Growth and Differentiation of Neuronal Cells in Injectable Collagen Hydrogel for Neural Regeneration

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Abstract: Injury to the central nervous system including brain and spinal cord causes neuron death and demyelination and these tissues have limited intrinsic regenerative capacity. Transplantation of neuronal cells to the lesion of the injured neural tissue may generate therapeutic effect. However few cells may survive in the hostile environment. Injectable hydrogel serving as cell carrier may overcome this challenge by providing the cells a permissive environment to generate function locally. In this study, we tested the ability of collagen hydrogel as a carrier for neuronal cell transfection and differentiation. PC12 cells were seeded in the collagen hydrogel and differentiated with nerve growth factor (NGF) stimulation. To study PC12 cell transfection and differentiation in the hydrogel, plasmids encoding NGF-ires-EGFP were complexed with Fugene transfection reagent. The complexed pNGF-ires-EGFP was incorporated into the hydrogel seeded with PC12 cells. We observed that PC12 cells were transfected in the hydrogel and expressed EGFP protein. PC12 cells differentiated and generated neurites. To investigate axonal myelination, we isolated oligodendrocyte progenitor cells and dorsal root ganglion (DRG) from neonatal rats. We characterized the phenotype of OPCs and induced OPCs differentiation into oligodendrocyte in cell culture. Myelination of axons in the co-culture of OPCs and DRG was observed. In the future studies, we will co-culture OPCs and DRG in the hydrogel to study the myelination of axons in this 3-dimentional cell culture system.

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