17e journée de la recherche

du Groupe de recherche en écologie buccale

Jeudi, 1 mai 2025

Faculté de médecine dentaire, salle 2615

Faculté de médecine dentaire

UNIVERSITÉ LAVAL

MOT DE BIENVENUE

C'est avec plaisir que je vous invite à cette 17e Journée de la recherche du Groupe de recherche en écologie buccale (GREB) qui aura lieu le 1 mai 2025. J'espère que cette activité scientifique annuelle sera pour vous une occasion propice pour apprécier la qualité, la diversité et la pertinence des travaux de recherche menés par les professeurs et les étudiants du centre de recherche.

Je profite de cette tribune pour remercier chaleureusement les étudiants et les professeurs qui contribuent à cette journée par une présentation orale ou par une affiche faisant état de leurs travaux. C'est grâce à votre participation, chères étudiantes et chers étudiants que la tenue de cette 17e journée de la recherche du GREB/FMD s'est concrétisée.

Je tiens à souligner la contribution très appréciée des collègues qui ont généreusement accepté d'agir comme évaluateurs. Que ces scientifiques soient remerciés pour leur grande disponibilité et leur dévouement.

Mes remerciements vont également à toute personne qui a collaboré de près ou de loin à la réussite de notre 17e Journée de la recherche incluant le personnel du secrétariat de la Faculté, des services des communications et des technologies de l'information.

Finalement, je ne peux passer sous silence l'appui financier de la direction du GREB, du Réseau Québécois de recherche intersectorielle en santé buccodentaire et osseuse durable (RiSBOd) et de la Faculté de médecine dentaire pour cette journée. Qu'ils en soient chaleureusement remerciés.

Que cette Journée de la recherche soit une occasion privilégiée de diffusion des connaissances, d'échanges et de collaborations fructueuses.

Pr Mahmoud Rouabhia
Président du comité organisateur de la journée de la recherche

Comité organisateur

Mahmoud Rouabhia, professeur, Faculté de médecine dentaire
Fatiha Chandad, professeure et directrice du GREB, Faculté de médecine dentaire
Mouhsine El Abboudi, Conseiller en développement de la recherche
Raphael Freitas de Souza, professeur, Faculté de médecine dentaire
André Luis Faria-e-Silva, professeur, Faculté de médecine dentaire
Maryam Bahraminia, étudiante au doctorat

Comité d'évaluation des présentations par affiches

Fatiha Chandad, professeure, Faculté de médecine dentaire
Vanessa Houde, Professeure, Faculté de médecine dentaire
André Luis Faria-e-Silva, Professeur, Faculté de médecine dentaire
Christine Nadeau, Professeure, Faculté de médecine dentaire
Liliane Aboud, Professeure, Faculté de médecine dentaire

Comité d'évaluation des présentations orales

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Remise des prix

Fatiha Chandad, professeure, Faculté de médecine dentaire et directrice du GREB
Mahmoud Rouabhia, professeur, Faculté de médecine dentaire

17e Journée de la recherche du Groupe de recherche en écologie buccale
Jeudi 1 mai 2025

PROGRAMME DE LA JOURNÉE

8h30-8h40	**Mot de bienvenue** : Mahmoud Rouabhia, Professeur, Faculté de médecine dentaire
Présentations orales	
8h45-9h00	**Sana Baroudi**, Doctorat en Immunologie-oncologie, sous la supervision de Abdelhabib Semlali Selective anti-tumor effects of hydroxychloroquine in human gingival carcinoma cells
9h00-9h15	**Leyla Desparois**, Maitrise en microbiologie, Sous la supervision de Vanessa Houde Acide hyaluronique et N-acétyle-cystéine pour traiter l'inflammation in vitro
9h15-9h-30	**Maryam Bahraminia**, Doctorat en microbiologie, Sous la supervision de Mahmoud Rouabhia CBD-Loaded Hydrogel : A Novel Approach to Manage Inflammatory Diseases
9h30-9h45	**Ibrahim Hoja**, Stagiaire postdoctoral, sous la supervision de Petros Papagerakis Circadian Clock Regulation of Salivary Gland Development and Maturation
10h00-10h30	**Pause-Café**
10h30-11h15	**Conférencier invité** : Christopher Fletcher, professeur, département de médecine sociale et préventive, Université Laval Relations de pouvoir, relations d'espoir : jalons historiques et contextes contemporains de la recherche en santé autochtone
11h15-11h30	**Neshat Eghbali**, Doctorat en génie des matériaux et de la métallurgie, sous la supervision de Diego Mantovanie Oxygen plasma immersion ion implantation treatment for potential enhanced biological response of Ti-6Al-4V alloy for dental applications
11h30-11h45	**Damitha Guanthilake**, stagiaire postdoctorale, sous la supervision de Sylvain Moineau Expanding Host Range of Bacteriophage AKVF33 through Tail Fiber Engineering
11h45-13h30	**Lunch et évaluation des affiches**
13h30-14h00	**Conférencier invité** : Lyne Létourneau, professeure Faculté des sciences de l'agriculture et de l'alimentation, Université Laval Conduite responsable en recherche
14h00-14h15	**Fatima Zahra Laaboudi**, Doctorat en chimie, Sous la supervision de Mahmoud Rouabhia Effects of Δ-9-tetrahydrocannabinol (THC) vaped aerosol on oral Candida albicans

14h15-15h00	**Conférencier invité** : Maria j. Fernandes, professeure à la faculté de médecine, Centre de recherche du CHU de Québec - Université Laval Caractérisation de l'effet inhibiteur de CLEC12A sur l'inflammation : implications pour la parodontite.
15h00-15h15	**Manal Dahdah**, Doctorat en biochimie, sous la supervision de Abdelhabib Semlali Viroelixir: Une approche naturelle et innovante contre le cancer buccal
15h15-15h30	**Mariana Pires Figueiredo**, stagiaire postdoctorale, sous la supervision de Diego Mantovani Développement d'un revêtement proactif ostéogénique et bactéricide pour améliorer la performance clinique des implants dentaires en titane
15h30-15h45	**Meenakshi Pundir**, stagiaire postdoctorale, sous la supervision de Petros Papagerakis Innovative Aptamer-Based Sensing Technique for Salivary Biomarker Detection
15h45-16h00	**André Luis Faria-e-Silva,** professeur, Faculté de médecine dentaire, Université Laval Effets du blanchiment dentaire sur l'harmonisation colorimétrique des restaurations avec composites monoteinte
16h00-16h30	**Remise des prix et mot de la clôture**

LISTE DES PRÉSENTATIONS PAR AFFICHE

Affiche	Auteurs	Titre
1	Carlos Henrique Michelin Beraldo et al.,	Cytotoxicity and Antimicrobial Activity of Electroformed Fe-Co Alloys
2	C.A. Cuao-Moreu et al.,	3D-Printed Biodegradable FeMnC Alloys for Maxillofacial Applications
3	C. Aude et al.,	Zinc oxide doped diamond-like carbon as antibacterial and adherent coatings for dental applications
4	Nathália Fernanda Sczesny et al.,	Surface Modifications of Polyetheretherketone (PEEK) for Dental Implants Applications
5	Kugambikai Vangetaraman et al.,	Nanofibrous Polyurethane/Chitosan Guided Bone Regeneration Membrane for Alveolar Bone Regeneration
6	José Luis Quijano Mendoza et al	Antimicrobial peptides (AMPs): An interesting approach to enhance osseointegration and gingival adhesion
7	Jayne Hannah Nicolette Sui et al	Keratin: A Prospective Material for Periodontal Applications
8	Malvestiti, Luciana. Paternoster et al.,	Oxygen plasma immersion ion implantation improves the performance of biodegradable Mg-alloys for bone applications
9	Tahani Zorgui et al.,	Développement d'échafaudages à cellules ouvertes pour l'ingénierie tissulaire osseuse via une approche innovante de moussage et de biofonctionnalisation in situ
10	Hawraa Issa et al.,	A new series of bioactive glasses for periodontitis management
11	Nesma El-Amier et al.,	A new series of bioactive glasses for periodontitis management
12	Praveen Bhoopathi Haricharan et al.,	Self-Perceived Masticatory Ability is associated with Cognitive Functioning among Canadian Adults.
13	Omayma Amri et al	Comment prévenir la stomatite prothétique à l'aide d'huile essentielle ?
14	Justine Lefrançois et al.,	Caractérisation des phages mutants échappant aux systèmes de défense contre les phages de Streptococcus thermophilus
15	Élodie Fortin-Hurtubise et al.,	Édition génétique ciblée des bactériophages de Staphylococcus spp.

16	Jiawei Li et al.,	Nanocellulose-based Regenerated Filaments Made from Biomass Provide a Novel Material Platform for Medicine
17	Sehrish Khan et al.,	Restoring Circadian Rhythms. A strategy for treating oral cancer
18	Raed Said et al.,	The Fourth Dimension of Enamel Organ Formation: A Timely Contribution

RÉSUMÉS DES CONFÉRENCES

Conférencier invité

Christopher Fletcher
Professeur titulaire
Département de médecine sociale et préventive
Université Laval

Relations de pouvoir, relations d'espoir : jalons historiques et contextes contemporains de la recherche en santé autochtone

Dans cette présentation, je proposerai un bref historique du développement de la recherche dans, sur et avec les communautés autochtones au Québec et au Canada. Je mettrai l'accent sur la manière dont la recherche a influencé le développement des communautés autochtones contemporaines et sur la façon dont celles-ci ont reflété, au fil du temps, les préoccupations du gouvernement du Canada et, dans une moindre mesure, du Québec. Une critique autochtone de la recherche, aujourd'hui bien établie et en constante évolution, a mis en évidence les rapports de pouvoir inégaux qui ont marqué les relations de recherche. Trop souvent, les communautés ont été perçues comme de simples lieux de collecte de données, sans réelle prise en compte de leur contexte et de leurs priorités locales.

