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Titel des Beitrags: Superior osteogenic capacity for bone tissue engineering of fetal compared with perinatal and adult mesenchymal stem cells.

Abstract: Mesenchymal stem cells (MSCs) from human adult bone marrow (haMSCs) represent a promising source for bone tissue engineering. However, their low frequencies and limited proliferation restrict their clinical utility. Alternative postnatal, perinatal, and fetal sources of MSCs appear to have different osteogenic capacities, but have not been systematically compared with haMSCs. We investigated the proliferative and osteogenic potential of MSCs from human fetal bone marrow (hfMSCs), human umbilical cord (hUCMSCs), and human adult adipose tissue (hATMSCs), and haMSCs, both in monolayer cultures and after loading into three-dimensional polycaprolactone-tricalcium-phosphate scaffolds. Although all MSCs had comparable immunophenotypes, only hfMSCs and hUCMSCs were positive for the embryonic pluripotency markers Oct-4 and Nanog. hfMSCs expressed the lowest HLA-I level (55% versus 95%-99%) and the highest Stro-1 level (51% versus 10%-27%), and had the greatest colony-forming unit-fibroblast capacity (1.6x-2.0x; p< .01) and fastest doubling time (32 versus 54-111 hours; p< .01). hfMSCs had the greatest osteogenic capacity, as assessed by von-Kossa staining, alkaline phosphatase activity (5.1x-12.4x; p< .01), calcium deposition (1.6x-2.7x in monolayer and 1.6x-5.0x in scaffold culture; p<...
calcium visualized on micro-computed tomography (3.9x17.6x; p< .01) and scanning electron microscopy, and osteogenic gene induction. Two months after implantation of cellular scaffolds in immunodeficient mice, hfMSCs resulted in the most robust mineralization (1.8x-13.3x; p< .01). The ontological and anatomical origins of MSCs have profound influences on the proliferative and osteogenic capacity of MSCs. hfMSCs had the most proliferative and osteogenic capacity of the MSC sources, as well as being the least immunogenic, suggesting they are superior candidates for bone tissue engineering.