Towards in situ Joint Repair in Osteoarthritis: Regenerative Potential of MSC from OA Patients

Tilo Dehne¹, Jürgen Eder¹, Philipp Franke¹, Carsten Perka², Michael Sittinger¹, Jochen Ringe¹
Corresponding Author Email: tilo.dehne@charite.de

¹Tissue Engineering Laboratory and Berlin-Brandenburg Center for Regenerative Therapies, Department of Rheumatology and Clinical Immunology, Charité-Universitätsmedizin Berlin, Berlin, Germany
²Musculoskeletal Research Center Berlin, Charité-Universitätsmedizin Berlin, Berlin, Germany

Introduction
Factor-guided in situ recruitment of regenerative cells is a promising approach for tissue repair for patients suffering from osteoarthritis (OA), who are still lacking an appropriate long-lasting treatment alternative. The regenerative properties of MSC from degenerated sources are of vital importance for successful in situ regeneration. For that purpose, MSC from patients undergoing total hip arthroplasty (endstage OA) were tested for their migration and differentiation potential and compared with potential of normal donor MSC.

Materials and Methods
MSC were isolated from femoral heads derived from endstage OA patients. Normal donor MSC were obtained from bone marrow aspirates. Identity of expanded cells was verified by their surface marker profile and differentiation towards osteo-, chondro- and adipogenic lineage applying standard assays. A 96-well plate chemotaxis assay was used to investigate the migratory response to potent chemokines known from normal donor MSC. The chondrogenic capacity was evaluated in a clinical relevant scaffold (fibrin/PGLA) model by histological proteoglycan assessment and immunohistochemistry for collagen types II. MSC cultured in monolayer and scaffolds were subjected to gene expression profiling using genome-wide oligonucleotide microarrays.

Results
Multilineage differentiation assays confirmed osteogenic, adipogenic, and chondrogenic potential of OA MSC by formation of calcium, lipid vacuoles and collagen type II deposits, respectively. Cells maintained in a clinical relevant scaffold (fibrin/PGLA) model showed proper viability, proteoglycan and collagen type II deposition over six weeks. Genome-wide gene expression analysis (e.g. COL2A1, aggrecan, COMP) confirmed the chondrogenic properties of osteoarthritic MSC. Chemotaxis experiments demonstrated migratory response to TECK (thymus expressed chemokine), and to MCP-1 (monocyte chemotactic protein).

Discussion and Conclusions
MSC from OA patients demonstrated comparable regenerative potential regarding their differentiation and migration potential known from normal donor MSC. These findings suggest, that MSC from OA patients fulfil the very basic requirements for an in situ tissue engineering repair strategy.

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Disclosures
MS works as a consultant for BioTissue Technologies GmbH (Freiburg, Germany). This company develops autologous tissue transplants for the regeneration of bone and cartilage. All other authors declare they have no competing interests.