DMD Summer Projects

- Clinical Research
- Clinical Research / Basic Science
- Clinical Research / Public Health
- Public Health

Clinical Research

Retentive properties of TiN-coated Novaloc attachments for overdentures

Dr. Raphael F. de Souza

Project Description:

Edentulism is an irreversible, chronic condition that can undermine the well-being of an individual. Removable complete dentures are the most common treatment modality for edentulism; however, the expected chewing performance of a patient with these appliances is roughly one third of dentate individuals. It is known that the lower denture is the major source of discomfort and poor chewing performance amongst denture wearers. Thus, the mandible has become the primary target for implant-assisted prosthetics. In the past, the efficiency of implant-retained mandibular dentures was extensively improved by retentive attachments over a reduced number of implants. Since 2002, there has been consensus on the 2-implant mandibular overdenture as a minimum standard of care for edentulism.

Despite the many benefits offered by 2-implant overdentures, its reliance on a reduced number of attachments outlines the importance of their regular maintenance. In more detail, the retentive stud attachment (e.g., a Locator or ball/O-ring) requires routine reactivation or a change in the retentive components, which may become inefficient/costly for the intended population (e.g. elderly patients). One new alternative to these traditional attachments is the Novaloc system. In this system, matrices are made of polyetheretherketone (PEEK), a material that is more resistant than the traditionally-used nylon.

Although Novaloc abutments have been previously manufactured with amorphous diamond-like carbon abutments (ADLC), a traditional titanium nitride (TiN) coating is still necessary to comply with the regulations of certain countries, e.g. the United States. To our knowledge, studies comparing TiN-coated coating are unprecedented.

To address this gap in knowledge, this in vitro study aims to understand the retentive capacity of the TiN-coated Novaloc attachments. Our specific objective is to compare Novaloc-TiN and Locator attachments for two-implant overdentures. Attachments will undergo retentive force measures before and after mechanical cycling, and plastic inserts will be tested for integrity by imaging and thermal analysis. These tests should elucidate changes in geometry and matrix composition of test attachments, without further influence of different coating materials (e.g. ADLC -coated Novaloc vs Locator).

Student Responsibilities:

To assist with specimen preparation for mechanical testing and data analysis (including organization of results in tables/graphs), presentation of results in conferences.

Project location:

Strathcona Anat. & Dent. Building, Room M60

Clinical Research

Therapeutic effects of Platelet rich fibrin on patients with symptomatic erosive Oral Lichen Planus

Dr. Firoozeh Samim

Project Description:

Oral Lichen Planus (OLP) is a chronic inflammatory mucosal condition which affects up to 2.0% of the general population. Even though no clear pathogenesis has yet been published for this chronic condition, but the most accepted pathway is described as a T-cell mediated autoimmune condition. Despite there is not yet an effective curative treatment for this chronic condition, some palliative treatments including topical or systemic corticosteroids have been previously suggested to clinically manage it. However , there were some minor to major complications or systemic adverse effects associated with proposed treatment including oral candidiasis. Platelets concentrate products are the biological autologous products derived from the patient's blood. One of these platelets products is Platelets Rich Fibrin (PRF) which has an effective role in bone regeneration and soft tissue healing in different dental procedures. Medical reports demonstrate that PRF could reduce inflammatory complications such as pain and swelling. It can also improve mouth opening and masticatory function in patients with immunologically mediated disorders, oral ulcers, and extraction sockets. One of the important molecular mechanisms that shows the effectiveness of this treatment is the immunomodulatory effects of platelet concentrates. In fact, via PRF therapy, the level of proinflammatory mediators can change which leads to inhibition of cytokine secretion, decrease in inflammation and consequently enhancing tissue healing. The overall aim of this clinical study is to suggest platelet rich fibrin as a possible curative treatment for symptomatic erosive oral lichen planus. This hypothesis will be met through the following objectives: (1) to assess the clinical pathological phase of the condition. (2) to evaluate the therapeutic effects on patients diagnosed with symptomatic erosive OLP based on their Visual Analogue pain score and the morphological form of the lesion.

In this study, we will conduct a randomized clinical blind study through which patients who are histopathologically diagnosed with symptomatic erosive OLP will be assigned into two groups. The focus group will receive 1ml of their PRF sample for an interval of 2 weeks up to 2 times, while the control group will receive 1 ml of corticosteroids (Triamcinolone Acetonide) for an interval of 6 weeks up to 2 times. Both groups will undergo a follow up every 4 weeks for a period of 12 months.