La création des Instituts de recherche en santé du Canada (IRSC) et de leurs 13 sous-instituts, dont Institut de la santé des Autochtones, en juin 2000 a marqué un tournant dans la conception, le financement et l'évaluation éthique de la recherche. D'importants efforts ont été déployés pour soutenir la formation d'étudiants autochtones dans des domaines liés à la santé, et nous observons aujourd'hui les fruits de ces investissements, notamment par l'augmentation significative du nombre de collègues, d'administrateurs et d'autres professionnels autochtones au sein des universités et des centres de recherche. Cet aperçu offrira un cadre historique et conceptuel pour mieux comprendre les discours contemporains sur la décolonisation de la recherche, l'évolution des contextes et des exigences en matière de financement, ainsi que les transformations des considérations éthiques entourant la recherche avec les communautés autochtones.

Ma présentation s'appuiera sur des exemples concrets tirés de plus de trente ans d'expérience en recherche sur des thématiques liées à la santé et à l'environnement, dans le cadre de projets de collaboration avec des communautés autochtones, principalement avec les Inuits du Nunavik.

Conférencier invité

Maria j. Fernandes
Professeure à la faculté, Faculté de médecine, CR-CHU Université Laval

Caractérisation de l'effet inhibiteur de CLEC12A sur l'inflammation : implications pour la parodontite

RÉSUMÉS DES PRÉSENTATIONS ORALES

Selective anti-tumor effects of hydroxychloroquine in human gingival carcinoma cells

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Introduction: Oral cancer (OC) is the most common head and neck malignancy, with high recurrence and poor prognosis, primarily due to chemotherapy resistance [1,2]. The adverse effects of conventional treatments have prompted researchers to explore safer and more efficient alternatives. Chloroquine (CQ) and its derivative hydroxychloroquine (HCQ) have shown promise due to their autophagy-modulating and immune-regulating properties [3]. These agents could be valuable adjuvants to improve tumor response and reduce chemotherapy side effects.

The objective This study explores the selective anti-tumor effects of CQ and HCQ on OC, focusing on their impact on proliferation, apoptosis, and autophagy. Additionally, we will compare the efficacy of these molecules in combination with chemotherapy drugs to determine their synergistic or additive effects.

Materials and Methods: Non-oncogenic cells (GMSM-K) and oral carcinoma cell lines, including tongue (SCC-9) and gingival (Ca9-22) cells, were exposed to different concentrations of CQ and HCQ. Cell viability, cytotoxicity, and colony formation were assessed using MTT, LDH, and crystal violet assays. Apoptosis and autophagy were evaluated by flow cytometry, and the transcriptomic profiles of related genes were measured by qPCR array.

Results and discussion: Our study revealed that CQ and HCQ selectively reduced cancer cell proliferation, induced cytotoxicity, and inhibited colony formation compared to GMSM-K. However, HCQ showed greater selectivity and efficacy, particularly against Ca9-22. HCQ significantly inhibited cancer cell proliferation at 1 μM, compared to CQ. Both drugs suppressed autophagy in SCC-9 and Ca9-22 cells. Notably, HCQ induced apoptosis in Ca9-22 cells more effectively than in SCC-9. The mean percentage of apoptotic cells in Ca9-22 ranged from 15.29% (untreated) to 26.38% (with 50 μM HCQ), while in SCC-9, it ranged from 12.39%(untreated) to 16.56% (with 50 μM CQ). qPCR analysis revealed distinct gene modulation in Ca9-22 cells, with HCQ upregulating 7 and downregulating 18 autophagy-related genes, while CQ upregulated 5 and downregulated 10. Similarly, HCQ inhibited 17 apoptosis-related genes, whereas CQ downregulated 11. Based on these results, we evaluated the effect of HCQ in combination with cisplatin or 5-FU on Ca9-22 cells. Our results demonstrated that HCQ exhibits a stronger effect than cisplatin or 5-FU, suggesting its potential as an alternative treatment to chemotherapy in human gingival carcinoma.

Conclusion: Our study revealed that CQ and HCQ selectively reduced cancer cell proliferation, induced cytotoxicity, and inhibited colony formation compared to GMSM-K. However, HCQ showed greater selectivity and efficacy, particularly against Ca9-22. HCQ significantly inhibited cancer cell proliferation at 1 μM, compared to CQ. Both drugs suppressed autophagy in SCC-9 and Ca9-22 cells. Notably, HCQ induced apoptosis in Ca9-22 cells more effectively than in SCC-9. The mean percentage of apoptotic cells in Ca9-22 ranged from 15.29% (untreated) to 26.38% (with 50 μM HCQ), while in

SCC-9, it ranged from 12.39%(untreated) to 16.56% (with 50 μM CQ). qPCR analysis revealed distinct gene modulation in Ca9-22 cells, with HCQ upregulating 7 and downregulating 18 autophagy-related genes, while CQ upregulated 5 and downregulated 10. Similarly, HCQ inhibited 17 apoptosis-related genes, whereas CQ downregulated 11. Based on these results, we evaluated the effect of HCQ in combination with cisplatin or 5-FU on Ca9-22 cells. Our results demonstrated that HCQ exhibits a stronger effect than cisplatin or 5-FU, suggesting its potential as an alternative treatment to chemotherapy in human gingival carcinoma.

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Acide hyaluronique et N-acétyle-cystéine pour traiter l'inflammation in vitro

Leyla Desparois[1], Sylvie Louise Avon[1], Fatiha Chandad[1], Diego Mantovani[1,2] et Vanessa Houde[1]

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Introduction :
L'acide hyaluronique (HA) et le N-acétyle-cystéine (NAC) présentent des propriétés bénéfiques pour traiter l'inflammation des tissus, notamment grâce à l'hydratation, la régénération tissulaire et la réduction de l'inflammation. Le HA favorise la cicatrisation en soutenant la prolifération cellulaire (1), tandis que le NAC, en tant qu'antioxydant, atténue le stress oxydatif et module les voies inflammatoires (2), mais leurs effets combinés restent inexplorés.

L'objectif de cette étude d'étudier les effets anti-inflammatoires du HA, du NAC et du HA-NAC combinés chez des kératinocytes gingivaux.

Matériels et Méthodes : Des kératinocytes gingivaux hTert TIGKs ont été cultivés et traités avec de HA de haut poids moléculaire 0,4% (w/v) et/ou du NAC 10mM avec et sans TNF-α recombinant (10 ng/mL). La cytotoxicité cellulaire des traitements a été analysée par MTT. Le profil de sécrétion des cytokines pro-inflammatoires IL-8, IL-6 et MMP-9 a été analysé par ELISA.

Résultats et conclusions : Les traitements de HA, NAC et/ou HA-NAC ne sont pas cytotoxiques pour les kératinocytes. Le HA 0,4% diminue la sécrétion de MMP-9 par les kératinocytes stimulés par le TNF-α tandis que le NAC 10mM a un effet anti-inflammatoire sur la sécrétion d'IL-6. La combinaison HA-NAC diminue la sécrétion d'IL-6 chez les kératinocytes en présence de TNF-α. Aucun des produits testés n'a prévenu la sécrétion d'IL-8 par les cellules stimulées avec le TNF-α. Nos résultats suggèrent un effet anti-inflammatoire du HA, NAC et de la combinaison HA-NAC. En perspective, nous évaluerons le potentiel anti-oxydant de ces composés.

Remerciements : Groupe de Recherche en Écologie Buccale (GREB), LBB: Laboratoire de biomatériaux et de bioingénierie.

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CBD-Loaded Hydrogel: A Novel Approach to Manage Inflammatory Diseases

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Introduction: Nowadays, CBD, a Cannabis derivative, is widely acknowledged for its therapeutic potential, including anti-inflammatory effects. Existing delivery systems, such as suspensions, emulsions, and nanoparticles, can be utilized to deliver this component rapidly to the inflamed area. However, sustained drug release is more beneficial for controlling and improving the inflammatory conditions.

This study aims to develop a CBD-rich hydrogel that ensures prolonged release while preserving CBD's bioactivity for enhanced therapeutic effects.

Materials and Methods: Polyvinyl alcohol (PVA) hydrogels were developed using a cyclic freeze-thaw method involving propylene glycol (PG), vegetable glycerine (VG), or both to enhance CBD solubility. The successful CBD loading was confirmed through macroscopic analysis and Fourier transform infrared spectroscopy (FTIR). Structural characteristics and porosity were assessed via scanning electron microscopy (SEM), while thermal stability was examined using differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). CBD presence and release profiles were evaluated using ultraviolet-visible (UV-Vis) spectrophotometry and UPLC-MS/MS. Lastly, the cytocompatibility of the CBD-enriched hydrogel was validated by assessing Skin keratinocyte cells' adhesion and proliferation.

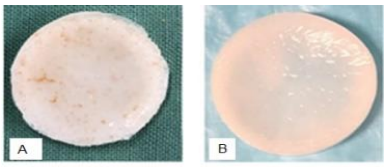

Fig. 1

Results and Discussion: The presence of CBD in the hydrogels was visually approved by a pink coloration (**Fig. 1a**), with PG and VG helping in the uniform distribution of CBD throughout the gel (**Fig. 1b**). FTIR analysis confirmed CBD presence, and SEM imaging revealed fine pores in hydrogels containing PG or VG. DSC analysis demonstrated that VG-containing gels are more amorphous than those without VG. TGA results also confirmed the amorphous structure and thermal stability up to 100°C. Compression tests indicated that the hydrogels could withstand over 60% deformation. UPLC-MS/MS analysis verified a sustained CBD release for at least 72 hours, with PG and VG enhancing release regulation by reducing PVA crystallinity. Additionally, keratinocyte cultures confirmed the cytocompatibility of the hydrogels. This study successfully developed a CBD-rich hydrogel with excellent biocompatibility and prolonged drug release. The hydrogel's ability to sustain CBD delivery makes it a promising candidate for managing tissue inflammation, chronic pain, and wound healing through topical application.

Acknowledgments: M. B. benefits from a studentship from the NSERC CREATE EvoFunPath. This research was funded by an NSERC-Alliance grant (ALLRP 561197 to MR).

