i>Transcriptomic analysis of microRNA expression in enamel-producing cells</i>
Margareth Ottersen	<i>Reliability and validity of panoramic imaging in the assessment of TMJ osteoarthritis using CBCT as gold standard</i>
Lisa Printzell	<i>Minimal effect of irradiation on the survival of human mesenchymal stem cells on titanium surfaces in vitro</i>
Shermin Rusthen	<i>The salivary microbiota profile in reduced and normal salivation</i>
Gro Rørvik	<i>The role of the second messenger C-di-AMP in the oral commensal Streptococcus mitis</i>
Maria Schröder	<i>Growing artificial bone in rotating bioreactors, a model system for identifying molecular mechanisms of treatment</i>

Manuel Schweikle	<i>Self-mineralising synthetic injectable hydrogels for bone repair</i>
Maren Solhaug	<i>Increased numbers of Langerhans cells in the epithelium of oral lichen planus are due to recruitment from hematopoietic precursors</i>
Kjersti Sturød	<i>Antibiotic induced streptococcal competence do not always correlate with transformability</i>
Ida Stødle	<i>Antibiotic resistance in anaerobic bacterial isolates in Norway</i>
Safiyye Süslü	<i>Changes in protein profile in bone marrow extracts and bone biopsies before and one year after gastric bypass surgery</i>
Helene Sæthre-Sundli	<i>Caries development from 5 to 12 years of age</i>
Kristine Tanem	<i>Taste function and oral late effect in long-term survivors after treatment during of medulloblastoma and supratentorial primitive neuroectodermal tumor</i>
Nina Torgersbråten	<i>A comparison of skeletal Class II open bite correction by maxillary versus mandibular surgery</i>
Amela Tulek	<i>New animal model of extrinsic dental erosion-erosive effect on the mouse molar teeth</i>
Charlotte Rosenberg Ulstad	<i>Transfer of multidrug resistant plasmids from salmonella to commensal Escherichia coli in healthy human carriers</i>
Florian Weber	<i>Impact of metalloid ions on the coating formation of polyphenolic molecules</i>
Kristine Westgaard	<i>Oral health in head and neck cancer survivors</i>
Elisabeth Wiig	<i>Modulation of inflammatory response to implants</i>
Hauk Øyri	<i>Alveolar osteitis – investigation of clinical characteristics and local expression of cytokines</i>



LIST OF ABSTRACTS



HANDOUT VERSION

