Differentiation of Umbilical Cord Blood Mesenchymal Stromal Cells to Bone Tissue for Tissue Engineering Applications

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Introduction

This study primarily focuses on the use of mesenchymal stem cells derived from umbilical cord blood on a newly synthesized hydroxyapatite containing poly(N-vinyl-2 prolydone-co-maleic acid) scaffold assigning the MSCs to differentiate and form bone in a 3D manner. The biomimetic essence of the study derives from the engineering solution to mimic the actual fragment of human bone in a molecular, chemical and morphological way.

Materials and Methods

UCB was obtained from informed normal individuals providing collections for allogeneic transplantation according to procedures approved by the Local Ethical Committee. The whole cord blood mononuclear cells were isolated by gradient density centrifugation. Obtained mesenchymal precursor cells were suspended in basal medium. Immunophenotypic analyses were done. Afterward, MSCs were seeded on hydroxyapatite containing poly(N-vinyl-2 prolydone-co-maleic acid) scaffold.

Results

The morphology of osteoclast like cells are heterogeneous and oval/round shape with smooth border and mesenchymal like cells were recognizable as adherent cells with a fibroblast-like appearance. 12 % percent of 10,000 labeled cells were mononuclear cells and 24 % percent of mononuclear cells were CD 44 positive cells. 10,000 labeled cells were counted again for CD 90 and CD105 and 22.2 % percent of mononuclear cells were positive for these markers. It was shown that the adherent cells expressed the characteristics of MSCs.

Discussion and Conclusions

Due to the development of cell separation techniques, cultivation of MSCs is more advanced. Although MSCs can be isolated from multiple tissue types, bone marrow stroma is still the most known tissue source utilized in growing MSCs. Still, the age of donor has a critical importance for bone defect applications due to gradually decreasing frequency of presence of MSCs within the marrow stroma. Therefore we have shown that UCB can be alternative way to isolate MSCs and useable with appropriate scaffold for tissue engineering applications.

References


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Disclosures

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