Student Responsibilities:

Review of literature and gathering patient data

Project location:

MGH and McGill Faculty of Dental Medicine and Oral Health Sciences

Clinical Research / Basic Science

TMD biomarkers and biomarkers signatures

Dr. Carolina Beraldo Meloto

Project Description:

Molecular mechanisms contributing to temporomandibular disorders (TMD) have yet to be identified, hampering development of mechanism-based diagnostic and treatment strategies for this complex condition. Historically, discovery of TMD-related molecular mechanisms has been impeded by the heterogeneous nature of TMD, which is characterized by disturbances in diverse biological and psychosocial processes. With the advent of new machine-learning methods, it is now possible to reproducibly classify TMD patients into 3 clusters: 1) a “global symptoms” (GS) cluster of patients sensitive to experimental pain and has multiple symptoms of depression, anxiety, and general somatic complaints; 2) a “pain sensitive” (PS) cluster likewise sensitive to experimental pain, but lacks excess psychological and somatic symptoms; and 3) the “adaptive” (A) cluster is relatively pain tolerant and copes well with psychological and somatic symptoms. I expect GS patients to have underlying pathological disturbances in a range of physiological systems (pain processing, autonomic dysregulation, immune systems), experience high-impact clinical pain, and have increased likelihood of onset and persistence of TMD. Importantly, greater homogeneity of pathological disturbances is expected within clusters than among TMD patients at large.

In this project, I propose a prospective observational clinical study to explicate molecular mechanisms to discriminate between TMD clusters and to better understand high impact pain and prognosis for clinical outcomes. My overall objective is to apply an integrative multi-omics approach to identify molecules and pathways that underly molecular pathophysiology of clinical TMD clusters and in the long run offer significant potential for patient selection and stratification in phase I&II clinical trials of new treatments that target pain-pathology mechanisms specific to TMD clusters, advancing patient care from symptom-based treatment to precision medicine. My specific aims are:

- Aim 1: Recruit a cohort of 200 patients seeking treatment for TMD and 200 TMD-free controls;
- Aim 2: Identify molecular signatures and pathways that discriminate between patient clusters (GS vs. PS, GS vs. A, PS vs. A) and between TMD cases and pain-free controls; and
- Aim 3: Identify molecular signatures and pathways that discriminate TMD patients whose symptoms improve over time from those whose symptoms do not improve.

Student Responsibilities:

The student will have a chance to learn and have hands-on experience with multiple aspects of clinical and basic research (molecular biology). The student will learn the logistical aspects of clinical research, including but not limited to, ensuring IRB requirements are being met, organizing the study schedule, and collecting and properly storing participant data. The student will also learn how to conduct a research study visit under direct supervision. Lastly, the student will be taught molecular biology techniques needed to properly handle (they will be introduced to the concepts of Laboratory Information Management Systems (LIMS) for Biobanking) and process biological samples, such as blood fractionation, DNA/RNA isolation, and cryopreservation of cells. Throughout the course of this summer project, the student will acquire both comprehensive understanding and hands-on experience in both clinical and basic research and will acquire a solid basis to pursue future scientific goals.

Project location:

Strathcona and Genome Buildings

Clinical Research / Basic Science

Jaw movement and orofacial muscle activity during singing

Elizabeth Zimmermann

Project Description:

Singers use the muscles in their head and neck to shape the vocal tract to produce sound, resonance, vibrato and overtones. Jaw position and muscle activity during singing is considered to be distinctly different from speaking. However, jaw kinematics during singing is poorly understood. This is important because tension in the orofacial muscles is anecdotally associated with problems of sound quality. Additionally, studies have found a higher prevalence of temporomandibular joint sounds and temporomandibular pain in amateur and professional vocalists.

This pilot study is a collaboration between researchers at the Faculty of Dental Medicine and Oral Health Sciences and the Schulich School of Music at McGill University. The long-term goal is to understand orofacial health in singers. As a first step, we are investigating jaw kinematics and muscle activity in relation to sound quality. The participants in the study are asked to perform a series of activities (clenching, chewing, speaking, singing), while jaw kinematics and muscle activity are simultaneously measured. Jaw kinematics is measured with a motion analysis system, where infrared trackers are placed on the forehead, lips and chin and their 3D spatial location is tracked with 10 infrared cameras. Muscle activity is measured with electromyography placed on the masseter and zygomaticus muscles.

Student Responsibilities:

During the research project, the student will have the following responsibilities:

- Attending group meetings
- Reading literature to understand techniques and background of research question
- Working with a graduate student to collect data and develop data analysis routines to quantify jaw displacements and muscle activity.

