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BIODEGRADABLE NEURO-SPINAL SCAFFOLD PRESERVES SPINAL CORD ARCHITECTURE FOLLOWING SPINAL CONTUSION INJURY IN RATS

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Severe spinal cord injury (SCI) is accompanied by disruption of spinal cord architecture, including cystic cavitation and tissue loss. We hypothesized that implantation of a biodegradable, biomaterial scaffold into the injured spinal cord could serve as a locus for appositional healing and tissue remodeling that would preserve spinal cord architecture. We evaluated the effect of implantation of scaffolds composed of a block copolymer of poly(lactic-co-glycolic acid) and poly(L-lysine) (PLGA-PLL) on preservation of spinal architecture in a rat contusion model of severe spinal cord injury (SCI). A spinal T10 contusion injury was created in female Sprague-Dawley rats with a Precision Systems IH Impactor (220 kDyn). Cylindrical scaffolds (1.0 mm diameter, 2.0 mm length) were surgically implanted at the lesion site between 24 and 72 hours later. Body weight, development of mechanical allodynia, and recovery of coordinated hind limb function using the Basso, Beattie, and Bresnahan (BBB) scale were evaluated for 12 weeks. Spinal architecture was evaluated at 12 weeks by morphometric analysis of paraformaldehyde fixed frozen sections (20 μm) stained with hematoxylin & eosin (H&E). Scaffold implantation did not result in mechanical allodynia, did not impair body weight gain, and did not interfere with partial recovery from full hind-limb paralysis. Histological analysis revealed that rats in the non-treated control group developed large cavities surrounded by a rim of spared tissue. In contrast, in rats treated with scaffold implantation

surgery, cavity volume decreased by 86% and spared tissue width increased by 44%. Although scaffolds were fully resorbed by 12 weeks after implantation, the amount of remodeled tissue at the site of implantation in the lesion epicenter increased by 111%. These results demonstrate that PLGA-PLL scaffold implantation in the acutely injured spinal cord can reduce cavitation, promote tissue sparing and remodeling, and act as a locus for appositional healing. Scaffold implantation preserves spinal cord architecture and may play an important role in combinatorial spinal cord repair strategies.

Keywords: biomaterial, tissue engineering, scaffold, implantation, biodegradable