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PROGRAM BOOK

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KSPE Korean Society for Precision Engineering (KSPE, Korea)

Jeju 제주특별자치도 Jeju Special Self-Governing Province

Jeju CVB Jeju Convention & Visitors Bureau (사)제주컨벤션뷰로

Regular session : ORAL

OP4-012 A268 **Direct Ink Writing of a 3-dimensional Carbon Nanotubes-based Nanocomposite Structure for Sensors Application**

In Hwan Lee (Chungbuk National University)
Chaima Fekiri (Chungbuk National University)
Chiyen Kim (Korea Polytechnic University)
Ho Chan Kim (Andong National University)

OP4-013 A270 **Design of Magnetic Robot with Magnetic Force Control Capability**

So Hee Park (Chungnam National University)
Young-Woo Park (Chungnam National University)
Myounggyu Noh (Chungnam National University)

OP4-014 A320 **Construction of 3D Thick Skeletal Muscle Tissue with Integrated Vasculature by In-bath Cell Printing**

Seungyeun Cho (POSTECH)
Jinah Jang (POSTECH)
Myungji Kim (POSTECH)
Uijung Yong (POSTECH)
Donghwan Kim (POSTECH)
Dong Gyu Hwang (POSTECH)

OP4-015 A153 **Design, Analytical and Experimental Evaluations of Novel Pin-on-disc Sliding Mechanism on Thermo-mechanical and Electrical Behavior on Carbon Fiber Reinforced Polymer Composites**

Chunliang Kuo (National Taiwan University of Science & Technology)
Yuren Chen (National Taiwan University of Science & Technology)
Chiachun Chung (National Taiwan University of Science & Technology)

Construction of 3D Thick Skeletal Muscle Tissue with Integrated Vasculature by In-Bath Cell Printing

Seungyeun Cho[1], Myungji Kim[2], Uijung Yong[1], Donghwan Kim[2], Dong Gyu Hwang[2], Jinah Jang[1,2,3#]

1 Department of Convergence IT Engineering, POSTECH, Republic of Korea
2 School of Interdisciplinary Bioscience and Bioengineering, POSTECH, Republic of Korea
3 Department of Mechanical Engineering, POSTECH, Republic of Korea
Corresponding Author / E-mail: jinahjang@postech.ac.kr

KEYWORDS : 3D printing, 3D engineered muscle tissue, Vascularization, in-bath cell printing

To date, engineering volumetric muscle tissue has been suggested as potential therapy for volumetric muscle loss (VML), where excessive muscle injuries are beyond the endogenous self-repair capacity. In addition, human-scale volumetric muscle tissues could be used for modeling muscle-related human diseases such as muscle aging and various metabolic conditions. Proper vascularization is required in these engineered tissues to allow the diffusion of nutrient and oxygen to the cells throughout the tissue thickness (or diameter). As for in vitro muscle disease models, long-term cell viability is also a primary requisite to maintain native tissue function such as contractility throughout the culture period. In current researches, several methods are introduced to fabricate vascularized skeletal muscle tissues. First method is fabrication of channel structures in customized scaffold which is often followed by subsequent endothelial cell seeding inside the preformed structure. Surrounding the channel structure is usually matrices such as collagen. However, using this method, it is challenging to build capillary-scale microvasculature due to the size limitation. Next, self-organization method, benefiting from the inherent traits of organoids, enables recapitulation of more complex human vasculatures. In this research, we suggest a three-dimensional (3D) bioprinting-based approach which could combine the two addressed methods for the construction of volumetric skeletal muscle tissue with long-term viability. We have constructed 3D muscle tissue with multi-diameter vasculature via in-bath cell printing. First, mixture of high-density myogenic cells and skeletal muscle decellularized extracellular matrix (mdECM) is deposited as a bath material within a surrounding polymeric framework. An anchoring structure provides mechanical tension to the cells, inducing uniaxial alignment. Next, endothelial cells are printed inside the bath material either parallel of perpendicular to the muscle alignment axis, closely mimicking the native skeletal muscle vasculature. Parameter optimization of in-bath cell printing allow generation of both perfusable, lumen-forming vessels and self-assembling microvascular network. To show myogenic maturation in our 3D muscle tissue, expression of myogenic maturation-related markers and myofiber diameter were analyzed via immunofluorescence staining. Angiogenesis-related marker expression and lumen formation were also assessed to confirm proper vasculature formation. In the future, we anticipate that the suggested model might be applied for in vitro testing platform requiring long-term analysis and implantable tissue grafts for the treatment of VML.

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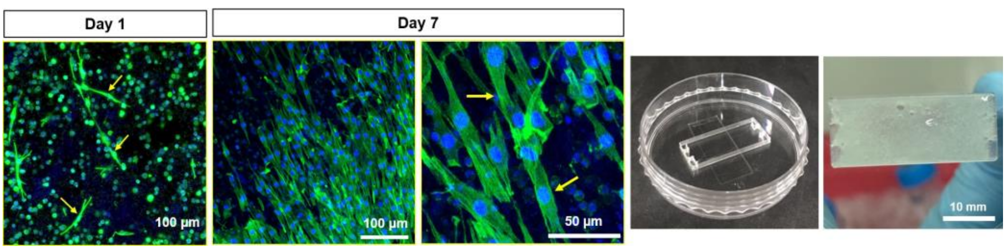

Fig. 1 Maturation of 3D skeletal muscle tissue based on polymeric framework and anchoring structure