*There may be a possibility for extended funding for this project.

Project location:

Strathcona Anatomy and Dentistry Building and the Centre for Interdisciplinary Research in Music, Media and Technology (Schulich School of Music, McGill University)

Clinical Research / Public Health

DNA methylation associated with HPV related oropharyngeal cancer

Dr. Firoozeh Samim

Project Description:

The most common malignancy affecting the oral cavity and head and neck is oral squamous cell carcinoma (OSCC). Unfortunately, global cancer statistics continue to associate OSCC with poor prognosis resulting in a five-year survival rate of 65%, although in late-stage disease survival is less than 30%. This low survival rate is due to a lack of awareness of two things: 1) the importance of early diagnosis; and 2) early clinical indicators. The estimated prevalence rate of HPV in OSCC is highly variable, ranging from as low as 3.9 % to as high as 34.5%. Overall, there has been a dramatic shift in epidemiology of head and neck cancers as smoking-related cancers decrease in incidence while HPV-related cancers rise. Regarding OSCC, a recent study revealed that infection with HPV 16, but not 18, may increase the risk of developing floor of the mouth, gingiva, tongue and palate cancers. Therefore, an urgent call for vigilance in reducing traditional risks factors for head and neck cancers, such as tobacco and alcohol use, and emerging risk like HPV infection. However, owing to the limited data on HPV prevalence in OSCC, understanding the role HPV status plays in OSCC survival rates is poor, hence, OSCC continues to be staged and treated regardless of HPV status.

OSCC and HPV(+)OPC are associated with significant morbidity, mortality, and cost burden to the individuals and the health care system, a matter that entails provision of preventive measures and efficient screening programmes aiming to reduce the overall burden.

This proposal is designed to collect and analyze oral cancer data in Quebec to determine the risk factors, prognostic factors, high-risk groups, and the 5-year disease-specific survival rates by patient related, treatment related and histopathologic related prognostic factors. The two research aims for this study will help: 1) to identify the oral cancer patient population in QC; and 2) to identify risk factors in this population including HPV. Results will guide the best

strategies for selective opportunistic screening and clinical treatment of oral cancer; generate advanced knowledge and skills for early detection of oral cancer by medical professionals; and offer firsthand information to inform and educate at-risk populations of oral cancer. The resulting information will be applicable to clinical professionals and high-risk populations to improve the incidence, mortality, survival, and quality of life of oral cancer patients in the NL area.

In this study, we will use quantitative epidemiologic research methods to determine trends in the incidence and survival of oral cancers in QC. An exploratory mixed inquiry methods will be used to capture multiple dimensions of the research questions. The provincial population-based cancer registry will be accessed including hematology and pathology reports, death certificates, and hospital reports from cancer treatment centers in the past 11 years from 2008 to 2019. Since HPV infection is identified as an emerging risk factor for oral cancer, its analysis will be completed separately for oropharyngeal cancer and oral cavity cancer, and its infection trends will be examined based on demographic patient data to identify at-risk groups. The genetic and epigenetic tests would be perform for HPV related oropharyngeal cancer.

Student Responsibilities:

Review of literature and gathering patient data

Project location:

MGH and McGill Faculty of Dental Medicine and Oral Health Sciences

Public Health

Analyzing Indigenous Oral Health Challenges at a Women's Shelter during the Covid-19 Pandemic

Dr. Elham Emami and Alissa Levine

Project Description:

Drawing on the fieldwork previously conducted by DMD students at a Shelter with a large clientele of Indigenous women, the project focuses on pursuing analysis of a series of interviews with shelter staff exploring their perceptions and experiences of Indigenous health, especially oral health, and well-being in the context of a pandemic. The ongoing initial project (IRB # A11-E70-19B) led to in-depth interviews and involvement in their analysis by DMD students: two students volunteered at shelters, contributing to shelter life while gaining insight and, ultimately, access to the field. The interviews have been conducted and transcribed. Analysis was initiated but must be completed. The aim of this summer project will thus be to finalize analysis and contribute to all steps leading to publication of an article. The added difficulties of undertaking fieldwork in the context of the pandemic will also be incorporated into the analysis.

