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Assessment of Supercritical CO_2 Acellular Dermal Matrix (Scadm) Utilizing Sprague Dawley Models

Ngan Giang Nguyen [1,2†], Linh Thi Thuy Le[2,3,4†], Ngoc Chien Pham [2,5†], Thuy-Tien Thi Trinh[2,5], Thi Nga Pham [2,5], Xin Rui Zhang[2,6], Yong Xun Jin[2,6], Shu Yi Zhou[2,6], Jeong-Hun Han[7], Sun -Young Nam[2*] and Chan -Yeong Heo[1,2,5,6*]

[1]Department of Medical Device Development, College of Medicine, Seoul National University, Seoul,Republic of Korea.
[2]Department of Plastic and Reconstructive Surgery, Seoul National University Bundang Hospital, Seongnam, Republic of Korea.
[3]Department of Biomedical Science, College ofMedicine, Seoul National University, Seoul, Republic of Korea.
[4]Faculty of Medical Technology, HaiphongUniversity of Medicine and Pharmacy, Haiphong, Vietnam.
[5]Korean Institute of Nonclinical Study, H&BioCo., Ltd., Seongnam, Republic of Korea.
[6]Department of Medicine, College of Medicine, Seoul NationalUniversity, Seoul, Republic of Korea,
[7]DOF Inc., Hwaseong, Republic of Korea
[†]The same contribution on this study
[*]Corresponding authors
nngiang1105@snu.ac.kr; ltthuylinh@snu.ac.kr; ngocchien1781@gmail.com; thuytienbiotech@gmail.com; phamngashk36@gmail.com;zhangxinrui@snu.ac.kr; jinyongxun@snu.ac.kr; shuyi_chow@snu.ac.kr; jeonghunhan@daumn.net; 99261@snubh.org; lionheo@snu.ac.kr

Extended Abstract

Human skin-derived ECM aids cell functions but can trigger immune reactions; therefore it is addressed through decellularization. Acellular dermal matrices (ADMs), known for their regenerative properties, are used in tissue and organ regeneration [1-3]. ADMs now play a key role in plastic and reconstructive surgery, enhancing aesthetics and reducing capsular contracture risk [4, 5]. Innovative decellularization with supercritical carbon dioxide preserves ECM quality for clinical use. The study investigated the cytotoxicity, biocompatibility, and anti inflammatory properties of supercritical CO_2 acellular dermal matrix (scADM) in vivo based on Sprague Dawley rat models. Initial experiments in vitro with fibroblast cells confirmed the non-toxic nature of scADM and demonstrated cell infiltration into scADMs after incubation. Subsequent tests in vitro revealed the ability of scADM to suppress inflammation induced by lipopolysaccharides (LPS) presenting by the reduction of pro-inflammatory cytokines TNF-α, IL-6, IL-1β, and MCP-1. In the in vivo model, histological assessment of implanted scADMsin 6 months revealed a decrease in inflammatory cells, confirmed further by the biomarkers of inflammation in immunofluorescence staining. Besides, an increase in fibroblast infiltration and collagen formation was observed in histological staining, which was supported by various biomarkers of fibroblasts. Moreover, the study demonstrated vascularization and macrophage polarization, depicting increased endothelial cell formation. Alteration of matrix metalloproteinases (MMPs) was analysed by RT-PCR, indicating the reduction of MMP2, MMP3, and MMP9 levels over time. Simultaneously, an increase in collagen deposition of collagen I and collagen III were observed, verified in immunofluorescent staining, RT-PCR, and western blotting. Overall, the findings suggested that scADMs offer significant benefits in improving outcomes in implant-based procedures as well as soft tissue substitution.

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