Hydrogels are biomaterials used in the treatment of experimental spinal cord injury (SCI). In a model of acute SCI, we implanted hydrogels based on 2-hydroxyethylmethacrylate (HEMA) and hydroxypropylmethacryla-mide (HPMA). One month after implantation the hydrogels bridged the cavity, adhered well to the spinal cord and created permissive environment, infiltrated with blood vessels, axons and Schwann cells.

Physical modifications (e.g. surface charge) of hydrogels may improve bridging of acute SCI. We implanted hydrogels based on HEMA with a surface charge in spinal cord hemisection and compared with a hydrogel without charge. Hydrogels with surface charge improved connective tissue adhesion and growth of axons compared to a hydrogel without charge.

Biodegradable hydrogels may bridge a lesion followed by complete re-sorption. In a model of acute SCI we implanted hydrogels based on the copolymer of HPMA and etoxyethylmethacrylate (EOMA) degraded from the periphery, which was substituted with new tissue after 1 month, to the center, comprising amorphous residuals of the hydrogel.

Delayed hydrogel implantation may improve bridging of spinal cord le-sion. We implanted hydrogels based on HEMA acutely or in a delayed fashion (after 7 days) in spinal cord transection. Delayed implantation re-duced the volume of the cavity after 3 months compared to acute implanta-tion of hydrogel. Hydrogel implantation (acute or delayed) significantly reduced the volume of the posttraumatic cavity compared to transection.

In a model of chronic SCI we implanted hydrogels based on HPMA (alone or with MSCs) after 5 weeks and compared to chronic SCI without treatment. Hydrogels bridged the cavity after 6 months and were infiltrated with blood vessels, axons, Schwann cells and astrocytes. Hydrogels with MSCs led to a statistically significant reduction of spinal cord atrophy.