

Differentiation potential of mesenchymal progenitor cells following transplantation into calvarial defects.

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Abstract:

The complexity of stem cell lineage commitment requires studies to investigate the intrinsic and extrinsic regulatory events during differentiation. The objective of this long-term . in vivo study was to investigate cellular differentiation and tissue formation of transplanted undifferentiated bone-marrow-derived mesenchymal progenitor cells (BMPCs) in combination with a medical grade polycaprolactone (mPCL) scaffold and to compare them to osteoblasts; a more differentiated cell type in a calvarial defect model. Tissue formation was assessed via histology, mechanical and radiological methods after 3, 12, and 24 months. After 3 months our results indicated that transplanted mesenchymal progenitor cells were influenced by the niche of the host environment. Scaffold/BMPCs formed islands of bone tissue inside the defect area. However when the surrounding host calvarium contained a high content of fatty tissue, the fat content in the defect areas was also significantly higher. In contrast, defects repaired with scaffold/cOBs did not show this phenomenon. Analysis after 12 and 24 months confirmed these observations indicating that a predominantly fatty environment leads to adipogenic development in the progenitor group. Biomechanical data revealed that the tissue was less firm in the BMPC group compared to the cOB seeded group. Evaluation of cell plasticity . in vivo has important consequences in clinical cell transplantation protocols. This study indicates that cell fate decisions are partially regulated by extrinsic control mechanisms of the immediate environment suggesting that induction of BMPCs into a specific lineage could be beneficial prior transplantation. © 2012 .