THE EFFECT OF AN Fmoc-DIKVAV SELF-ASSEMBLING NANOFIBROUS HYDROGEL IN SPINAL CORD INJURY REPAIR

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Spinal cord injury (SCI) is a devastating condition that leads to permanent functional and neurological deficits in injured individuals. Typically, there is a lack of a physical matrix where neurons and other repairing cells can adhere. Self-assembling peptide hydrogel scaffolds are a novel class of biomimetic materials consisting of structure forming low molecular weight peptide sequences used as scaffolds for tissue engineering. Therefore, hydrogels may have a high therapeutic value for SCI treatment. In this study, the effect of Fmoc-DIKVAV, a self-assembling nanofibrous hydrogel with IKVAV laminin motifs, was evaluated in a subacute contusion model of rat SCI. Male adult Wistar rats (n=14) were subjected to a spinal cord injury by contusion using the MASCIS impactor. The animals were divided into two groups: hydrogel implant and lesion control vehicle. 10 µL of a 20 mg/mL Fmoc-DIKVAV hydrogel solution was injected into the lesion epicenter one hour after the SCI. Functional recovery was assessed using the Basso, Beattie and Bresnahan (BBB) locomotor rating scale at different time points, before surgery, two days after and weekly up to six weeks after transplantation. The rats injected with Fmoc-DIKVAV showed significantly higher BBB scores when compared with the vehicle; at day 42, the hydrogel group showed a BBB score of 14.0±3.6 and the vehicle a score of 8.5±2.3. By hematoxylin and eosin staining, visible cavities of varying sizes were observed in the injury site with similar sizes in both groups. To quantify neurodegeneration and the glial scar, a flow cytometry analysis was performed with beta 3 tubulin, glial fibrillary acidic protein and O4 antibodies. The flow cytometry data shows that the hydrogel group showed improved neural regeneration (29.9% tubulin positive cells in the hydrogel group vs 12.57% in the vehicle only group), increased glial scar (increased GFAP expression) and a downregulation of myelination in the transplanted groups. In conclusion, the use of a hydrogel to connect the two segments of the injured spinal cord and provide a three-dimensional environment for the regenerating axons is of significant interest.