Circadian Clock Regulation of Salivary Gland Development and Maturation

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4. Centre Hospitalier Universitaire de Québec Research Centre, Axe Maladies Infectieuses et Immunitaires, Université Laval, QC, Canada

Introduction: The circadian clock is essential for regulating daily physiological functions across nearly all organs, including the salivary glands (SGs). Disruptions in circadian rhythms are associated with various diseases. In SGs, the temporal coordination and complex interactions among different cell types during development and maturation suggest a significant role for the circadian clock in these processes.

The objective: This study investigates how circadian clock dysfunction impacts SG stem/progenitor cell dynamics, secretory maturation, and functional homeostasis, with implications for understanding developmental biology and treating SG-related disorders.

Materials and Methods: We generated a *Bmal1* conditional knockout mouse model (*Bmal1fl/fl;Krt14-Cre*, *n*=3 per group), selectively disrupting the clock in SG epithelial cells. Tissues were harvested at three developmental stages: day 1 postnatal (neonatal), 2-week-old (post-weaning), and 12-week-old (adult) mice. We assessed stem/progenitor cell biomarkers (Sox9, Ascl3) and functional markers (Mucin19, Aquaporin5, alpha-amylase) using RT-PCR, immunohistochemistry (IHC), and immunofluorescence (IF).

Results and discussion: Bmal1 deletion triggered a significant upregulation of stem/progenitor markers Sox9 and Ascl3 in 2-week-old and adult mice, suggesting persistent stem cell activation, but no changes were observed at day 1 postnatal. Functional biomarkers Mucin19 and Aquaporin5 remained stable neonatally but statistically significant upregulated in 2-week-old and adult mice. Conversely, alpha-amylase, a key digestive enzyme, exhibited reduction in 2-weeks-old and adult Bmal1 knockout mice, highlighting divergent regulation of secretory components. Our findings demonstrate that the circadian clock is dispensable during neonatal SG development but becomes essential postnatally to balance stem/progenitor cell activity and functional maturation. The opposing effects on mucins/aquaporins (upregulated) and alpha-amylase (downregulated) suggest clock-dependent partitioning of secretory pathways. These insights underscore the clock's role in maintaining SG homeostasis and offer a mechanistic foundation for targeting circadian pathways to restore function in aging, radiation-induced damage, or autoimmune disorders like Sjögren's syndrome.

Acknowledgements: NSERC and Dr. Petros Papagerakis Startup Fund.

Oxygen plasma immersion ion implantation treatment for potential enhanced biological response of Ti-6Al-4V alloy for dental applications

Neshat Eghbali [a], Carlo Paternoster [a], Francesco copes [a], Diego Mantovani [a]

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Introduction. Ti6Al4V is one of the most widely used metallic materials for dental implants, attributed to its exceptional biocompatibility, excellent mechanical properties, and superior corrosion resistance. However, a significant challenge is its tendency to induce blood coagulation, where the initial interaction between the implant surface and the oral environment takes place [1]–[3]. Oxygen plasma immersion ion implantation (O-PIII) is a surface modification technique that allows precise control in the nanometric range of the modified layer thickness and producing controlled features in terms of chemical composition, physical properties and roughness. The technique was used for different kinds of alloys, and it was successfully used for bone-related applications [1]. The high affinity of Ti with O is responsible for the creation of a highly adherent, titanium oxide-rich layer, which improves the biological response.

The objective. Study of the effects of substrate bias voltage on the features of the Ti-6Al-4V modified surface layer, in terms of surface morphology and chemical composition.

Material and methods. O-PIII was applied to modify the surface properties of previously mechanically polished grade 5 Ti (Ti-6Al-4V). The treatment was conducted at a bias voltage of U_{bias} =-10 kV and -1.0 kV, frequency of 1000 kHz, pressure of 10 mTorr, and flow rate of φ = 10 sccm for 60 min. Surface characterization of the mechanically polished surface was carried out using scanning electron microscopy (SEM), atomic force microscopy (AFM), contact angle (CA) measurements, and x-ray photoelectron spectroscopy (XPS). Hemocompatibility was preliminarily assessed to evaluate the biological response of the modified alloy.

Results and Discussion. The modification resulted in the formation of a hydrophilic oxide layer with a ~2.5-times increase in surface roughness, that is, from 1.6 nm to 4.2 nm. XPS evidenced the formation of titanium oxide on the surface, while the thickness layer is related to the applied substrate bias. Elements other than Ti are buried below the surface and under the titanium oxide layer. Hemocompatibility assessment, including hemolysis and clotting time tests, revealed significant improvements. Blood coagulation was notably delayed during the critical first 15 minutes of contact with the treated surfaces, with no evidence of hemolytic reactions. These findings demonstrate that oxygen plasma treatment significantly enhances the hemocompatibility of Ti6Al4V compared to untreated substrates, making it a promising approach for improving the performance of dental implants. Further studies are going to be related to the cytocompatibility properties of the modified surface for several kinds of cell lines, like osteoblasts and fibroblasts.

Keywords: Titanium alloy, Hemocompatibility, Oxygen-PIII, Surface modification

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Expanding Host Range of Bacteriophage AKVF33 through Tail Fiber Engineering

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Introduction:

With the upsurge of antibiotic resistance among bacterial pathogens, bacteriophages offer a promising alternative due to their host specificity and adaptability. However, the narrow host range and the potential for bacterial resistance can limit the effectiveness of phage therapy. To overcome these limitations, engineered phages are being developed to expand host range and enhance host-killing efficiency.

This study presents a mutant bacteriophage, AKVF33:LtpB_X(1), generated by replacing the tail fiber gene B (LftB) of the wild-type (WT) phage AKVF33 with that of another WT phage, AXO103A(2). Both WT phages target Shiga toxin-producing *E. coli* (STEC), but their host ranges differ: AKVF33 infects STEC O157:H7 strains but not O103:H7 strains, while AXO103A exhibits the opposite host specificity. These two WT phages not only share an average nucleotide identity (ANI) of 78% but also possess a genome structure similar to *E. coli* phage T5. Host specificity is mediated by the tail fiber, encoded by three genes (*LftA*, *ORF136*, and *LftB*), with *LftB* playing a critical role in host recognition. The LftB proteins of the two WT phages share only 66.7% amino acid identity, while LftA and ORF136 exhibit 94.7% and 98% identity, respectively.

Materials and Methods:

Using CRISPR-Cas9-based phage genome engineering, we successfully replaced the *LftB* gene of AKVF33 with that of AXO103A, creating the mutant AKVF33:LtpB_X. To evaluate the mutant's efficacy, host-killing assays were conducted by infecting *E. coli* O103:H7 (HER1392) and O157:H7 (R508) strains at mid-exponential phase with the corresponding WT-phages and the mutant at MOIs of 0.1, 1, 10, and 100. Then the optical density (OD600) was measured at 30-minute intervals for 16 hours at 37°C and compared with uninfected controls.

Results and Discussion:

The mutant phage exhibited an expanded host range, effectively infecting both *E. coli* O157:H7 (R508) and O103:H7 (HER1392) strains. Host-killing assays demonstrated that the mutant phage, at an MOI of 100, achieved significantly higher host-killing efficiency and minimized resistance formation against both bacterial strains compared to its wild-type counterparts. Interestingly, combining WT phage AXO103A with the mutant at MOIs 0.1 & 1 resulted in comparable efficacy to the mutant alone at MOI 100, highlighting the potential for synergistic phage therapy strategies.

This study emphasizes the benefits of phage genome engineering to expand host range and improve therapeutic outcomes. The mutant phage AKVF33:LtpB_X not only broadened its host range but also demonstrated its potential as a valuable tool for designing phage cocktails against STEC with reduced resistance formation. These findings contribute to the advancement of phage therapy applications in combating antibiotic-resistant bacterial infections.

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Effects of Δ-9-tetrahydrocannabinol (THC) vaped aerosol on oral *Candida albicans*

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The emergence of electronic cigarettes, initially designed to reduce tobacco-related risks[1], [2], has expanded to cannabis vaping, particularly THC, gaining popularity in Canada. In 2024, 37% of users reported using vape pens and cartridges — a 17% increase since 2020 — while 23% purchased vape pens directly, a rise since 2018. This trend raises concerns, especially as 12% of users lose control according to the Severity of Dependence Scale SDS[3]. The oral cavity, the first point of contact with these aerosols, is especially vulnerable to disruptions in microbial ecology and host-pathogen interactions. *Candida albicans*, a typically harmless commensal, can shift to a pathogenic state, causing infections[4]. The impact of aerosols on this opportunistic pathogen remains poorly understood.

Objectif: Evaluate the effects of e-cigarette aerosol generated from a THC-rich e-liquid on the growth of C. albicans, its metabolic activity, biofilm formation, and gene expression/suppression.

Methods: *C. albicans* was cultured and exposed twice daily for 5, 10, and 20 minutes to aerosol from e-liquid, either THC-free or containing 10% and 15% THC, with or without nicotine (12 mg/ml). After a 24-hour incubation at 30 ºC with 5% CO_2, growth kinetics were analyzed by measuring absorbance over 24 hours. At the same time, metabolic activity was determined using the MTT colorimetric assay, and morphological changes were evaluated and photographed after 6h of incubation in the presence of FBS. Biofilm formation was evaluated by culturing *C. albicans* on 3D collagen matrices, followed by twice-daily aerosol exposure for three days. Biofilm formation was analyzed qualitatively and quantitatively using crystal violet staining and histological analysis. The effect of aerosol exposure on the expression of genes *S-calb*, *SAP2*, *SAP4*, *SAP9*, *HWP1*, and *EAP1* were assessed by qRT-PCR.

