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5th International Conference on
Tissue Engineering & Regenerative Medicine
September 12-14, 2016 Berlin, Germany

Induction of mesenchymal stem cell chondrogenic differentiation and functional cartilage microtissue formation for in vivo cartilage regeneration by cartilage extracellular matrix-derived particles

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We propose a method of preparing a novel cell carrier derived from natural cartilage extracellular matrix (ECM), designated cartilage ECM -derived particles (CEDPs). Through a series of processes involving pulverization, sieving, and decellularization, fresh cartilage was made into CEDPs with a median diameter of 263±48 μm. Under microgravity culture conditions in a rotary cell culture system (RCCS), bone marrow stromal cells (BMSCs) can proliferate rapidly on the surface of CEDPs with high viability. Histological evaluation and gene expression analysis indicated that BMSCs were differentiated into mature chondrocytes after 21 days of culture without the use of exogenous growth factors. Functional cartilage microtissue aggregates of BMSC-laden CEDPs formed as time in culture increased. Further, the microtissue aggregates were directly implanted into trochlear cartilage defects in a rat model (CEDP+MSC group). Gait analysis and histological results indicated that the CEDP+MSC group obtained better and more rapid joint function recovery and superior cartilage repair compared to the control groups, in which defects were treated with CEDPs alone or only fibrin glue, at both 6 and 12 weeks after surgery. In conclusion, the innovative cell carrier derived from cartilage ECM could promote chondrogenic differentiation of BMSCs, and the direct use of functional cartilage microtissue facilitated cartilage regeneration. This strategy for cell culture, stem cell differentiation and one-step surgery using cartilage microtissue for cartilage repair provides novel prospects for cartilage tissue engineering and may have further broad clinical applications.

Biography

Heyong Yin graduated in July 2016 with a master's degree in surgery at Nankai University and Chinese PLA General Hospital. His researches are focus on Cartilage tissue engineering and stem cell. Since September 2016 he joins department of surgery, University of Munich (LMU) as a PhD candidates and continues his research into regenerative treatment of orthopaedics injuries to ligaments, tendon and hyaline cartilage.

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