9th International Conference on Mechanics of Biomaterials and Tissues (ICMOBT)

16-20 December 2023 | Waikoloa Beach, Hawaii, USA

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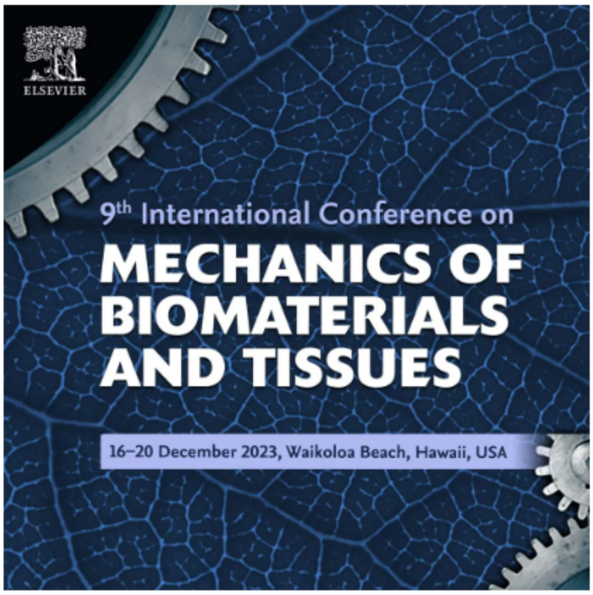

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Mechanical concepts are vital for living systems, for their stability, flexibility, locomotion and survival. In the course of evolution, materials were identified that help organisms fulfil these various functions. Consequently, mechanical concepts guide materials scientists to draw special inspiration for their own engineering solutions. Likewise, humans have always sought new bioinspired material concepts that assist them in overcoming their health limitations.

The field of implant materials is now moving from static concepts to dynamic biomaterials that can adapt to stimuli from the living environment. It is an exciting time for biomaterial research. The same is true for robotics, as soft actuated and responsive materials pave the way for the rapidly emerging field of "soft robotics", from the nano- to

11:00-12:20 Monday, 18 December, 2023, Naupaka 1 - 3

Session 9: Tissue engineering and regeneration I

Presentation type Oral

Chair: Christopher Chen

IN THIS SESSION

O9.1 11:00-11:20

Development of a new extrusion-based 3D-printing method (Dragging technique) and its application to tissue engineering

Hun Jin Jeong[1,2], Hyoryung Nam[3], Jae-Seok Kim[2], Sungkeon Cho[3], Hyun-Ha Park[2], Young-Sam Cho[2], Hyungkook Jeon[4], Jinah Jang[3], Seung-Jae Lee[2]
[1] Columbia University Irving Medical Center, USA. [2] Wonkwang University, Republic of Korea. [3] Pohang University of Science and Technology, Republic of Korea. [4] Seoul National University of Science and Technology, Republic of Korea

O9.2 11:20-11:40

Self-assembled fibrinogen nanofibers: a new bioinspired scaffold class for wound healing

Antoine Eyram Kwame, Titinun Nuntapramote, Dorothea Brüggemann
Hochschule Bremen - City University of Applied Sciences, Germany

O9.3 11:40-12:00

Mechanical stimulation of human chondrocytes by ultrasound as a bioinspired strategy to regenerate knee cartilage

Sofia Oliveira[1], Jorge Padrão[2], Susana Catarino[1], Francisca Monteiro[1,3], Andrea Zille[2], Filipe Silva[1], Betina Hinckel[4], Ana Leal[1,5], Óscar Carvalho[1]
[1] Center for MicroElectroMechanical Systems (CMEMS), University of Minho, Portugal. [2] Centre for Textile Science and Technology (2C2T) University of Minho, Portugal. [3] ICVS/3B's - PT Government Associate Laboratory, Portugal. [4] Department of Orthopaedic Surgery, William Beaumont Hospital, Royal Oak, USA. [5] Dom Henrique Research Centre, Portugal

O9.4 12:00-12:20

Functionally graded structures and hip implants durability

Muhammad Ali, April Trimmer
Ohio University, USA

ICMOBT 2023
(Dec 16 – 20, 2023)

Title

Development of a new extrusion-based 3D-printing method (Dragging technique) and its application to tissue engineering

Hun-Jin Jeong[1,7,#], Hyoryung Nam[2,#], Jae-Seok Kim[1], Sungkeon Cho[4], Hyun-Ha Park[1], Young-Sam Cho[3], Hyungkook Jeon[8], Jinah Jang[2,4,5,6,*], Seung-Jae Lee[3,*]

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Abstract

In the field of tissue engineering and regenerative medicine, considerable research has been conducted into the development of artificial tubular structures that mimic tubular constructs with a multi-layer cellular structure. Recently, many researchers have used 3D bioprinting, which can be used to fabricate free-form shapes, and which enables cell positioning at specific locations using bio-ink-containing cells. However, it is still challenging to develop a 1) free-form, 2) multi-layered cellular structure, or a tubular structure with 3) an implantable level of mechanical rigidity. In this study we developed to implement a tubular structure that satisfied above all three conditions using our well-established dragging 3D printing technique. Dragging technique can be able to create the free-form porous multi-layer tubular construct in one step, without any sacrificial materials and post-processing. Additionally, by combine with bioprinting technology, we successfully development the multi-cellular tubular structure, similar to physiological features of native tissue.

Therefore, we applied to developt an artificial esophageal tubular construct and small diameter vasculature (SDV). In order to fabricate the artificial esophageal tubular, we designed multi-layered free-form tubular construct (MFT) with wrinkle structure and bellows pattern to mimic native esophageal using dragging technique and developed the esophageal mucosa- and muscle-tissue derived decellularized extracellular bioink to build multi-cellular tubular construct. To development of the SDV, we prepared Human Umbilical Vein Endothelial Cell (HUVEC) and Human Aortic Smooth Muscle Cell (AoSMC) encapsulated collagen bioink and used this bioink to produce the SDV construct using the dragging technique.

The dragging technique developed in this study is a unique technology that can easily print a free-form porous multi-layered structure in a one-step process. In the future, the dragging technique could be valuable for the study and development of various tubular tissue-engineering constructs.

Acknowledgement

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