Tissue Engineering and Regenerative Medicine
International Society Asia-Pacific Chapter Conference 2022

TERMIS-AP 2022

October 5-8, 2022 / ICC Jeju, South Korea

New Chapter of Future Regenerative Medicine

Program Book

Korean Tissue Engineering and Regenerative Medicine Society

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S1-F

Session Topic	SYIS
Title	Tissue regeneration
Date	October 5 (Wed) Time 14:30-16:00
Room	Room 401
Chair(s)	Hwan Kim (Korea National University of Transportation, Republic of Korea) Mako Kobayashi (Tokyo Medical and Dental University, Japan)

S1-F-01	14:30-14:40	**The effects of matrix-bound nanovesicles (MBVs) derived from high-hydrostatic pressure decellularized tissues on neural regeneration** **Mako Kobayashi**[1], Naoki Ishida[1], Yoshihide Hashimoto[1], Jun Negishi5, Hideki Saga[4], Takehiro Iwanaga[3], Yoshihiro Sasaki[2], Kazunari Akiyoshi[2], Tsuyoshi Kimura[1], Akio Kishida*[1] [1]Tokyo Medical and Dental University, [2]Kyoto University, [3]Kagoshima University, [4]KM biologics Co., Ltd., [5]Shinshu University, Japan
S1-F-02	14:40-14:50	**Interactions between macrophage and human fibroblast-derived extracellular matrix leads to advanced wound healing** **Cininta Savitri**[1], Sang Su Ha[1], Jae Won Kwon[1], Song Hoon Kim[1], Young-Min Kim[1], Kwideok Park*[1] [1]Korea Institute of Science and Technology, Republic of Korea
S1-F-03	14:50-15:00	**Exploring the use of regulatory T cells to promote tissue repair and regeneration** **Bhavana Nayer**[1], Jean Tan[1], Yasmin Alshoubaki[1], Ziad Julier[1], Anthony Park[1], Ajithkumar Vasanthakumar[2], Mikael Martino*[1] [1]Australian Regenerative Medicine Institute, Monash University, [2]Olivia Newton-John Cancer Research Institute, Australia
S1-F-04	15:00-15:10	**A designed spacer for resolving collagen hydrogel contraction** **Shih-Yen Wei** [1], Yu-Shan Chen[1], Ying-Chieh Chen*[1] [1]National Tsing-Hua University Chinese Taipei
S1-F-05	15:10-15:20	**Trizonal, tissue-engineered meniscus microtissues for treatment of meniscal defects in a micropig partial meniscectomy model** **Sujin Noh**[1], YONGJUN JIN[2], Dong Il Shin[3], Hee-Woong Yun[4], Hyeon Jae Kwon[3], Do Yeon Kim[1], Do Young Park*[2] [1]Department of Biomedical Sciences, Graduate School of Ajou University, [2]Department of Orthopedic Surgery, School of Medicine, Ajou University, [3]Department of Molecular Science and Technology, Ajou University, [4]Cell Therapy Center, Ajou Medical Center, Republic of Korea
S1-F-06	15:20-15:30	**Biomimetic semi-flexible hydrogel with reduced inflammation for bone defects** **Jae Seo Lee**[1], Il Keun Kwon*[2] [1]Department of Dentistry, Graduate School, Kyung Hee University, 26 Kyungheedae-ro, Dongdaemun-gu, Seoul 02447, [2]Department of Dental Materials, School of Dentistry, Kyung Hee University, 26 Kyungheedae-ro, Dongdaemun-gu, Seoul 02447 Republic of Korea
S1-F-07	15:30-15:40	**Fabrication of cell bead-laden 3D structure via oil-free microfluidic system for using thermoresponsive hydrogel** **Juyeon Kim**[1], WonJin Kim[1], Hyeongjin Lee[1], JiUn Lee[1], SooJung Chae[1], Dongyun Kim[1], GeunHyung Kim*[1] [1]Sungkyunkwan University Republic of Korea
S1-F-08	15:40-15:50	Spatiotemporal modulation of skeletal muscle regeneration with varying vasculature patterns in an in-bath bioprinted skeletal muscle tissue **Seungyeun Cho**[1], Myungji Kim[1], Uijung Yong[1], Donghwan Kim[1], Dong Gyu Hwang[1], Jinah Jang*[1] [1]POSTECH, Republic of Korea
S1-F-09	15:50-16:00	**Effect of chondroitin sulfate concentration and matrix stiffness on chondrogenic differentiation of mesenchymal stem cells** **Chengchong Ai**[1], James Goh*[1] [1]National University of Singapore

S2-F

Session Topic	SYIS
Title	Biomaterials
Date	October 5 (Wed) Time 16:30-18:00
Room	Room 401
Chair(s)	Hee Ho Park (Hanyang University, Republic of Korea) Yunji Lee (POSTECH(Pohang university of science and technology), Republic of Korea)

S2-F-01	16:30-16:40	**Decellularized tissue-derived adhesive hydrogel with enhanced mechanical property for tissue regeneration** **Yi Sun Choi**[1], Jung Seung Lee[1], Mi Jeong Lee[1], JungHo Bae[1], Jong Seung Lee[1], Eun Je Jeon[1], Soohwan An[1], Min Suk Lee[2], Hee Seok Yang[2], Seung-Woo Cho*[1] [1]Yonsei University, [2]Dankook University
S2-F-02	16:40-16:50	**The modification of terminal end of thermal sensitive Pluronic for enhancing nasal drug deliver to brain** **Tsung-Yun Wu**[1], Yu-Shuan Chen[2], Hsieh-Chih Tsai*[1] [1]National Taiwan University of Science and Technology, [2]Hualien tzu chi hospital buddhist tzu chi medical foundation, Chinese Taipei
S2-F-03	16:50-17:00	**Preparation of doxorubicin-liposomes loaded composite scaffolds of gelatin and gold nanoparticles for breast cancer therapy and breast tissue engineering** **Huajian Chen**[1], Naoki Kawazoe[2], Guoping Chen*[1] [1]Research Center for Functional Materials, National Institute for Materials Science; Sch. of Pure and Applied Science, University of Tsukuba, [2]Research Center for Functional Materials, National Institute for Materials Science, Japan

