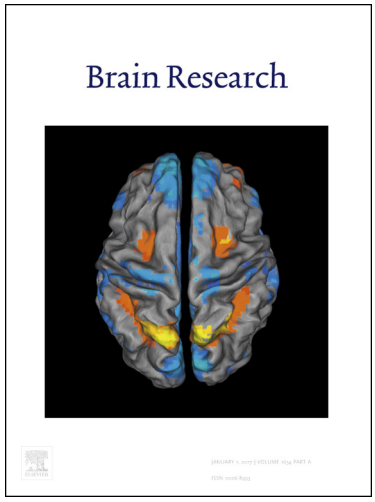

Research report

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PII: S0006-8993(17)30295-0
DOI: http://dx.doi.org/10.1016/j.brainres.2017.07.005
Reference: BRES 45419

To appear in: *Brain Research*

Received Date: 7 April 2017
Revised Date: 12 June 2017
Accepted Date: 5 July 2017

Please cite this article as: A.N. Stewart, G. Kendziorski, Z.M. Deak, D.J. Brown, M.N. Fini, K.L. Copely, J. Rossignol, G.L. Dunbar, Co-Transplantation of Mesenchymal and Neural Stem Cells and Overexpressing Stromal-Derived Factor-1 for Treating Spinal Cord Injury, *Brain Research* (2017), doi: http://dx.doi.org/10.1016/j.brainres.2017.07.005

Article

Co-Transplantation of Mesenchymal and Neural Stem Cells and Overexpressing Stromal-Derived Factor-1 for Treating Spinal Cord Injury

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Abstract

Genetic engineering of mesenchymal stem cells (MSCs) and neuronal stem cells (NSCs) has been used to treat spinal cord injuries (SCI). As a mechanism of therapy, MSCs secrete high amounts of anti-inflammatory cytokines and trophic factors, while NSCs can differentiate into neuronal lineages and aid in tissue replacement. Additionally, the forced overexpression of secreted proteins can enhance the secretome of transplanted cells, which can increase therapeutic efficacy. This study utilized a combinational treatment consisting of MSCs, NSCs, and the forced overexpression of the chemokine stromal-derived factor-1 (SDF-1) from MSCs (SDF-1-MSCs), to treat a rat model of SCI. Transplants occurred at 9-days post-injury, and motor functions were evaluated for 7-weeks post-injury. White matter sparing and axon densities surrounding the lesions were quantified. Findings from this study demonstrate that co-transplanting SDF-1-MSCs with NSCs can improve motor functions and enhance axon densities surrounding the lesion. However, no improvements in white matter sparing were found. Tumors were found in some of the animals that received co-transplantations with either SDF-1-MSCs and NSCs or unmodified-MSCs and NSCs, but no tumors were found in any animal treated with a single cell type alone. Nonetheless, this study offers evidence that providing SDF-1 to NSCs, through the forced expression from MSCs, can enhance the therapeutic potential of the graft.

Keywords: Spinal Cord Injury, Stromal Derived Factor-1, CXCL12, Mesenchymal Stem Cell, Neuronal Stem Cell, Co-transplantation

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Abbreviations: BBB: Basso, Beattie, and Bresnahan scale for locomotor recovery; **CXCR4:** Chemokine Receptor-4; **GFP:** Green Fluorescent Protein; **MSCs:** Mesenchymal Stem Cells; **NF-70**: Neurofilament-70kD; **NSCs:** Neuronal Stem Cells; **SCI:** Spinal Cord Injury; **SDF-1:** Stromal Derived Factor-1α; **tdTomato**: Fluorescent Tandem-Dimer Tomato Protein.