Results: THC affects C. albicans growth in a concentration-dependent manner, inhibiting growth at 10% and promoting initial growth at 15% before stabilization, preventing fluctuations, while for the growth kinetics, THC-free and 10% THC conditions show promoted growth, more pronounced after 20min of exposure, however, 15% THC shows a contrasting effect as longer exposures seem to inhibit growth. Nicotine presence modulates these outcomes with minimal impact, subtly shifting the growth patterns and altering how C. albicans respond to aerosol exposures. For gene expression, results demonstrate that THC has a significant impact on the expression of *SAP* genes (*SAP2*, *SAP4*, and *SAP9*), with a general trend of increased gene expression as the concentration increases (15% THC), while the presence of nicotine seems to have a suppressive influence at lower doses of THC and a potentially enhancing effect at higher doses. Meanwhile, *EAP1* expression appears to be suppressed in groups exposed to nicotine and nicotine with 10% of THC. At the same time, it increases with higher doses of THC (with and without nicotine), suggesting a positive effect on *EAP1* expression, confirming the results related

to biofilm formation, as this gene contribute to cell adhesion and biofilm formation[5]. In contrast, the expression of *HWP1* is more variable in the presence of nicotine and or THC than *EAP1*. These results are translated visually by variability in hyphae formation in the transformation assay, as this gene interferes with the tissue invasion process[6].

Conclusion: Our results show that THC, alone or combined with nicotine, influences *C.* albicans biofilm formation and gene expression. These changes disrupt host-pathogen interactions and may disturb the balance of the oral microbiota, though the full extent of these interactions remains to be explored.

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Viroelixir : Une approche naturelle et innovante contre le cancer buccal

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Introduction : Le cancer de la cavité buccale est un problème de santé publique majeur[1], souvent aggravé par des infections causées par des agents pathogènes opportunistes tels que *Candida albicans*[2–4]. Ce micro-organisme provoque la progression des tumeurs en déclenchant une inflammation persistante et en libérant différentes toxines[5–9]. Les traitements classiques se concentrent exclusivement sur la maladie sans intervenir sur son origine et manquent de sélectivité[10,11]. Cette étude évalue le potentiel préventif et thérapeutique du Viroelixir, un extrait riche en polyphénols du thé vert et de la grenade, contre le cancer buccal.

Matériels et méthodes : L'effet du Viroelixir sur la croissance de *C. albicans* a été évalué par MTT et test agar. Son impact sur la virulence a été analysé à travers la transition morphologique par microscopie électronique et la formation de biofilm sur des membranes CollaTape. L'expression des gènes impliqués dans l'adhésion et l'invasion a été évaluée par RT-qPCR. L'effet du Viroelixir sur les réponses inflammatoires induites par *C.albicans* a été étudié en analysant l'expression des gènes pro-inflammatoires et des β-défensines par RT-qPCR, puis validée par ELISA. La sélectivité de Viroelixir a été évaluée sur des cellules cancéreuses buccales (Ca9-22, SCC9 et Cal-27) et des cellules épithéliales gingivales normales (GMSM-K) à l'aide des tests MTT et LDH. L'apoptose a été évaluée en utilisant la cytométrie en flux (Annexin V/PI) et par qPCR arrays pour identifier l'expression des gènes impliqués dans l'apoptose et l'autophagie.

Résultats : Le Viroelixir a démontré une efficacité similaire à l'Amphotéricine B en inhibant la croissance de *C. albicans* avec une concentration minimale d'action (CMA) de 1/1000 et une concentration inhibitrice médiane (IC50) de 1/200. A cette concentration, le Viroelixir a permis le passage de *C. albicans* de la forme la plus virulente (Hyphe) à la forme la moins virulente (blastopore) et inhibe considérablement la formation de biofilm. Nos résultats ont montré que, le traitement de *C. albicans* par Viroelixir inhibe l'expression des gènes de virulence (EAP1 et la famille SAPS) d'au moins trois fois à une dilution de 1/50 et permet l'atténuation de l'inflammation en réduisant les niveaux d'IL-6, d'IL-8, d'IL-1β et des peptides antimicrobiens (β-défensines) à partir de 1/1000. Le Viroelixir a démontré une **sélectivité** et **spécificité** envers les cellules cancéreuses gingivales (Ca9-22) en inhibant a faible dilution leur prolifération tandis que son effet est réduit ou nul sur les cellules normales GMSM-K et les cellules de cancer de la langue (SCC-9 et Cal-27). L'effet anticancéreux de Viroelixir sur les cellules Ca9-22 repose principalement sur sa capacité à induire l'apoptose et à cibler l'autophagie en modulant 50 des 84 gènes autophagiques étudiés. De plus le Viroelixir démontre une synergie significative avec le cisplatine et le 5-Fluorouracile dans le traitement du cancer de la gencive.

Conclusion : Viroelixir démontre un potentiel prometteur contre les infections fongiques et l'inflammation, offrant une alternative aux antifongiques conventionnels et un candidat pour les produits d'hygiène buccale. Grâce à sa spécificité et sa sélectivité, il pourrait être intégré dans des approches thérapeutiques novatrices pour le traitement du cancer de la gencive.

Mots clés : Cancer buccal, *C.albicans*, Virulence, Viroelixir, sélectivité.

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Développement d'un revêtement proactif ostéogénique et bactéricide pour améliorer la performance clinique des implants dentaires en titane

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Introduction

La demande croissante de remplacement dentaire suit l'augmentation de l'espérance de vie à l'échelle mondiale.[1] Le titane et ses alliages sont largement utilisés, mais des complications surviennent dans 5 à plus de 20 % des cas.[2] Le taux d'échec augmente avec les maladies liées à l'âge, en particulier dans les pays en développement. Deux principaux facteurs contribuent à l'échec des implants en titane : l'infection bactérienne et la formation de biofilm, ainsi que l'hypersensibilité et la toxicité des particules de titane.[3,4]

L'objectif

Développer un revêtement composé de particules minérales synthétiques d'hydroxyapatite déficiente en calcium (ostéogéniques) dopées avec des cations Zn^{2+} (bactéricides) afin d'améliorer les performances cliniques des alliages Ti6Al4V.

Matériels et Méthodes

Quatre phases d'hydroxyapatite déficiente en calcium dopée au zinc ($Ca_{1-x}Zn_xP$, avec x = 0; 0,05; 0.1 et 0.15) ont été synthétisées par addition goutte à goutte des solutions de MCl_2 (M = Ca^{2+} ou Zn^{2+}) dans une solution de Na_2HPO_4 à température ambiante. Les particules, encapsulées dans de la polydopamine sur un alliage de Ti (Ti6Al4V), ont ensuite guidé la précipitation des différentes phases minérales étudiées.

Résultats est conclusions

Les diffractogrammes de rayons X (XRD) des solides CaP et $Ca_{1-x}Zn_xP$ synthétisés ont montré les pics caractéristiques de la phase souhaitée. La quantification des métaux a confirmé la substitution efficace des cations Ca^{2+} par Zn^{2+}. Les particules formées à la surface présentent une distribution homogène, ont la composition attendue et sont guidées par les particules pré-immobilisées dans la couche de polydopamine. Les revêtements sont stables en immersion et sous vortex. Les prochaines étapes du projet consisteront à évaluer les propriétés biologiques, viabilité cellulaire et activité antibactérienne, et mécaniques des revêtements.

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Innovative Aptamer-Based Sensing Technique for Salivary Biomarker Detection

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Introduction: Saliva presents a promising medium for early disease detection, providing a non-invasive and easily accessible alternative to traditional diagnostic methods. However, circadian fluctuations in salivary biomarkers are often overlooked, significantly influencing the accuracy of diagnosis. Profiling these circadian biomarkers over 24 hours is essential to enhance the precision of diagnosing conditions linked to circadian disruptions, such as sleep disorders, and to facilitate more timely and personalized interventions. One of the major challenges is measuring low concentrations of salivary biomarkers. This issue can be addressed through the use of chemically synthesized biorecognition molecules known as DNA aptamers - short, single-stranded oligonucleotides – that enable highly sensitive and selective detection.

The objective of this study is to characterize melatonin aptamers and develop a novel rapid sensing mechanism for detecting salivary melatonin, a biomarker of circadian rhythm disorders, paving the way for a highly sensitive and selective detection mechanism.

Methodology: Various forms of melatonin aptamer, including full sequence (MLT-C-1) and truncated versions (MLT-A-4 and MLT-A-2), were examined for their sensitivity to detect low salivary melatonin levels. The aptamers were characterized in terms of their structural changes and binding affinities using circular dichroism and microscale thermophoresis, respectively. For rapid detection of salivary melatonin, an aptamer-based gold nanoparticle colorimetric assay was developed. Additionally, a proof-of-concept enzyme-linked aptamer-based immunoassay was developed to assess whether aptamers could serve as a substitute for antibodies.

Results and Discussion: Characterization revealed that the 36-mer MLT-A-2 aptamer had the highest binding affinity showing a visible colorimetric response at 0.1 nM, with a limit of detection of melatonin at 0.0011 nM (~0.25 pg/ml) and a limit of quantification of 0.0021 nM (~0.5 pg/ml) in saliva. The measured melatonin levels using the MLT-A-2 aptamer-AuNP probe closely aligned with the lowest physiological melatonin levels in saliva, ranging from 0.0043 nM to 0.0086 nM. This innovative aptamer-based technique offers rapid, simple, and highly sensitive detection of salivary melatonin. The developed assays will be beneficial in providing valuable insights into individual circadian patterns and their health implications. This advancement paves the way for personalized treatments and more informed precision health decisions.

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Effets du blanchiment dentaire sur l'harmonisation colorimétrique des restaurations avec composites monoteinte

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Contexte : Le blanchiment dentaire est une procédure esthétique courante, mais il peut entraîner des discordances de couleur avec les restaurations en résine composite existantes. Toutefois, les résines composites monoteinte sont conçues pour s'adapter à la couleur des dents blanchies, réduisant potentiellement le besoin de remplacer les restaurations.

Objectif : Évaluer l'effet du blanchiment dentaire sur l'harmonisation colorimétrique des restaurations en résine composite monoteinte à l'aide d'évaluations instrumentales et visuelles.

Méthodes : Des préparations rondes sur les surfaces buccales et palatines de molaires intactes ont été restaurées avec des résines composites Charisma Diamond One ou Palfique Omnichroma. Les mesures de couleur ont été effectuées à l'aide d'un téléphone portable et d'un logiciel de traitement d'images avant et après la restauration, puis après 3 applications d'un agent de blanchiment à 35 % de peroxyde d'hydrogène. Les variations de couleur ont été calculées à l'aide des indices de blancheur (WID) et de différence de couleur CIELAB (ΔE00). Des évaluateurs ont également réalisé des analyses visuelles de l'harmonisation colorimétrique.

