Ming Pei, J Cell Sci Ther 2012, 3:8
http://dx.doi.org/10.4172/2157-7013.S1.019

OMICS Group Conferences
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2nd World Congress on
Cell Science & Stem Cell Research

November 12-14, 2012 Hilton San Antonio Airport, USA

Decellularized stem cell matrix rescues human synovium-derived stem cells from oxidative stress and enhances expanded stem cell chondrogenesis

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Clinical treatment of cartilage defects is challenging due to concomitant posttraumatic joint inflammation. This study was to demonstrate that the antioxidant ability of human adult synovium-derived stem cells (SDSCs) could be enhanced by *ex vivo* expansion on decellularized stem cell matrix (DSCM). Microarray was used to evaluate oxidative, antioxidative, and chondrogenic status in SDSCs after expansion on DSCM and induction in chondrogenic medium. Hydrogen peroxide (H_2O_2) was added to create oxidative stress in either expanded SDSCs or chondrogenically induced premature pellets. The effect of H_2O_2 on SDSC proliferation was evaluated using flow cytometry. Chondrogenic differentiation of expanded SDSCs was evaluated using histology, immunostaining, biochemical analysis, and real-time PCR. MAPK signaling pathways and p21 were compared in DSCM and plastic flask expanded SDSCs with or without H_2O_2 treatment. We found that expansion on DSCM upregulated antioxidative gene levels and chondrogenic potential in human SDSCs, retarded the decrease in cell number and the increase in apoptosis, and rendered SDSCs resistant to the G1 arrest resulting from H_2O_2 treatment. Treatment with 0.05 mM H_2O_2 during cell expansion yielded pellets with increased chondrogenic differentiation; treatment in premature SDSC pellets showed that DSCM expanded cells have a robust resistance to H_2O_2-induced oxidative stress. Erk1/2 and p38 were positively involved in antioxidative and chondrogenic potential in SDSCs expanded on DSCM, in which p21 was downregulated. DSCM could be a promising cell expansion system to provide a large number of high-quality human SDSCs for cartilage regeneration in a harsh joint environment

Biography

Dr. Ming Pei completed his Ph.D. from Beijing University and conducted postdoctoral studies at Harvard-MIT Division of Health Sciences and Technology (HST) and Brown University. Currently he is an Associate Professor and the Director of Stem Cell and Tissue Engineering Laboratory at the Department of Orthopaedics at West Virginia University. He also serves as Adjunct Faculty in Exercise Physiology and Mechanical and Aerospace Engineering at WVU. He has published more than 55 papers in reputed journals and is serving as a Reviewer for 30+ peer-reviewed journals and 9 national and international funding agencies. He is also an Editorial Board Member for 8 journals

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