한국정밀공학회 2/0/1/9
춘계학술대회
KSPE 2019 SPRING CONFERENCE
2019.5.15 수 ~ 17 금 라마다프라자제주호텔

[주최] KSPE
[후원] KOFST, Jeju, Jeju CVB, SAMSUNG

이 발표논문들은 정부재원(과학기술진흥기금 및 복권기금)으로 한국과학기술단체총연합회의 지원을 받아 발간되었습니다.
This work was supported by the Korean Federation of Science and Technology Societies (KOFST). Grant funded by the Korean Government.
# 프로그램

## 좌장, 발표자 일정표

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##희귀성 발표자 일정표

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구두발표 7

일시 및 시간: 2019년 5월 16일(목) / 13:50-14:50
장소: 제7발표장 (2층 라마다블룸3)

작중조심시스템 3

1950P140 13:50-14:05 3D 프린팅 국제표준화 ISO/TC 261과 KS표준개발에 대한 연구
최두선(한국기계연구원), 백두현(한국산업화학협회 연구원), 박경호(한국산업화학협회 연구원),
강승철(3D융합산업협회), 정태훈(3D융합산업협회)

1950P141 14:05-14:20 3D 바이오프린팅을 이용한 채도 세포 이식용 미세 다중성 매트로 촉매합 시스템의 제작
황동규(POSTECH), 장진야(POSTECH)

1950P142 14:20-14:35 3차원 바이오 프린팅 기술로 제작된 혈관화 원 조직 구조체 이식 후 심근 조직 재생의 관점
이미경 모니터링
용동준(POSTECH), 장진야(POSTECH)

1950P143 14:35-14:50 글재생용 기계적 강성이 향상된 카고udge 구조 세포지지체의 개발 및 기계적/생물학적 특성 분석
이재현(POSTECH), 조영상(은평고등학교), 이희균(서울아산병원), 조용성(한밭대학교),
철골학(가톨릭대학교), 정종현(한밭대학교), 장진야(POSTECH), 박용우(고려대학교),
김영철(가톨릭대학교), 이수범(서울아산병원)

구두발표 8

일시 및 시간: 2019년 5월 16일(목) / 15:00-16:00
장소: 제7발표장 (2층 라마다블룸3)

작중조심시스템 4

1950P144 15:00-15:15 3D 프린팅 기술을 활용한 3차원 마이크로 세포 집 제작
허철우(한국생산기술연구원), 송용(한국생산기술연구원), 양동열(광주과학기술원)

1950P145 15:15-15:30 세포 스페로드의 제작 및 정밀 포지셔닝이 가능한 바이오 포인트 프린팅 장치의 개발
강현욱(울산과학기술원), 전승규(울산과학기술원), 윤영호(울산과학기술원)

1950P146 15:30-15:45 FDM 방식 3D 바이오 프린팅 유연 PLGA 펄라멘트 제작 기술 개발
한종희(울산과학기술원), 강현욱(울산과학기술원), 전승규(울산과학기술원), 정현우(울산과학기술원),
상대한(울산과학기술원)

1950P147 15:45-16:00 식도 재건을 위한 드레싱 기법을 이용한 다층 복합 관 구조체의 제작
정종주(원광대학교), 이승재(원광대학교), 남호영(POSTECH), 조영준(POSTECH), 하동현(POSTECH),
김지현(가톨릭대학교), 정재희(가톨릭대학교), 조동우(POSTECH), 장진야(POSTECH)
3 차원 바이오 프린팅 기술로 제작된 혈관화 된 조직 구조체
이식 후 심근 조직 재생의 광학 형광 이미징 모니터링

Optical Fluorescence Imaging-Based Monitoring of Myocardial Tissue Regeneration After Transplanting Pre-Vascularized Tissue Construct Fabricated by 3D Bioprinting Technology

*용의중(포항공과대학교), 박광리(Harvard Medical School), 이민석(단국대학교), 양희석(단국대학교),
최학수(Harvard Medical School), 장진아(포항공과대학교)

*U. Yong, G. K. Park, M. S. Lee, H. S. Yang, H. S. Choi, #J. Jang

Key words : 3D printing, Decellularized extracellular matrix, Stem cell, Tissue engineering, Optical fluorescence imaging