Résultats : Après le blanchiment, les restaurations et l'émail ont présenté des valeurs WID comparables, et aucune variation significative des valeurs ΔE00 n'a été observée. Toutefois, les évaluateurs ont attribué une meilleure harmonisation colorimétrique aux restaurations non blanchies.

Conclusion : Les mesures instrumentales ont indiqué que le blanchiment dentaire n'affectait pas significativement l'harmonisation colorimétrique des restaurations en résine composite monoteinte. Cependant, les évaluations visuelles ont révélé une moins bonne harmonisation après le blanchiment.

RÉSUMÉS DES PRÉSENTATIONS PAR AFFICHE

Cytotoxicity and Antimicrobial Activity of Electroformed Fe-Co Alloys

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Introduction: Iron and their alloys are of major interest in the medical field thanks to their bioresorbable behavior[1]. In oral and maxillofacial applications, high purity alloys need to match personalized dimensions. This is especially required for tiny devices, that is, those for which a dimension is much smaller than the other two. Electroforming might represent the right process for controlling purity and dimensions. Iron offers promising biocompatibility and mechanical properties, but its low degradation rate must be improved[1]. Cobalt, despite its controversial toxicity, has the potential to accelerate the corrosion. In fact, it is a trace element in the human body and has also been extensively studied for biomedical applications[2-3].

The objective of this exploratory work was to investigate whether selected amounts of cobalt, in a series of binary Fe-based alloys produced by electroforming, showed toxic effects against fibroblasts and antimicrobial activity.

Materials and Methods: Pure electroformed iron (e-Fe) was deposited using a modified Fischer–Langbein solution, while Fe-Co samples were produced in an electrolytic bath with fixed $FeCl_2$ amount and varying the $CoCl_2$ concentration (1.0, 2.5, 5.0 and 10 g L^{-1}). Deposition occurred in a three-electrode cell with an Ag wire as reference electrode, a carbon rod counter-electrode, and titanium as working electrode. Samples were characterized with the indirect cytotoxicity test on fibroblasts (ISO 10993-5:2009) and antimicrobial activity (ASTM E2922-23) against *E. coli*.

Results and discussion: The cell viability test indicated that all the Fe-Co alloys exhibited low toxicity to fibroblasts after one day of incubation. Cytotoxicity for some Fe-Co alloys was even lower than that one measured for e-Fe. For the antibacterial test, most of the samples presented a decrease of the *E. coli* viability of about 10^4 CFU·mL^{-1} after direct contact with the samples. Sample Fe-10Co presented a value of zero CFU·mL^{-1}. This indicated a direct killing as the antibacterial mechanism.

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3D-Printed Biodegradable FeMnC Alloys for Maxillofacial Applications

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Introduction: The use of maxillofacial implants has increased due to tumors, trauma, and infections. Recent research has focused on using biodegradable metals as implants, such as scaffolds, which offer structural support for tissue regeneration while gradually degrading to allow for new bone formation. The most common biodegradable metals are Mg, Zn, and Fe, where Mg-based alloys degrade extremely fast. At the same time, Zn-based does not have enough mechanical strength for load-bearing applications. On the other hand, Fe-based alloys exhibit superior mechanical properties, making them suitable for maxillofacial implants [1, 2]; however, their slow corrosion rate, which considerably increases the biodegradation time, is its major limitation. Different elements like Mn and C can be incorporated to increase the corrosion rate of Fe-based alloys. Also, non-conventional fabrication techniques, like 3D printing through Laser Powder Bed Fusion (LPBF) [3], lead to complex microstructural changes affecting the degradation rate. Nevertheless, the optimization of the 3D-printing parameters is an important aspect that should be controlled to keep the good mechanical performance of the Fe alloys.

Objective: This study aims to optimize LPBF parameters to fabricate a Fe12Mn1.2C alloy with minimal porosity while maintaining structural integrity**.**

Materials and Methods: Samples were produced using an EOS M 100 LPBF system equipped with a 200 W Yb-fiber laser. Commercial elemental powders of AISI 1025 steel, manganese, and graphite were used. Porosity was assessed through Nikon optical microscopy.

Results and conclusions: The laser power and the scanning velocity were the chosen 3D-printing variables to control the porosity of the Fe12Mn1.2C alloy. Based on the irregular morphology of the employed elemental powder, a density over 100 J/mm3 was required to achieve denser samples. The densification can be improved by increasing the laser power or decreasing the scanning speed. However, an excessive reduction of the scanning velocity could have been associated with larger melt pools that led to vaporization-induced porosity due to trapped gas bubbles. The results are feasible for producing denser samples for future tensile testing.

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Zinc oxide doped diamond-like carbon as antibacterial and adherent coatings for dental applications

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Introduction: Medical implants made of titanium (Ti) and its alloys are widely used today thanks to their excellent mechanical properties and biocompatibility, making this metal ideal for applications requiring durability and compatibility with human tissues [1]. In particular, grade V Ti (Ti-6Al-4V), is used in dental implants due to their good resistance-to-wear ratio, higher corrosion resistance and tenacity. However, complications such as peri-implantitis, a bacterial infection, often leads to implant failure [2-3]. Therefore, diamond-like amorphous carbon coatings (a-DLC), known for their excellent mechanical properties, loaded with zinc oxide (ZnO) nanoparticles, chosen for their antibacterial properties [4-6], could solve this issue. However, adhesion of DLC coatings on metallic surfaces remains a significant challenge. To overcome this lack of adhesion, plasma-enhanced chemical vapor deposition (PECVD), used for DLC deposition, has emerged as a promising technique thanks to its versatility.

Objective: This project aims to develop a plasma-based process to deposit resistant, adherent, and antibacterial DLC-ZnO doped nanocoatings on titanium alloy dental implants.

Materials & methods: Cleaned and polished Ti-6Al-4V samples underwent different pre-treatments prior to DLC coatings by PECVD using a FLR-1200 reactor. To investigate the impact of pre-treatment on DLC deposition and adhesion, some samples underwent argon etching, others methane carburizing, and a third group experienced both treatments. Surface composition was assessed by XPS and Raman spectroscopy, pre-treatment impact by XPS depth-profiling, surface topography by AFM, and surface wettability by WCA. Additionally, preliminary stability tests were performed by immersing the coated samples in a pseudo-physiological medium at 37°C for 7 days.

Results and conclusion: Depth-profiling analyses have displayed that longer the etching and carburizing time were, thinner the coating was. When compared to carburizing, etching led to a thinner film with a lower carbon content, highlighting the efficiency of carburizing over etching for a higher carbon containing coating. Sample pre-treated with both etching and carburizing exhibited a carbon content similar to that of carburizing alone. However, 10 min-carburized samples still resulted in a thicker coating, as indicated by longer sputtering time in depth-profiling analysis. Stability tests further demonstrated that carburized samples exhibited better stability, with lower carbon content decrease compared to etched samples, and no delamination was observed. The carburization process appears the most promising pre-treatment to obtain a stable DLC coating. Further investigations are still needed to assess the DLC adhesion, and to evaluate the impact of ZnO incorporation on the overall DLC properties. By using a single plasma process, it is expected to obtain an adherent DLC-ZnO coatings with antibacterial properties, which may be used for dental applications and lead to the next generation of dental implants.

Acknowledgement: The Laboratory of Biomaterial and Bioengineering team and Vanessa Houde (Faculty of Dental Medicine, UL).

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Surface Modifications of Polyetheretherketone (PEEK) for Dental Implants Applications

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Introduction: Titanium (Ti) and its alloys are frequently used in implant applications due to their strength and corrosion resistance. However, these materials also present certain concerns, such as fracture risk, metal hypersensitivity, and stress generation on the surrounding bone [1]. Indeed, the elastic modulus of Ti is approximately 100 GPa higher than that of cortical and cancellous bone, which can result in mechanical overload and subsequent tissue damage and bacterial infiltration [2]. To overcome these limitations, the synthetic polymer polyetheretherketone (PEEK) has emerged as a promising alternative. PEEK offers mechanical properties closer to those of bone [3], along with resistance to degradation, biocompatibility, and the capacity to be 3D printed, creating porous and personalized scaffolds. However, its bioinertness due to its low surface energy limits osseointegration, which is crucial for clinical success [3,4].

Objective: To this end, the objective of this study is to enhance the suitability of PEEK for dental implant applications by exploring various surface modification and 3D printing approaches. The aim is to develop an innovative dental implant recapitulating the mechanical properties of oral bone while promoting suitable biological interactions with the surrounding tissues.

Materials and Methods: This first semester doctoral research is currently in the bibliographic review phase. A comprehensive search strategy was employed in various databases, including PubMed, Web of Science, and Sofia, utilizing keywords such as "PEEK", "osseointegration", “antibacterial properties”, "surface modification" and "dental implants".

Results and discussion: The literature review indicated different approaches to handle PEEK, highlighting its strengths and weaknesses. In addition, several approaches have been investigated to enhance its bioactivity, such as hydroxyapatites coatings to improve osseointegration and ZnO-loaded PEEK for antibacterial properties. Despite improvements, few of these studies take a multi-faceted approach, promoting both osseointegration and antibacterial properties. Moreover, the number of FDA-approved PEEK implants on the market is still low, meaning that further improvements are still needed.

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Nanofibrous Polyurethane/Chitosan Guided Bone Regeneration Membrane for Alveolar Bone Regeneration

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Introduction: Guided bone regeneration (GBR) membranes are utilized in dental procedures to block gingival tissue infiltration, ensuring an optimal environment for alveolar bone regeneration (1). However, the rapid degradation compromises the mechanical integrity of the commercialized collagenous GBR membranes, limiting their therapeutic effectiveness for alveolar bone defects (2).

The objective: Thus, this study addresses to overcome this limitation by forming an electrospun GBR membrane made of biodegradable polyurethane (PU) and chitosan (CS) with biocompatibility and antibacterial properties.

