

Abstract

Spinal cord injury (SCI) results in the loss of nervous tissue and consequently the loss of motor and sensory function. The transplantation of neural stem cells (NSCs) and a porous hydrogel material may support spinal cord repair. In my Master of Science thesis we evaluate the biocompatibility of the human fetal neural stem cell (hfNSC) line SPC-01_GFP3 in combination with hydroxy ethyl methacrylate hydrogel modified with a serotonin agonist (P2544-1). Moreover, we evaluate the effect of a combination of SPC-01-derived progenitors and P2544-1 hydrogel on functional improvement and tissue reconstruction. As a model of SCI, a spinal cord lateral hemisection at the Th8-9 level in adult Wistar rats was used. A P2544-1 hydrogel seeded with SPC-01 cells was applied immediately after the hemisection surgery (n=11) in the treated animals, while the control group was only hemisected (n=20). Locomotor (BBB) and sensitivity (plantar test) evaluations were performed weekly for three months. An immunohistochemical analysis (IHC) of the cells and hydrogel was made *in vitro* before the surgery and also at the conclusion of the experiment. IHC and the behavioural tests showed that this combination of NSCs and hydrogel material is highly biocompatible *in vitro*, but that after transplantation it was unable to quickly stimulate the ingrowth of endogenous nervous and capillary system elements and that the cells that persisted in the hydrogel survived only in low numbers. A major portion of the transplanted cells successfully migrated and proliferated out of the lesion, but the only positive effect on the surrounding tissue was decreased astrogliosis. The treatment did not lead to functional improvement, except for short-term stabilisation of the nerve circuits and increased survival of treated animals. Only the sensory test revealed a functional trend of increased thermal sensitivity compared to the controls. In general, the treatment of SCI in a hemisection model by a combination of hfNSCs seeded on a P2544-1 hydrogel led to limited functional improvement within the time constraints of the experiment. These results were possibly influenced by the inadequacy of the hemisection model itself. On the other hand, the human fetal neural stem cell line SPC-01 appears to be promising for cell therapy thanks to its migratory, survival and neural phenotype potential. In combination with a hydrogel to enable more convenient *in vivo* transplantation, the use of these cells may possibly lead to significant improvement in functional outcome.

Key words: SPC-01, neural stems cells, hydrogel, spinal cord injury, hemisection, hydrogel surface modification,