Hydrogels Mediate Cell Migration for Neural Regeneration

Negar Seyedhassantehrani
Faculty: Li Yao
Department of Biological Sciences, Fairmount College of Liberal Arts and Sciences

Spinal cord injury is a significant health problem in the world and 500,000 new spinal cord injuries are reported every year. Biomaterial hydrogels are promising scaffolds that can support neural cell migration and conduct axonal regeneration for the injured spinal cord. As cellular substrates, the hydrogels can provide efficient structural support for central nervous system repair. Since natural material based hydrogels are biocompatible and biodegradable, they can provide a permissive and efficient environment for transplanted stem cells and a carrier for the delivery of therapeutic molecules into the animal body.

In this study, collagen type I hydrogel and fibrin hydrogel were fabricated and evaluated for neural cell growth and migration. The collagen hydrogel was crosslinked with polyethylene glycol (PEG) and fibrin/fibronectin (FB/FN) was modified by incorporation of aprotinin, which is a protease inhibitor. Fibronectin that can support neural cell survival, migration, proliferation and differentiation was added into the fibrin hydrogel as a supplemental material.

In the preliminary data of the study, I showed that PEG crosslinking can strengthen the collagen hydrogel and incorporation of aprotinin in the fibrin gel can prevent fibrin gel from degradation caused by cellular enzyme. In this study, the growth of astrocyte and fibroblasts and cell viability in the gels were investigated. The results showed that astrocytes can grow and proliferate in the PEG-collagen hydrogel and FB/FN and PEG and aprotinin in the hydrogel were not toxic to the cells.

In summary, the study demonstrated that chemically modified hydrogels of extracellular matrix proteins are suitable scaffolds to mediate neural cell growth and they can be potentially used as implantable materials to promote neural regeneration. In future studies, the specific extracellular matrix gene expression for the cells grown in the hydrogel will be investigated.