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Commentary

Investigation of Bone Marrow- and Adipose-Derived Stem Cells in Microenvironmental Circumstances

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DESCRIPTION

Adult stem cells known as Mesenchymal Stem Cells (MSCs) may be easily separated from the stroma of a variety of tissues in the adult body and have a nine passage capacity for self-renewal. These cells can also develop into a variety of cell types, such as osteoblasts, adipocytes, chondrocytes, and myoblasts. Although MSC differentiation has attracted the attention of many researchers, there is conflicting information about the use of MSCs in tissue engineering applications. While other studies have established that MSCs have full functionality after differentiation *in vitro*, certain investigations demonstrated that the MSCs developed a differentiated phenotype but lacked that type of cell functionality.

When it comes to MSC sources, those produced from bone marrow have been the most thoroughly studied and have actually been used in *in vitro*, preclinical, and clinical investigations. The process to extract the bone marrow, however, is intrusive and uncomfortable for the donor. Additionally, MSCs make up just 0.001-0.1% of the bone marrow's total nucleated cells. However, since adipose tissue can be used in minimally invasive elective surgical procedures like liposuction and a lot of waste tissue can be produced during these operations, adipose tissue is seen to be a viable source of MSCs. Additionally, compared to Bone marrow-derived MSCs (Bm-MSCs), 500 times more stem cells were present. Adipose tissue has been employed as a source of acellular Extra Cellular Matrix (ECM) material in addition to being a source of stem cells, primarily in the form of scaffolding material or as a bioactive covering for scaffolds. Our past research has shown that during the decellularization process, the major proteins and growth factors present in the native adipose tissue can be preserved. As a result, cells will effectively receive the important biological cues of the native adipose tissue microenvironment *via* a coated layer of adipose-derived ECM on a substrate.

Both ASCs and Bm-MSCs have the ability for multi-lineage differentiation, self-renewal, and immunophenotypic expression in general. There have been some reported discrepancies between the two cell populations, nevertheless. For instance, compared to Bm-MSCs, ASCs have been demonstrated to have better proliferative and angiogenic capacities *in vitro*. Senescence has been reported to occur later in ASCs, which has been found to increase their genetic stability. In terms of their ability to differentiate, ASCs have exhibited improved adipogenic differentiation in certain investigations, while conflicting results have been reported in others. The increased osteogenesis of Bm-MSCs was also shown by some, but was refuted by others.

Due to differences in cell culture conditions and experimental techniques, there isn't a universal agreement on the differentiation capability of ASCs and Bm-MSCs. Therefore, this work examines the ability of these two cell types to differentiate into adipocytes in the presence of pro-adipogenic microenvironments. Growing cells on native adipose ECM-coated Tissue Culture Plastic (TCP) creates a 2D microenvironment, while growing cells inside alginate-based scaffolds with mechanical qualities similar to native adipose tissue creates a 3D environment. This research investigates how the microenvironment affects the fate of MSCs that are isolated from two different human tissues.

To do this, the identities of ASCs and Bm-MSCs were formed *in vitro* first, and then their characteristics under comparable *in vitro* growing conditions were examined. Then, the cell proliferation and gene expression profiles of the two populations of cells were compared after being cultivated in both 2D and 3D microenvironments. In general, the impact of these microenvironmental cues on the ability of the two cell types (ASCs and Bm-MSCs) to differentiate was examined, and the results are given.

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