Materials and Methods: The 8% (w/v) PU blended with 3% CS was electrospun and characterized in terms of surface morphology, porosity, wettability, *in-vitro* weight loss degradability and hemocompatibility test.

Results and discussion: The PU-CS electrospun membrane had fiber diameter ranging from 100 – 550 nm, porosity percentage of 60% accommodating the range to promote bone regeneration and water contact angle of approximately 95°.The PU-CS membrane exhibited a slow degradation rate with a weight loss of 5% in 60 days facilitating sustained mechanical support for alveolar bone regeneration. The PU-CS membrane exhibited excellent hemocompatibility with a low hemolysis percentage of 2.7%. Thus, projecting its suitability for possible GBR applications.

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Antimicrobial peptides (AMPs): An interesting approach to enhance osseointegration and gingival adhesion

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Introduction: Nowadays, failure rate of Ti-based dental implants still remains around 10% due to possible pathogenic infections or a mismatch between oral tissues and implant surface (1). Among the strategies proposed to solve this, surface modifications using acid-etching, ceramic coatings, and bioactive molecules are highlighted due to their capacity to promote both the osseointegration and soft-tissue interaction on Ti-based alloys. However, some controversies can be found in the literature regarding the use of acid-etching and ceramic deposition for soft tissues (2). Bacterial infection, on the other hand, has been targeted mainly using antibiotics and inorganic agents, such as particles and/or coatings. Nevertheless, complications such as bacterial resistance to antibiotics, toxicity of inorganic particles or delamination of the coatings may arise from these strategies (3). Conversely, AMPs are organic molecules showing a potent bactericidal activity without compromising cytocompatibility of eukaryotic cells (1). Moreover, some AMPs such as GL13K, JH8194, and hBD3 have been shown to also promote either osteoinduction, gingival cell adhesion/proliferation or both effects in parallel with their antibacterial effect.

The objective of this PhD research (actually only at the second semester) is to design and develop a new generation of bioactive dental implants, with antibacterial and buccal-cell stimulating properties, using AMPs.

Materials and Methods: Ti-6Al-4V samples were plasma activated and will be grafted with different AMPs through linking arms. Surface composition, roughness, and wettability will be assessed. The biological performance will also be evaluated.

Results and discussion: AMPs can be deposited onto Ti alloys by wet chemistry approaches (1). However, the stability of these strategies can be compromised due to low adhesion and stability. To address this, plasma-based surface modification techniques are a good alternative since they are versatile and solvent-free processes allowing to tailor surface composition and morphology, key parameters for biological responses (4). Moreover, linking arms may impact the biological behavior of peptides (5).

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Keratin: A Prospective Material for Periodontal Applications

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Introduction: Periodontal diseases result in the need for surgical intervention to remove the diseased region of the tooth, and a contact inhibition membrane is typically incorporated as the gold standard for guided tissue regeneration (GTR) (1). These membranes serve two important functions which are to prevent unwanted cell migration and promote tissue regeneration. Conventionally, synthetic polymers such as ePTFE (expanded polytetrafluoroethylene) were used before natural polymers like collagen emerged as an alternative due to their biocompatibility and biodegradability (2). However, periodontitis is still often observed, and the periodontal tissue gap present during the healing stage is probably one of the main causes.

Objective: Therefore, natural polymers such as collagen and chitosan were engineered in films, hydrogels or sponges to act as scaffolds to fill the gap and promote tissue regeneration and adhesion at their interface (1,2). Keratin-based materials have already been reported as a successful candidate for drug delivery, wound healing and tissue engineering applications (3,4).
Materials and Methods: Keratin is a fibrous protein which is commonly found in human hair, chicken feathers, and sheep wool. It is considered for the biomedical field due to its excellent biocompatibility, biodegradability and ease of functionalization due to the presence of various functional groups such as thiols, amino and carboxyl groups (3). In particular, keratin possesses hemostatic abilities and intrinsic cell adhesion motifs, such as the RGD and leucine-aspartic acid-valine (LDV) sequences, which are desirable properties to promote tissue regeneration (5). In addition, its ability to self-assemble and form porous polymeric structures, coupled with its good mechanical properties and high abundance in nature, makes keratin a prospective material for periodontal applications (3).

Results and discussion: While current studies are limited, studies have proved the potential of keratin-chitosan sponge for homeostasis and keratin-alginate sponge for wound healing which opens the door to opportunities of keratin blends (4,5). Herein, a keratin-chitosan sponge is proposed for periodontal applications, with the vision to maximize keratin's potential as a sustainable biomaterial via innovative approaches to pave the way for its broader adoption as an alternative material in the biomedical field.

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Oxygen plasma immersion ion implantation improves the performance of biodegradable Mg-alloys for bone applications

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Introduction: Due to its biodegradable, biocompatible and mechanical properties, Mg-based alloys have been extensively studied for temporary implants. Particularly, Mg-based alloys exhibit mechanical strength and an elastic modulus comparable to natural bone [1]. These properties make this alloy suitable for use as a bone graft implant. However, the main limitation of Mg is its high corrosion rate in physiological environment [1]-[2]. This process generates excessive hydrogen and hydroxide release, causing an inflammatory response in the body. To improve the biological response of the material, oxygen plasma-immersion ion implantation (O-PIII) has been proposed as a surface modification [2]. Through the formation of a thin and relatively homogenous film on the alloy surface, chemical composition, topography, wettability and corrosion behavior were also impacted. Therefore, the interface between Mg and the physiological environment was modified in order to enhance the performance of the alloy for a targeted range of clinical applications.

The objectives of this study were to optimize the O-PIII process, taking into account the features of the substrate, and characterize the surface properties for the targeted biomedical application.

Materials and Methods: A commercial AZ31 alloy composed of Magnesium 95-96%wt, Aluminum 2.5-3-5%wt and Zinc 0.6-1.5%wt was studied. After chemical polishing, an O-PIII was performed in a PBII-300 system (Plasmionique, Varennes, Canada) varying different working parameters, such as working pressure (P_W), plasma exposition time (t_d) and pulse repetition rate (f). The morphological, chemical and electrochemical characterization were carried out by scanning electron microscopy (SEM), X-ray Photoelectron Spectroscopy (XPS), static contact angle (wettability) and potentiodynamic polarization curves in Hanks' solution.

Results and discussion: The alloy was chemically polished before any further treatment; this was considered the as-received (AR) condition. The plasma treatment introduced different surface features, according to the used parameter values, in terms of morphology, roughness, chemical composition, and resistance to corrosion. In particular, XPS showed a general surface O increase, for all the considered conditions; it was bound to the metallic substrate mainly in the form of metal oxide and hydroxide [3]. The hydrophilicity of the treated surfaces decreased, from a maximum for the AR conditions, to a minimum for lower P_W and shorter t_d. In the AR condition, AZ31B exhibited a corrosion current, which is proportional to the corrosion rate (CR), of 0.21 mA. Current decreased to a minimum in the range 0.08 - 0.09 mA for a P_W = 5 mTorr and a short td (t_d = 60 min.), corresponding to a decrease of CR. As the corrosion improvement was significant, it is possible to conclude that the chosen surface modification parameters improved considerably the resistance to corrosion of the alloy, modifying its electrochemical response, and constituting a valid approach for clinical applications, such as bone regeneration.

Further biological studies will be conducted to assess the cytocompatibility of AZ31B after O-PIII, considering for example fibroblast and osteoblast viability and proliferative analyses.

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Développement d'échafaudages à cellules ouvertes pour l'ingénierie tissulaire osseuse via une approche innovante de moussage et de biofonctionnalisation in situ

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Introduction

La régénération osseuse repose sur l'utilisation d'échafaudages tridimensionnels servant de support à l'adhésion, la prolifération et la différenciation cellulaires. Les méthodes conventionnelles de fabrication impliquent souvent l'usage de solvants pour l'incorporation de matériaux bioactifs, ce qui peut entraîner la présence de résidus toxiques compromettant la viabilité cellulaire et la bio-intégration du matériau [1]. Pour pallier ces limitations, ce projet propose une approche innovante de moussage/bio-fonctionnalisation in situ sans solvant, permettant l'incorporation d'un copolymère bioactif à base de chitosane directement sur la surface des pores [1]. Cette stratégie vise à optimiser l'interaction cellules-matériau tout en préservant des propriétés mécaniques compatibles avec la régénération osseuse.

Objectif : Ce projet vise à développer des échafaudages à cellules ouvertes à base de chitosane modifié, en utilisant une approche innovante de moussage bio-fonctionnel in situ. Cette stratégie permettra l'intégration d'agents bioactifs directement lors du processus de moussage, afin de favoriser l'adhésion, la prolifération et la différenciation cellulaires, en vue d'optimiser la régénération osseuse.

Matériels et Méthodes : L'étude consistera à développer des échafaudages à base de biopolymères biodégradables tels que le poly(acide lactique) (PLA), le poly(acide lactique-co-glycolique) (PLGA) et le poly(lactide-co-ε-caprolactone) (PLCL). Ces échafaudages seront fabriqués en deux étapes : d'abord par compoundage à l'aide d'un mélangeur interne, puis par compression-moussage à l'aide d'un agent moussant chimique bioactif. L'efficacité de la méthode sera évaluée au moyen d'analyses physico-chimiques (microscopie électronique à balayage, spectroscopie FTIR, caractérisation mécanique), ainsi que par des études biologiques in vitro sur des lignées de cellules ostéoblastes et des cellules souches différenciées en ostéoblastes.

Résultats est conclusions : L'objectif principal est de développer des échafaudages dotés d'une architecture poreuse optimisée (taille des pores : ~300 µm), favorisant une colonisation cellulaire efficace. L'intégration du chitosane greffé vise à améliorer l'adhésion et la prolifération cellulaires, tout en éliminant les effets cytotoxiques liés aux solvants résiduels. Cette approche novatrice pourrait représenter une avancée significative en l'ingénierie tissulaire osseuse et en médecine régénérative.

