

#1 Dr. Vinicius Rosa

Associate Professor

ORCHIDS Oral Care Health Innovation and Designs Singapore (Director)

Title: Essentials and Tips for Testing Biological Properties of Materials

The precise assessment of biological properties is indispensable in biomaterials research, as overlooking the intricate interplay between biomaterials and biological systems can impede progress and hinder the development of innovative solutions. Thus, addressing this gap becomes imperative to ensure biomaterials' functionality, biocompatibility, and their ability to elicit positive responses in biological contexts. This session aims to elucidate the fundamentals of biomaterials testing concerning biological properties and their profound influence on clinical behavior. Through discussions, participants will explore the selection and execution of biological tests crucial for developing next-generation biomaterials capable of modulating cellular and tissue behavior. By understanding the importance of precise assessment, attendees will gain insights into the pivotal role of biomaterial testing in fostering advancements in the field and paving the way for innovative clinical applications.

Learning Objectives:

1. Focus on the selection and execution of biological tests to develop next-generation biomaterials that modulate cellular and tissue behavior.
2. Gain insight into the importance of precise assessment of biological properties in biomaterials research and the consequences of neglecting this interplay on innovation.
3. Explore the fundamentals of biomaterials testing and its impact on clinical behavior.

#2 Dr. Vesna Miletic

Professor of Restorative Dentistry

Director of Restorative Dentistry & Head of Discipline Tooth Conservation

Director of Academic Career Development

The University of Sydney

Faculty of Medicine and Health, Sydney Dental School

Title: Clinical Techniques Affecting Material Properties – Where are the Red Lines?

There is no best restorative material for a clinical indication. In clinical practice, inherent material properties cannot be improved beyond their upper limits, however, modifications in clinical techniques may compromise material properties and adversely affect restoration longevity. The current learning landscape in dentistry has changed significantly in that social networks have been recognized by many clinicians as a secondary learning resource. This is especially so as these platforms offer useful and visual clinical tips and tricks and are more easily accessible to clinicians than expensive hands-on courses or subscription-based scientific literature. A downside of social networks is the lack of peer-review and often scientific evidence behind some clinical practices.

This lunch & learn session will discuss some prominent clinical practices, such as the snow-plow technique, preheating materials, light-curing through cavity walls, management of oxygen

inhibition layer on restoration surface, the use of modelling liquids and liners in restorative procedures. We will discuss ways these may affect restorative materials, focusing on existing scientific evidence.

Learning Objectives:

1. Identify and discuss critical aspects of clinical restorative procedures that may adversely affect material properties and restoration longevity
2. Critically appraise scientific literature/alternative learning resources pertinent to modifications in recommended clinical techniques from the material perspective

#3 Dr. Hilde Molvig Kopperud

**Head of laboratory / Laboratorieleder, NIOM
NIOM - Nordic Institute of Dental Materials**

Title: Leaching and Analysis of Polymer-Based Materials

All polymer-based materials include some residual monomer after curing, some in very small amounts and some in larger amounts. A low amount of residual substances is important for good biocompatibility and high functionality of the material. We will briefly discuss different curing procedures and how this affects monomer leaching from a material. Further, an overview will be given on analytical procedures, starting with the choice of medium and extraction conditions, and ending with the identification and quantification of substances.

Learning Objectives:

1. essential differences in curing processes (in situ, in lab, industrial)
2. why initial investigation of the material is important
3. the choice of the “right” analytical parameters

#4 Dr. Salvatore Sauro

**BioMat – Dental Biomaterials Laboratory / Prof. Dr. Sauro Salvatore
Facultad de Ciencias de la Salud, Universidad CEU-Cardenal Herrera**

Title: Why should we consider the use of “bioactive” materials in modern dentistry

Modern “simplified single-step” dental adhesive systems have improved considerably over the last ten years, although shortcomings such as post-operative sensitivity, premature reductions in bond strength, interface and marginal degradation, and biocompatibility are still considered important issues with such materials. The degradation of the hybrid layer (HL) occurs through two main mechanisms: the enzymatic degradation of its collagen fibrils, and the leaching of the resin from the HL are enabled by residual unbound water between the denuded collagen fibrils, trapped within the HL. Indeed, activated proteases such as the matrix metalloproteinases and cysteine cathepsins can degrade the denuded collagen matrix. Furthermore, hydrolysis of dental polymers within the hybrid layer is a further major factor thought to destabilise the resin-dentine interface.

This L&L session has the aim to bring together a number of research observations to show how “bioactive” materials may interact therapeutically with dental hard tissues and reduce the degradation of the resin-dentine interface via remineralisation of the mineral-depleted dental hard tissues, so improving the durability of resin-dentine bonds. Moreover, the possible mechanisms of “bioactive” materials to interfere with the bacteria growth and prevent secondary caries will be emphasised. Their biocompatibility when used for pulp capping procedures will also be debated during this session.

Learning Objectives:

1. To discuss the different mechanisms of degradation processes at the resin-tooth bonding interface when using simplified and multi-steps adhesive systems.
2. To understand the interaction of “bioactive” materials with dental hard tissues and how these may reduce the degradation of the resin-dentine interface via remineralisation.
3. To discuss how “bioactive” materials can interfere with the bacteria growth and prevent secondary caries.
4. To debate on the biocompatibility of “bioactive” materials when used for pulp capping procedures.

#5 Dr. Jukka Matinlinna

**Biomaterials Science
Division of Dentistry
University of Manchester**

Title: Dental Implant Surfaces Tomorrow

Additive manufacturing, a.k.a. 3D printing, of dental implants is during these days rapidly increasing and substituting CAD/CAM milling technologies. At the same time, dental implant surfaces remain vital for successful osseointegration, stabilization, and healing. This is highly important for expected high survival and success rates for implants. On the other hand, the global dental implant market today is around 5 billion USD and its annual growth is estimated around 10% per annum for the following 5 years period. In implant dentistry the ultimate goal is a satisfied patient whose missing teeth are replaced with strong and durable dental implants with a lifelong service time. One of the open questions to consider is will ceramic implants ever overcome and beat Ti-based implants. And also, what kind of constructions are 3D printed dental implants and their surfaces? What else should we know about the dental implant surfaces today? Are there any special and superior coatings?

Learning Objectives:

1. What are 3D printed Ti implants?
2. What are 3D printed ceramic implants
3. What is important in implant surface structures?
4. Which implant surface treatments and coatings are most effective?

#6 Dr. Ana Bedran-Russo

**Associate Dean for Research
Distinguished Professor and Head, Department of Oral Biology
University of Illinois Chicago, College of Dentistry**

Title: Chemical and Mechanical Methods to Study Teeth and Adhesive Interfaces

This presentation will cover current methods to study chemistry and mechanical properties of teeth and adhesive interfaces; and how these properties are relevant to understand longevity of teeth and dental restorations. This session will cover advantages and limitations of methods and sample preparation.

Learning Objective:

1. To become familiar with tools, advantages and limitations to chemically study teeth and adhesive interfaces.
2. To become familiar with multi-length scale methods to study mechanical behavior of teeth and adhesive interfaces.