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POSTER

Establishing an artificial cartilage from rabbit bone marrow derived mesenchymal stem cell and polycaprolactone scaffold

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Abstract

Nowaday, the regenerative medicine based on the use of biomaterial scaffold combine to stem cells was considered as a necessary treatment strategy for injury or diseases involving cartilage. In this study, we investigated the adherence, proliferation and chondrogenic differentiation of rabbit bone marrow-derived mesenchymal stem cells (rBM-MSCs) on biodegradable polycaprolactone scaffold (PCL). MSCs were isolated from bone marrow of rabbit. rBM-MSC (2x105cell/scaffold) were seeded on PCL and collagen-coated PCL (PCL/col) scaffolds. The cell adhesion and proliferation abilities on the PCL and PCL/col scaffolds were compared to each other to find the better using MTT assay. Then 3D cultured-cells were induced in chondrogenic differentiation medium. The change of scaffold surface structure was evaluated by scanning electron microscope (SEM). The accumulation of aggrecan protein was detected by Alcian Blue staining. The chondrogenic-related gene expression such as sox9, collagen type 1, collagen type 2, collagen type 10, aggrecan, runx2 was assessed by RT-PCR. The existence of artificial cartilage after transplantation of chondrocyte-seeded scaffold under rabbit skin was evaluated by staining histological sections with Alcian Blue. The results showed that rBM-MSCs attached and grown on PCL/col and PCL scaffolds. However, the adhesion efficient of rBM-MSC on PCL/col scaffold was better than PCL scaffolds. Therefore, PCL/col scaffold was used for next experiments. The morphology of rBM-MSCs on PLC/col scaffold were changed and the aggrecan accumulation increased after cultured in chondrogenic differentiation medium. The scaffold surface modification was detected with the presentation of collagen-like fiber structures. The expression of chondrogenesis-associated genes increased after 3, 7, 21, 28 days of chondrogenic induction, especially for collagen type II, collagen type I, aggrecan and collagen type X. Transplanted artificial cartilage was existed in rabbit for six weeks. The mature chondrocyte-like cells were detected and cartilage specific-proteoglycan accumulated more in differentiated cell-scaffold than scaffold seeded undifferentiated-cells. Thus artificial cartilage could be created when differentiating rBM-MSC into chondrocyte on collagen-coated PCL scaffold.

Keywords

3D scaffold, artificial cartilage, biodegradable scaffold, bone marrow, chondrocyte, mesenchymal stem cell, polycaprolacton

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