

Biodegradable Neuro-Spinal Scaffold Preserves Macroscopic Spinal Cord Architecture and Allows For Neural Regeneration at the Epicenter of Spinal Cord Injury

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The pathophysiological sequelae of primary spinal cord injury (SCI) include edema, spinal cord swelling, reduced blood flow, and local tissue ischemia resulting in further cellular necrosis culminating in the appearance of a tissue void (cavity). Biodegradable scaffolds can be implanted within the necrotic lesion to fill this void and provide structural support to the surrounding viable tissue while serving as a locus for appositional healing.^{1,2} This work focuses on elucidating the scaffold's mechanism of action in animal models of SCI.

Various animal models, including primate hemisection and rat contusion, were utilized to evaluate the role of the scaffold in providing both histological and functional benefits. In the primate hemisection model, the scaffold promoted tissue remodeling that is permissive to the growth of endogenous myelinated axons and led to functional benefit. In the more clinically relevant rat contusion model, scaffold implantation preserved spinal cord architecture by reducing cavitation, sparing white matter, and promoting the production of remodeled tissue that supported axonal regeneration. In these animal models, host cells were able to infiltrate the scaffold and deposit matrix at a rate comparable to that of scaffold degradation.

Multimodal therapeutic interventions are needed to provide next generation spinal cord injury treatments. Scaffold implantation to provide structural support to residual tissue and serve as a permissive environment for appositional healing is currently under clinical investigation for acute spinal cord injury.

References

1. Teng YD, Lavik EB, Qu X, Park KI, Ourednik J, Zurakowski D, et al: Functional recovery following traumatic spinal cord injury mediated by a unique polymer scaffold seeded with neural stem cells. *Proc Natl Acad Sci U S A* 99, 3024, 2002.
2. Pritchard CD, Slotkin JR, Yu D, Dai H, Lawrence MS, Bronson RT, et al: Establishing a model spinal cord injury in the African green monkey for the preclinical evaluation of biodegradable polymer scaffolds seeded with human neural stem cells. *J Neurosci Methods* 188, 258, 2010.