SESSION PROPOSAL 2024 IADR Annual Meeting & Exhibition

New Orleans, USA

1. TITLE: **Interface Between Oral Biology and BioMaterials**

2. DESCRIPTION: The interactions between materials, tissues, and organisms at the cellular and molecular levels are critical for advancing the development of the next generation of materials with improved biological properties. Material chemistries and properties can be fine-tuned to modulate biological responses, transform living systems toward regeneration, and prevent dysbiosis and tissue destruction. This workshop will discuss the potential of biomaterials to interact with living organisms and modulate cell and tissue responses.

3. SPONSORING SCIENTIFIC GROUP/NETWORK: Dental Materials

4. EDUCATOR/CLINICIAN TRACKS:

This proposal is of equal interest to both academic and clinical researchers.

5. FORMAT:

Five speakers (15 min presentation) followed by a Q&A session between the audience and speakers and closing remarks (10 min)

6. LEARNING OBJECTIVES

a. Exploring Biomaterial Applications: Explore how biomaterials can modulate cell and tissue responses, promote regeneration, and prevent issues like dysbiosis and tissue destruction in living systems
b. Fine-tuning material properties to modulate biological responses inspires novel materials and techniques. Furthermore, the focus on preventing dysbiosis and tissue destruction is integral to biomaterial innovation.

7. PROPONENTS

Vinicius Rosa (Organizer/Chair)

Associate Professor, Faculty of Dentistry, National University of Singapore, Singapore

Adriano Lima (Chair)

Professor, School of Dentistry, Health Science Institute, Paulista University, São Paulo, SP, Brazil.

Symposium Speakers:

1) **Adriano F. Lima**, School of Dentistry, Health Science Institute, Paulista University, São Paulo, SP, Brazil.

Title: **Cell analysis for determination of the cytotoxicity of dental materials**

Summary: Dental materials used in various dental specialties must offer optimal clinical performance, longevity, and minimal side effects on oral tissues. Evaluating the cytotoxicity of these materials is vital for validating their clinical applications. Dental resins, in particular, pose a challenge due to the numerous compounds in each formulation and their diverse applications. Assessing the cytocompatibility of dental materials depends on the intended use of the material or compound. This choice directly influences the selection of cell types for experiments. Additionally, the cell response should align with the material's application, extending beyond just assessing cell metabolism. For instance, cells may increase cytokine levels without affecting mitochondrial metabolism or cell death rates after exposure to a material. Even without impacting cell metabolism, such materials are far from inert. This presentation will delve into key parameters for assessing the cytotoxicity of dental materials, considering cell characteristics and chemical analysis. It aims to guide researchers toward more suitable and relevant study designs to ensure the safety and effectiveness of these materials in various dental applications.

2) **Denise Carleto Andia**, School of Dentistry, Health Science Institute, Paulista University, São Paulo, SP, Brazil

Title: **The plasticity of molecular mechanisms on the biological effects of a biomaterial.**

Synopsis: Studies have revealed variations in cell responses to different environmental challenges, such as biomaterials or regenerative therapies. These variations are linked to the unique molecular patterns expressed by cells and should be taken into account in clinical approaches. Various methods can be employed to assess biological effects in specific cell types, ranging from genome-wide screening to molecular and biochemical analyses. In the context of bone regeneration and implantology, biomaterials can enhance mineral deposition, cell proliferation, and adhesion. Molecular assays provide insights into potential molecular targets like proteins and genes that can be influenced by specific materials, contributing to the resolution of clinical issues. Molecular responses, when combined with cellular and morphological evaluations, should be conducted, considering their limitations, advantages, and disadvantages in interpreting results. Therefore, it's crucial to adopt

a well-planned approach that incorporates molecular methods alongside other experimental techniques to achieve a more comprehensive analysis that can inform clinical applications. This presentation will center on molecular aspects that enhance our comprehension of the biological effects of biomaterials, taking into account cell phenotypes in certain clinical approaches.