O-T01-0125

Spatiotemporal modulation of skeletal muscle regeneration with varying vasculature patterns in an in-bath bioprinted skeletal muscle tissue

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

[1]*POSTECH*

For the treatment of volumetric muscle loss (VML), de novo regeneration of damaged sites can be achieved by incorporation of muscle-resident satellite cells (SC), which possess intrinsic self-repair capacity upon regenerative stimuli such as tissue injury. However, limited long-term maintenance (e. g. loss of quiescence) of SCs function hampers their therapeutic efficacy. Engineering an artificial SC niche with tissue-specific stiffness and ECM composition has been suggested to overcome the addressed limitations. Another promising strategy is to mimic the SC-endothelial crosstalk that takes place during tissue regeneration by fabrication of three-dimensional (3D) vasculature in an implantable muscle construct. We suggest a 3D bioprinting-based direct endothelial cell patterning method which leads to a spontaneous vascular network formation. Human umbilical vein endothelial cells, encapsulated in skeletal muscle decellularized extracellular matrix (mdECM), were directly printed into a supporting bath composed of myogenic cells and mdECM. Immunostaining for CD31 and F-actin confirmed that printed cells remained viable after printing. With cytokine array and ELISA analysis, we observed the upregulation of myokines upon vascularization that beneficially affects SC self-repair capacity. Moreover, incorporation of human muscular endothelial cells resulted in skeletal muscle endothelium specificity confirmed by TSPAN7 and FLK1 immunostaining. In addition, angiogenesis-myogenesis coupling was maintained long-term (at least 14 days) by optimizing the pattern-pattern distance and eventually resulted in enhanced muscle maturation, confirmed by qRT-PCR analysis of late myogenesis genes. We expect that temporal modulation of regeneration in our tissue could be effectively used for treatment of dystrophic muscles such as VML and Duchenne Muscular Dystrophy.

Keywords : Skeletal muscle decellularized extracellular matrix (mdECM), Regeneration, Angiogenesis, Myogenesis, 3D bioprinting, In-bath bioprinting, VML, DMD

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- Spatiotemporal modulation of skeletal muscle regeneration with varying vasculature patterns in an in-bath bioprinted skeletal muscle tissue -

(October 5, 2022 – October 8, 2022)

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

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Abstract

For the treatment of volumetric muscle loss (VML), de novo regeneration of damaged sites can be achieved by incorporation of muscle-resident satellite cells (SC), which possess intrinsic self-repair capacity upon regenerative stimuli such as tissue injury. However, limited long-term maintenance (e. g. loss of quiescence) of SCs function hampers their therapeutic efficacy. Engineering an artificial SC niche with tissue-specific stiffness and ECM composition has been suggested to overcome the addressed limitations. Another promising strategy is to mimic the SC-endothelial crosstalk that takes place during tissue regeneration by fabrication of three-dimensional (3D) vasculature in an implantable muscle construct. We suggest a 3D bioprinting-based direct endothelial cell patterning method which leads to a spontaneous vascular network formation. Human umbilical vein endothelial cells, encapsulated in skeletal muscle decellularized extracellular matrix (mdECM), were directly printed into a supporting bath composed of myogenic cells and mdECM. Immunostaining for CD31 and F-actin confirmed that printed cells remained viable after printing. With cytokine array and ELISA analysis, we observed the upregulation of myokines upon vascularization that beneficially affects SC self-repair capacity. Moreover, incorporation of human muscular endothelial cells resulted in skeletal muscle endothelium specificity confirmed by TSPAN7 and FLK1 immunostaining. In addition, angiogenesis-myogenesis coupling was maintained long-term (at least 14 days) by optimizing the pattern-pattern distance and eventually resulted in enhanced muscle maturation, confirmed by qRT-PCR analysis of late myogenesis genes. We expect that temporal modulation of regeneration in our tissue could be effectively used for treatment of dystrophic muscles such as VML and Duchenne Muscular Dystrophy.

Keywords: Skeletal muscle decellularized extracellular matrix (mdECM), Regeneration, Angiogenesis, Myogenesis, 3D bioprinting, In-bath bioprinting, VML, DMD

Conclusion

- In-bath endothelial cell printing을 통해 혈관세포와 근육세포를 구획화 해 주었을 때 근육 성숙화 및 혈관화 관련 유전자 발현이 증가하였다.
- 근육 성숙화 및 혈관화가 서로 촉진되는 현상인 angiogenesis-myogenesis coupling 이 나타남을 확인하였다.
- 혈관화에 의해 근조직 재생에 유리한 pro-regenerative factor의 분비가 촉진됨을 확인하였다.

Reference

1. Quarta et al., "Bioengineered constructs combined with exercise enhance stem cell-mediated treatment of volumetric muscle loss." Nature Communications, Vol.8, 15613, 2019

2. Tiburcy et al., "Regeneration competent satellite cell niches in rat engineered skeletal muscle." FASEB BioAdvances, Vol.1, 12, p731-746, 2019

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