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A new series of bioactive glasses for periodontitis management

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Introduction: With a global prevalence ranging from 20% to 50%, periodontal disease represents a significant public health concern. This chronic inflammatory condition is marked by the destruction of alveolar bone, leading to tooth detachment. Insufficient bone volume to support dental implants has been a challenge in dentistry. Therefore, treatment of periodontal disease has shifted from traditional methods to regenerative therapy. At this level, degradable Bioglass (BG) ceramics emerge as a potent solution stabilizing periodontal disease and stimulating healing and regeneration.

The objective of this study is to validate the bioactivity of a new series of BG, in terms of osteogenic potential.

Materials and Methods: We recently formulated and characterized a first series of 6 BG by doping the 63S37C parent system with strontium and phosphate by the means of hydrothermal method. In-vitro bioactivity in an acellular medium was evaluated by soaking the glass samples in simulated body fluid (SBF). BG ability to form apatite was assessed by Fourier transform infrared spectroscopy (FTIR), X-ray Diffraction (XRD), and scanning electron microscope coupled energy dispersive spectroscopy (SEM-EDX). MTT and LDH assays were used to confirm biocompatibility towards Dental Pulp Stem Cells (DPSCs)[1]. The Alizarin red test allowed evaluation of osteogenic potential.

Results and discussion: All the samples (S1-S6) can grow a homogeneous layer of an apatite structure on their surfaces. This was evident after only 7 days of immersion in SBF. Slightly more important biological activity corresponded to BG with high phosphate content, mainly BG-S6. The ions released by up to 10 mg/mL of all six BG formulations presented no cytotoxic effects on DPSCs after 24h. Preliminary results indicated osteogenic differentiation of stem cells and mineral deposits after 14 days exposure to 5mg/ml BG samples. In summary, our new BG formulations show strong biocompatibility and promising potential for periodontitis management. Further investigations confirming osteogenic as well as anti-inflammatory and anti-microbial potential are currently carried out.

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3D-Printed Polyether Ether Ketone (PEEK) for Biohybrid Root-Analogue Dental Implants

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Background: Tooth loss has a devastating impact on the quality of life due to impaired oral functions combined with aesthetic disfigurement. The periodontal ligament (PDL) that surrounds natural teeth is adaptable to diverse biomechanical challenges by deforming to dissipate strains over a larger area through natural dental roots. In contrast, osseointegrated dental implants with their screw-shaped design transfer intense concentrated forces to peri-implant bone causing possible biomechanical failures. Moreover, there is a mismatch in elastic modulus between Titanium (gold standard implant fabrication material) and human bone that leads to stress shielding effect and eventual implant loss. Polyether-ether-ketone (PEEK) is an alternative biocompatible implant fabrication material with elastic modulus closer to human bone, thus it optimizes stress distribution. PEEK-implants can be customized by fused-deposition-modeling (FDM) 3D-printing technology. Currently, a dental implant with PDL and natural root morphology does not exist, and it is unknown whether mimicking root morphology with a PDL-like layer in PEEK-implants could restore the biomechanical adaptability of natural teeth or not.

Objectives: The overarching goal is to develop biohybrid root-analogue dental implant with improved biomechanical functions using FDM-printed PEEK through three objectives: **1.** To optimize the 3D-printing parameters of PEEK implants to reproduce the mechanical behaviour of natural teeth, and **2.** to precisely reproduce the natural root morphology, and **3.** To induce the formation of a PDL-like layer over PEEK implant surface through surface engineering.

Methodology: *Objective 1:* PEEK print-outs produced by different FDM-printing parameters will be mechanically tested in comparison to the mechanical characteristics of human bone and teeth. *Objective 2:* Computed tomography will be used to 3D-print PEEK-implants with patient-specific root morphology, and will be tested for their precision. *Objective 3:* Formation of a PDL-like layer on PEEK surface will be stimulated using different surface treatments that will be tested *in vitro* using fibroblast cell culture (PDL-principal-cells).

Expected outcomes: We hypothesize that 3D-printing parameters of PEEK can be tuned to accurately print single and multi-rooted implants with mechanical behaviour similar to natural dentition, and that functionalization of PEEK surface to attach collagen molecules will promote formation of a PDL-like layer over PEEK implants.

Research impact: The development of patient-specific root-analogue dental implants that can restore the periodontal tissue functions will promote peri-implant bone health, and increase dental implants' service life. Consequently, these novel implants will improve the oral health and quality of life for patients suffering tooth loss worldwide.

Keywords: Patient-specific implants (PSIs); Polyether ether ketone (PEEK); 3D printing ; Fused deposition modeling (FDM); Surface modification; Periodontal ligament (PDL).

Self-Perceived Masticatory Ability is associated with Cognitive Functioning among Canadian Adults

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Background: Life expectancy has increased globally, leading to a higher proportion of older adults, particularly in developed countries like Canada. This demographic shift strains healthcare systems and is associated with an increased risk of cognitive decline and dementia. Oral health has emerged as a potential modifiable risk factor for dementia, yet the evidence remains conflicting.

Objective: This study examines the association between oral health and cognitive functioning in the Canadian population, utilizing data from the Canadian Longitudinal Study on Aging (CLSA).

Methods: A cross-sectional analysis was conducted using baseline data from the comprehensive cohort of the CLSA, comprising 26,703 participants aged between 45 and 85 years. Oral health was assessed via self-reported oral health (SROH) and masticatory ability (MA). Cognitive function was evaluated using a battery of neuropsychological tests, and a Cognitive Impairment Indicator (CII) was derived. Logistic regression models were employed to examine the association between oral health and cognitive impairment, adjusting for confounders.

Results: Poor SROH was not significantly associated with cognitive impairment (OR = 1.19, 95% CI = 0.63-2.09), while inadequate MA was significantly associated with higher odds of cognitive impairment (OR = 2.82, 95% CI = 1.82-4.25).

Conclusion: The findings suggest a significant association between MA and cognitive impairment in the comprehensive cohort of the CLSA. These results indicate the importance of oral health as a potentially modifiable risk factor for cognitive decline. Further research is warranted to explore the mechanisms underlying these associations and to develop targeted preventive strategies.

Keywords: Oral health, Cognitive Dysfunction, Dementia, Mastication.

Comment prévenir la stomatite prothétique à l'aide d'huile essentielle

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La stomatite prothétique est une maladie multifactorielle impliquant des facteurs prédisposants locaux et systémiques (1). *Candida albicans (C. albicans)* est l'un des principaux agents pathogènes responsables du développement de la stomatite des prothèses dentaires (2). Les matériaux utilisés pour concevoir les prothèses dentaires favorisent l'interaction chimique/physique des cellules microbiennes et la formation de biofilms due à la présence d'irrégularité de structure et la présence de fissures (1,3). Une mauvaise hygiène peut aussi endommager la surface des prothèses favorisant l'adhésion, la multiplication de *C. albicans* sur la surface des prothèses. L'utilisation d'antifongiques contribue à la réduction des méfaits de *C. albicans*, mais présente des limites importantes dont leur mode d'utilisation et le développement de résistance. Les plantes médicinales sont source prometteuse de nouvelles molécules dotées d'activités antimicrobiennes. Parmi ces plantes, nous trouvant le romarin (4).

Objectifs : évaluer l'effet d'huile essentielle de romarin sur la virulence de *C. albicans*. Évaluer in vitro l'efficacité d'huile essentielle de romarin à prévenir la stomatite prothétique.

Matériels et Méthodes. L'huile essentielle (HE) de romarin utilisé provient de feuille et de fleurs de la plante poussant dans le nord de la Tunisie. Cette HE a été extraite par hydrodistillation pour éviter tout produit chimique pouvant la contaminer. Cette huile a été utiliser dans nos expériences à une concentration allant de 1 à 10 µl en la comparant à un antifongique chimique (l'amphotéricine-b, Ampho-B) utilisé à 5 µl. La composition chimique de l'huile a été déterminée par HPLC. Avec une première partie d'expérimentation, nous avons évalué la croissance de *C. albicans* et sa transformation en présence et en absence d'HE. Nous avons analysé la capacité d'HE à inhiber la formation de biofilm par *C. albicans*, ainsi que la dégradation d'un biofilm déjà formé. Le contrôle de la virulence de *C. albicans* par l'HE a été analysé par l'expression de plusieurs gènes impliqués dans la virulence de *C. albicans*. Avec une seconde partie d'expérimentation, nous avons évalué les effets de l'HE sur l'interaction de *C. albicans* avec les matériaux de restauration dentaire, incluant la résine acrylique, la résine composite et du verre-monomère.

Résultats. Nos travaux montrent que l'HE de romarin est riche en 1,8-Cinéole (42%), alpha Pinène (13%), beta-Caryophyllène (6,13%), Camphre (9,6%), et Camphène (4,24%). L'ajout de faible concentration (moins de 10 µl) d'HE à une culture de *C. albicans* cause une réduction significative de la croissance, même à fable dose (1 µl), ainsi que la transformation de la levure. L'HE de romarin a aussi un important effet en inhibant la formation de biofilm par *C. albicans*. Aussi, l'exposition d'un biofilm déjà formé à l'HE de romarin montre une dégradation significative du biofilm. L'effet de l'HE sur la croissance de *C. albicans* et l'inhibition de la formation de biofilm est confirmé par l'inhibition de plusieurs gènes de virulence de *C. albicans*,

incluant Saps, HWP1 et EAP1. L'HE a inhibé l'adhésion et la croissance de *C. albicans* sur les matériaux de restauration dentaire. L'HE de romarin à des concentrations plus de 5 µl, montre un effet antifongique plus important que l'Ampho-B,

Conclusion : L'HE de romarin contrôle de façon efficace la capacité de *C. albicans* de se multiplier, de se transformer et de former un biofilm. Ce contrôle se fait en inhibant l'expression de plusieurs gènes contrôlant la virulence de *C. albicans*. Cette étude est réalisée avec des collaborateurs tunisiens.