3) **Nileshkumar Dubey**, Faculty of Dentistry, National University of Singapore, Singapore

Title: **Shaping Dental Biomaterials: The Impact of Biointerfaces on Bioactivity and Cellular Differentiation Outcomes.**

Summary: Biointerfaces represent the dynamic interfaces where biomaterials, such as implants and scaffolds, meet the biological milieu within the oral cavity. The development of advanced biomaterials for dental application necessitates precise control over interfacial properties that influence cellular and biomolecular behaviours. These properties, including nano and micro-scale roughness, mechanical characteristics, chemical signals and many more are crucial factors sensed by cells, impacting their responses. For instance, culturing stem cells in environments designed that mimic the bone extracellular matrix composition results in the expression of tissue-specific transcription factors, driving their commitment to an osteogenic fate. The presentation will talk about the strategies used to engineer these interfaces for enhanced biological responses, fostering enhanced tissue regeneration or implant integration for improved dental treatments. Furthermore, it will highlight their potential to modulate cellular behaviour, guiding the development of advanced dental materials for more efficient and personalized clinical applications.

4) **James Tsoi**, Faculty of Dentistry, The University of Hong Kong, Hong Kong SAR, PR China

Bio-active vs bio-inactive - a tug of war on dental (bio)materials

Over the years, the development of dental (bio)materials has an ultimate goal - to be functional in certain aspects, such as restoring missing (or a part of) tooth with good mechanical and aesthetic properties. However, the oral cavity is a challenging environment that contains a variety of microbes, enzymes, temperature changes and so on. Thus, the oral cavity is not easily simulated in a laboratory environment. This

said, placing materials in the oral cavity has induced other diseases such as secondary caries and peri-implantitis that have not been expected and predicted. New (bio)materials have started to develop and are claimed to have other functions such as bio-active and bio-inactive in combating these new diseases - isn't it a loop? This presentation will discuss whether a balance of these properties can be achievable, and will discuss the future of design of dental materials including some frontier techniques such as data-driven artificial intelligence.

5) **Sung-Hwan Choi**, Department of Orthodontics, Institute of Craniofacial Deformity, Yonsei University College of Dentistry, Seoul, Republic of Korea

Title: Antifouling Bioactive Materials using *Zwitterions*

Summary: Oral biofilm consists of more than 700 different types of microorganisms and extracellular polymeric substances (EPS). Because of EPS, conventional physical and chemical methods have limitations in removing biofilms once they have matured thickly. Therefore, I would like to introduce the antifouling effect that prevents bacterial contamination by functionalizing the material surface using zwitterionic polymers (ZP) at the initial biofilm maturation stage.If a thick hydration shell is formed on the material surface via ZP, it is possible to resist the adhesion of salivary proteins and oral harmful bacteria, and the prevention of enamel demineralization. When multiple ZPs are grafted onto the material surface simultaneously under biological conditions such as saliva, an anti-polyelectrolyte effect occurs accompanied by swelling of the ZP brushes, and hydration enhancement due to weakened inter- and intra-polymer interactions to achieve maximum antifouling effect. In addition, multiple ZP can act as a multivalent zwitterionic network modifier (α-mZM) for the upregulation of ionic exchange when incorporated with bioactive materials such as glass ionomer cements. Using bioactive materials with ZPs, antifouling effects by hydration shell resist bacterial contamination and normalized microbiome community. Also, due to increasing ion-releasing channels, eluted ions support neutral pH and remineralization potential.

IADR INTERNATIONAL ASSOCIATION FOR DENTAL, ORAL, AND CRANIOFACIAL RESEARCH

2024 IADR/AADOCR/CADR GENERAL SESSION & EXHIBITION

SESSION PROPOSAL PRESENTER AUTHORIZATION FORM

The International Association for Denta, Oral, and Craniofacial Research seeks submission of session proposals to be presented and recorded as part of the IADR/AADOCR/CADR General Session & Exhibition (March 13-16, 2023) in New Orleans, Louisiana. As part of the 2024 General Session, session recordings will be available for access by attendees and on demand through an IADR partner. The sessions will be recorded and available for up to one year after the conclusion of the General Session for continued participation by meeting attendees virtually within the IADR meeting platform. All session proposals accepted into the 2024 General Session program are required to agree to be included in the meeting platform and to complete all necessary tasks, including signing this agreement.

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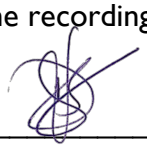
Signature:  Date: 10/17/2023

Printed Name: Denise Carleto Andia

Presentation Title: The plasticity of molecular mechanisms on the biological effects of a biomaterial.