Student Responsibilities:

- Read and code interview transcripts based on the previously established coding system
- Contribute new codes in the form of pertinent themes and subthemes
- Perform a review of select literature to enhance the background section of the article
- Meet with the directors regularly to discuss progress and work on all components of the proposed article (including background, results and discussion)

Project location:

5th floor, 2001 McGill College Avenue and remote work, as required

Public Health

Artificial intelligence in periodontal disease diagnosis: a review

Sreenath Madathil and Dr. Thomas Nguyen

Project Description:

Periodontitis is a leading cause of tooth loss affecting 20-50% of global population. Diagnosis of periodontists is multimodal including periodontal probing depth measurement, clinical and radiographic assessment. However, due to the difficulty in accurately assess the severity of the diseases, accurate diagnosis and staging of periodontitis remains challenging. To aid this process, the American Academy of Periodontology introduced a new classification system of periodontitis consisting of multidimensional staging and grading. However, the complexity of this system has been noted, especially in instructional settings. Artificial intelligence-based diagnosis algorithms have been a promising development in the field with potential to improve accuracy in diagnosis and supporting clinical decision making. However, the quality of evidence and performance of these algorithms must be critically evaluated to further facilitate the research in this direction. The current project aims to synthesise the evidence on the application of artificial intelligence in diagnosis of periodontal disease using a systematic approach. This summer project is the first step of our main project aiming to develop machine learning based diagnostic algorithm for staging and grading of periodontitis.

Student Responsibilities:

The student will work through steps of conducting a review with the help of a librarian. Critically review the final set of papers selected and prepare a manuscript. There is a possibility of working on initial data extraction for developing an algorithm, depending on how progressed we are on the IRB approvals.

Project location:

Can be virtual, otherwise 2001 McGill College Ave, McGill College

Public Health

Motivational conversations: oral health behavior tele-counseling interviews using a Motivational-Interviewing approach

Nora Makansi

Project Description:

This feasibility project is about counseling parents in disadvantaged communities on prevention of Early Childhood Caries (ECC) using a Motivational Interviewing (MI) approach. MI is a person-centered, non-confrontational and non-judgmental counseling approach that may be effective in changing oral health behaviors. The guided conversations (tele-consultations) with parents will elicit the challenges and motivators of preventive oral health behaviors in their children such as nutrition, oral hygiene, fluoride use, and preventive dental visits and attempt to define specific goals. Up to two follow-ups will also be carried out to record any self-reported behavior change or intentions, and to explore parents' perceived value of MI.

Student Responsibilities:

Student would be asked to transcribe and analyse interviews (under supervision of the researchers). Also, the student may be involved in data collection (conduct follow up calls with participating parents).

Note: if data collection is delayed for any reason, the student could be involved in a systematic review of the literature on the same topic.

Project location:

The project will be carried out at the Welcome Hall Mission, however, most of the student's work can be done remotely

Public Health

Teledentistry in Quebec during and beyond the COVID-19 pandemic: what do we know and where are we going?

Drs. Pascaline Kengne Talla, Elham Emami, Paul Allison, Christophe Bedos

Project Description:

Background: Digital innovations are increasingly recognized as levers to address multiple health system challenges to help improve access, continuity, quality and cost of care for an efficient and equitable health system. COVID-19 has been a catalyst for digital health and its many applications to sustain and strengthen the health ecosystem. The literature, including recent systematic reviews, demonstrates the benefits of teledentistry at the patient, provider, and organizational levels. However, there is a lack of knowledge about the readiness of Quebec dentists to adopt virtual dental care, as well as the factors that may influence the delivery of this model of care. A better understanding of dentists' current teledentistry practices and needs becomes essential to improve the successful implementation of this oral health care delivery modality.

Objectives: 1) To describe dentists' current teledentistry practices and their expectations and needs for its integration into their practices; 2) To understand dentists' perspectives on the facilitators and barriers to its integration into their practices.

Methodology: This project is descriptive qualitative research, involving dentists working throughout the province of Quebec, namely general dentists and specialists, practicing in both public and private settings, in urban and remote/rural areas. Sampling and recruitment will be based on the maximum variation and snowball technique. A bilingual interview framework based on the Michie et al. conceptual framework will be developed and piloted. Data will be collected through semi-structured, virtual, one-on-one interviews lasting 45-60 minutes and will continue until saturation. Data will be digitally recorded and then transcribed verbatim. Interview transcripts will be coded with NVivo software. Deductive and inductive thematic analyses will be conducted.

Implications: This project will provide a portrait of the barriers and enablers to the adoption of teledentistry by dentists in Quebec.

Student Responsibilities:

Support in project coordination and in collection and collaboration, literature review and draft of the article, collaboration with the research team.

Project location:

Remote meetings or in person at 5th floor at 2001 McGill College Avenue, Faculty of Dental Medicine and Oral Health Sciences.