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Caractérisation des phages mutants échappant aux systèmes de défense contre les phages de Streptococcus thermophilus

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Introduction : *Streptococcus thermophilus* est une bactérie utilisée dans l'industrie de la transformation du lait pour la production de yogourt et de certains formages. Un des problèmes rencontrés dans cette industrie est la présence de virus bactériens (bactériophages ou phages) dans le lait. Les phages posent un risque pour les entreprises de transformation du lait, car ils peuvent perturber le processus de fermentation du lait et causer une réduction de la qualité des produits laitiers fermentés. L'utilisation de souches de *S. thermophilus* possédant des mécanismes de défense contre les phages est l'une des solutions à ce problème. Quelques mécanismes de défense contre les phages sont déjà connus chez cette bactérie dont le système CRISPR-Cas qui est le plus efficace. Toutefois, des phages possédant des protéines anti-CRISPR (ACR, qui bloquent Cas9) ont émergé et de nouveaux systèmes de défense sont maintenant nécessaires. Les gènes codant pour des systèmes anti-phages sont souvent regroupés dans le génome bactérien (îlots génomiques) ce qui nous a permis de découvrir par association des mécanismes de défense contre les phages. Récemment, nous avons identifié plusieurs systèmes de défense chez *S. thermophilus* et ceux-ci ont été validés expérimentalement pour confirmer leur efficacité, incluant contre certains phages possédant des ACR. De plus, nous avons observé des synergies entre certains de ces systèmes et CRISPR-Cas[1].

L'objectif est maintenant d'identifier les cibles virales des systèmes de défense.

Matériels et Méthodes : Des phages mutants échappant aux systèmes de défense ont été isolés, à la fois en milieu liquide et en milieu solide, puis leurs génomes ont été séquencés (Illumina).

Résultats et conclusions : Des phages mutants ont été isolés pour quatre des treize systèmes de défense testés et ils seront caractérisés sous peu. Nous anticipons la détection de mutations dans les génomes des phages, ce qui permettra de localiser leurs cibles. L'identification de ces cibles est cruciale, car elle nous permettra d'introduire ces défenses dans des souches ayant un système CRISPR-Cas ciblant d'autres gènes de phages via divers espaceurs (spacers, crRNA). Nos travaux antérieurs ont démontré qu'une approche combinant plusieurs systèmes de défense distincts au sein d'une même souche est une stratégie prometteuse pour renforcer la résistance aux phages.

Remerciements : Op+Lait, CRSNG, IFF, Wallonie-Bruxelles International

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Édition génétique ciblée des bactériophages de Staphylococcus spp.

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Introduction : Dans la quête de solutions contre l'antibiorésistance, les bactériophages (phages) lytiques sont considérés comme une excellente alternative aux antibiotiques[1]. Certains phages n'infectent qu'une souche bactérienne spécifique, alors que d'autres peuvent infecter plusieurs souches d'une même espèce, ou d'espèces différentes au sein du même genre : c'est la gamme d'hôtes du phage[2]. Cette gamme d'hôte est influencée par plusieurs facteurs, notamment les interactions phages-hôte tels que les mécanismes de défense des bactéries et les systèmes anti-défense déployés par les phages. Nombreux de ces mécanismes ont été identifiés à l'aide d'outils bio-informatiques et caractérisés expérimentalement. Cependant, plusieurs mécanismes demeurent inconnus ou peu étudiés[3].

L'objectif de ce projet est de générer des phages mutants par la délétion de gènes accessoires afin d'identifier les systèmes anti-défenses présents chez les phages lytiques capables d'infecter une large gamme de bactéries.

Matériels et Méthodes : La gamme d'hôtes de 14 phages de la collection ULaval (phage.ulaval.ca) a été déterminée sur 140 souches de *Staphylococcus spp*. par le test du dépôt de la goutte (*spot test*) et l'efficacité à former des plages de lyse (*EOP*) a été calculée. Les génomes des bactéries et des phages à large gamme d'hôtes ont été analysés afin de construire une matrice des systèmes de défense et anti-défenses connus. Ensuite, la technologie CRISPR-Cas9 sera utilisée pour déléter des gènes accessoires chez les phages d'intérêt.

Résultats et conclusions : Les résultats de l'analyse de l'*EOP* des phages testés sur les différentes souches ont révélé que les myophages K, 812, RuSa1 et Stab21 possèdent une très large gamme d'hôtes. Ils constituent ainsi les phages d'intérêt de ce projet. Nous anticipons que la délétion des gènes ciblés entraînera une réduction de l'*EOP*, voire la gamme d'hôte des phages mutants, ce qui confirmerait le rôle de ces gènes dans la protection du phage contre les systèmes de défense de la bactérie lors de l'infection.

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Nanocellulose-based Regenerated Filaments Made from Biomass Provide a Novel Material Platform for Medicine

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Introduction: Nanocellulose is a kind of high-performance biomass material with abundant resources, renewability and good biocompatibility. Effectively assembling nanocellulose into regenerated filaments provides a novel material platform in a controllable bottom-up manner. By adjusting the material, preparation process and filament structure, it possesses broad application prospects for medicine, such as drug loading, absorbable wound sutures [1], and biochemical sensors [2].

The objective of this study is to prepare nanocellulose-based regenerated filaments from jute waste and to analyze the factors affecting their properties.

Materials and Methods: Nanocellulose suspensions were prepared using a TEMPO-mediated oxidation process combined with a brief ultrasonic treatment. Then, the regenerated filaments were produced continuously through an environmentally-friendly wet-spinning method, using $CaCl_2$ solution as the coagulation bath. The rheology and spinnability of the nanocellulose suspensions of various oxidation degrees and nanocellulose concentrations were investigated.

Results and discussion: Nanocellulose suspensions shows shear-thinning rheological behavior, which is suitable for wet-spinning. The correlation among oxidation parameters, rheological properties of the nanocellulose suspensions, and the mechanical properties of the obtained filaments was verified. And the preparation process was optimized. Finally, filament with good flexibility and mechanical properties was prepared, with a breaking strength of 327.06 MPa.

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Restoring Circadian Rhythms. A strategy for treating oral cancer

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Introduction

Circadian rhythms are recurring cycles of approximately 24 hours that align the physiological processes in our body with the day/night cycle. The regulation of circadian rhythm in cells is intertwined with gene expression and chromatin organization within the nucleus. Disruption of this molecular clock may significantly disrupt chromatin organization and epigenetic marks. Furthermore, research has reported new classes of compounds that modulate the function of specific clock components and have the potential to re-establish normal clock function at the molecular level.

The objective

Using squamous cells as a model, the main aim of this proposed research is:
1) identify the changes in epigenetic and genome folding patterns and
2) determine specific compounds that modulate clock function impact epigenetics and folding.

Materials and Methods

Based on the genome folding assay, chromosome conformation capture (3C). 3C is a technique used to determine whether distal genomic sequences (enhancers, promoters) are interacting with each other *via* loop formation. Chromatin immunoprecipitation (ChIP) sequencing, ChIP is used to identify the interaction of circadian clock proteins with the genome at specific locations. RNA sequencing is be used to identify gene expression in order to determine which genes are being activated/inactivated. Assays such as cell synchronization, RNA and DNA extraction, qPCR, primer design, western blots and immunofluorescence microscopy go hand in hand.

Results and discussion

Clock genes are disrupted in oral cancers linked to disrupted chromatin organization and epigenetic marks. Furthermore, research has reported new classes of compounds that modulate the function of specific clock components and have the potential to re-establish normal clock function at the molecular level. Using squamosal cells as a model, ideal for studying disrupted circadian rhythms, we characterize abnormal genome folding and epigenetic patterns using chromatin conformation capture (a tool for analyzing genes in proxi) and chromatin immunoprecipitation. In addition, we explore the potential role of specific compounds that modulate clock function impact on genome folding *via* RNA sequencing, immunofluorescence and western blot. This research will provide new insights into mechanisms of genome folding and will identify new biomarkers to predict early signs of circadian rhythm disruption.w

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The Fourth Dimension of Enamel Organ Formation: A Timely Contribution

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Introduction: Most cellular processes and physiological functions follow circadian rhythms, and there is accumulating evidence that circadian clock disruption is directly linked to a variety of human disorders. Dental enamel formation is an excellent developmental model where one can observe the daily rhythms of life at all biological levels, including synchronized cell movement and rhythmic progression through the stages of cell differentiation linked to interconnected alternated waves of matrix deposition and mineralization in 3D spaces.

The objective of this study is to understand the dynamics and complexity of circadian-developmental interactions in mineralized dental tissues, particularly enamel.

Methodology: We performed an in-depth analysis of the dental phenotype and ameloblasts' molecular profile in three circadian knockout (KO) mice models with different chronotypes: Period2 (Per2) KO (arhythmic), Cryptochrome1 (Cry1) KO (shortened circadian period) and Cryptochrome2 (Cry2) KO (elongated circadian period).

Results and Discussion: Our results show direct links between chronotypes and phenotypes in all dental tissues, including alveolar bone. In Per2 and Cry2 mutant mice, enamel mineralization was delayed, while targeting Cry1 resulted in precocious enamel mineralization. In addition, targeting the Cry2 gene resulted in a faster rate of enamel secretion. Per2 KO mice showed impaired enamel prismatic structure and defective surface enamel, and Per2 KO ameloblasts showed significantly higher protein levels of the main enamel matrix protein amelogenin (AMELX) and of the enamel protease kallikrein-4 peptidase (KLK4). Similar unique links between the different chronotypes and dental tissue phenotypes were observed in dentin and alveolar bone (AB). While dentin mineral content didn't significantly change across the three KO. models, targeting Cry1 and Cry2 yielded opposing effects on dentin thickness, with Cry1 knockout mice exhibiting thinner dentin and Cry2 knockout mice showing thicker dentin, suggesting a correlation between circadian rhythm length and the secretion of dentin matrix proteins. With regards to AB, only Per2 KO mice showed reduced mineral content in alveolar bone compared to wild type, with no differences observed in Cry1 and Cry2 KOs. This study clarifies causal relationships between circadian rhythms disruption and enamel organ formation,

dentinogenesis, and AB remodelling that may be used to establish future research directions to elucidate the links between dynamic organogenesis and its fourth dimension, time.

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