Stem cell therapy has been actively studied as a treatment for ischemic heart disease. Particularly, a patch-type carrier can improve the therapeutic effect by enhancing homing and engraftment of stem cells into damaged myocardial tissues. From a therapeutic point of view, longitudinal monitoring of living cells is essential to understand the mechanisms of neovascularization induced by stem cells. Optical fluorescence imaging can provide long-term live tracking of multiple target cells due to its high sensitivity and multimodal capability. Also, the recent development of molecular probes, which are target-specific and nontoxic with optical and physicochemical stability in the near-infrared (NIR) window, contributes to in vivo live cell tracking. Therefore, this study aims to monitor the efficacy of cardiac stem cell-laden patch in ischemic myocardial tissue by using optical fluorescence imaging based on the NIR probes. First, we used three sets of spectral filter and CCD sensor. Second, contrast agents were selected to observe ischemic tissue, mitochondria, and lipoprotein. Using 3D bioprinting technology, we fabricated a pre-vascularized tissue construct with bioink composed of decellularized extracellular matrix and stem cells. Finally, we observed the interaction between the delivered construct and the ischemic myocardial tissue after transplanting it into the heart of the rats.

후기 This research was supported by the MSIT(Ministry of Science and ICT), Korea, under the ICT Consilience Creative program(IITP-2019-2011-1-00783) supervised by the IITP(Institute for information & communications Technology Planning & Evaluation) and the Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education(No. 2015R1A6A3A04059015).

*발표자, #교신저자(jinahjang@postech.ac.kr)
Optical Fluorescence Imaging-based Monitoring of Myocardial Tissue Regeneration after Transplanting Pre-vascularized Tissue Construct Fabricated by 3D Bioprinting Technology

(May 15, 2019 – May 17)

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1. Department of Creative IT Engineering, Pohang University of Science and Technology (POSTECH), Pohang, Korea
2. Gordon Center for Medical Imaging, Department of Radiology, Massachusetts General Hospital and Harvard Medical School, Boston, USA
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4. School of Interdisciplinary Bioscience and Bioengineering, POSTECH, Korea

Abstract

Stem cell therapy has been actively studied as a treatment for ischemic heart disease. Particularly, a patch-type carrier can improve the therapeutic effect by enhancing homing and engraftment of stem cells into damaged myocardial tissues. From a therapeutic point of view, longitudinal monitoring of living cells is essential to understand the mechanisms of neovascularization induced by stem cells. Optical fluorescence imaging can provide long-term live tracking of multiple target cells due to its high sensitivity and multimodal capability. Also, the recent development of molecular probes, which are target-specific and nontoxic with optical and physicochemical stability in the near-infrared (NIR) window, contributes to in vivo live cell tracking. Therefore, this study aims to monitor the efficacy of cardiac stem cell-laden patch in ischemic myocardial tissue by using optical fluorescence imaging based on the NIR probes. First, we used three sets of spectral filter and CCD sensor. Second, contrast agents were selected to observe ischemic tissue, mitochondria, and lipoprotein. Using 3D bioprinting technology, we fabricated a pre-vascularized tissue construct with bioink composed of decellularized extracellular matrix and stem cells. Finally, we observed the interaction between the delivered construct and the ischemic myocardial tissue after transplanting it into the heart of the rats.

Conclusion

• Optical fluorescence imaging system was developed in order to monitor the regeneration of myocardial tissue after transplanting 3D pre-vascularized tissue construct.
• Myocardial infarction (M.I.) rat model was developed to observe the regeneration process in vivo environment.
• Tissue-specific near-infrared agents for assessing the efficacy of cardiac patch were developed and selected.
• Patch transplantation to the M.I. rat model was performed.

Reference

2. David E. Lee, Akshay Bareja, David B. Bartlett, and James P. White, Autophagy as a therapeutic target to enhance aged muscle regeneration, Cells 2019, 8(2), 183

Acknowledgement

This research was supported by the MSIT(Ministry of Science and ICT), Korea, under the ICT Consilience Creative program(2019-2011-1-00783) supervised by the IITP(Institute for information & communications Technology Planning & Evaluation) and the Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education(No. 2015R1A6A3A04039015).