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Author: Joonseong Heo Hyoryung Nam Dongha Hwang
Seong J. Cho Sung-Young Jung Dong-Woo Cho Jin-Hyung
Shim Geunbae Lim



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Enhanced cellular distribution and infiltration in a wet electrospun three-dimensional fibrous scaffold using eccentric rotation-based hydrodynamic conditions

Joonseong Heo^{1,a}, Hyoryung Nam^{1,b}, Dongha Hwang^a, Seong J. Cho^c, Sung-Young Jung^a, Dong-Woo Cho^a, Jin-Hyung Shim^{d,*}, Geunbae Lim^{a,*}

^a*Department of Mechanical Engineering, Pohang University of Science and Technology, San 31, Pohang, Gyeongbuk, Republic of Korea*

^b*Department of Integrative Bioscience and Biotechnology, Pohang University of Science and Technology, San 31, Pohang, Gyeongbuk, Republic of Korea*

^c*School of Mechanical Engineering, Chungnam National University, 99 Daehak-ro, Daejeon, Chungnam, Republic of Korea*

^d*Department of Mechanical Engineering, Korea Polytechnic University, 237 Sangidaehak-Ro, Siheung, Gyeonggi-do, Republic of Korea*

Abstract

Electrospinning technology is a versatile method for fabricating three-dimensional (3D) nanofibrous scaffolds using a wide range of polymeric materials for tissue engineering and regenerative medicine. However, a major concern regarding 3D electrospun scaffolds is that the densely packed layers hinder an even cellular distribution and in-depth infiltration. Here, we describe a new 'all-at-once' method enabling scaffold fabrication and cell seeding simultaneously, in which the medium bath containing cells is rotated eccentrically at high speed (> 1500 rpm). The unstable flow of culture medium under hydrodynamic conditions resulted in a skein-shaped 3D structure and enhanced the even cellular distribution and in-depth infiltration. Cellular distribution and infiltration analyses confirmed that our method was superior to static and dynamic seeding methods. Moreover, we showed that our method facilitated long-term (14 days) proliferation.

Keywords: scaffold, electrospun, three-dimensional, eccentric

*Corresponding author

Email address: happyshim@kpu.ac.kr (Jin-Hyung Shim), limmems@postech.ac.kr (Geunbae Lim)

¹Joonseong Heo, Hyoryung Nam are contributed equally to this work.

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