Comparison of Fetal and Adult Marrow Stromal Cells in Osteogenesis with and without Glucocorticoids

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Abstract

To better understand the potential use of fetal marrow stromal cells (MSCs) in bone tissue engineering, we compared the ability of these cells with those of adult MSCs with respect to osteoblasts differentiation in the presence or absence of glucocorticoids. Cells were grown for 3-4 weeks in basal medium or supplemented with 100 nM dexamethasone (DEX, a synthetic glucocorticoid analog) or with 50 μM L-ascorbate and 10 mM glycerol-2-phosphate (AS+GP) or with AS+GP+DEX. At various time points in culture, the following parameters were compared between fetal and adult MSCs: cell morphology, cell proliferation, alkaline phosphatase activity, calcium (45Ca) uptake, von Kossa staining, and glucocorticoids receptor expression were analyzed. Compared with adult MSCs, fetal cells showed a less dramatic change to cuboidal morphology in DEX-containing media. Fetal MSCs in all media conditions showed higher proliferation rates and lower alkaline phosphatase activities ($p < 0.001$) than adult cells. Both fetal and adult MSCs responded similarly in DEX-containing media with respect to suppressing cell proliferation, stimulating alkaline phosphatase activity, and consistently accumulating calcium (usually higher in fetal cells) with subsequent formation of mineralized matrix when compared with cells cultured in AS+GP. Our findings further implicate the requirement of glucocorticoids in osteogenesis. In conclusion, compared with adult MSCs, fetal cells showed greater ability in sustaining cell proliferation and calcium uptake suggesting that they may be useful for bone tissue repair.