Induced Pluripotent Stem Cell-Seeded Collagen Scaffolds as a Mechanism for Regeneration after Spinal Cord Injury

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Spinal cord injuries (SCIs) are highly debilitating conditions for which no effective treatment or cure currently exists. Stem cell replacement therapies may offer hope to people suffering with SCIs. The use of biomaterial scaffolds, both alone and combined with stem cells, has also been suggested for spinal cord repair. A relatively new type of stem cells, induced pluripotent stem cells (iPSCs) originate from adult somatic cells and bypass the ethical and immunological concerns of other stem cell lines. In this study, iPSCs were cultured and subsequently differentiated into neural stem cells (NSCs). These iPSC-derived NSCs were able to survive and extend axons after multiple reseedings, indicating the possibility of creating reservoirs in clinical use. Additionally, iPSC-derived NSCs were shown to survive in a biomaterial hydrogel during 3D-culturing and extend axons into the gel. A collagen scaffold was designed with four channels running parallel through its center. Hydrogel containing iPSCs was injected into the channels to test for cell survivability. This cell-seeded scaffold is a strong candidate for surgical implantation with the aim of generating host-integrated neurons and functional recovery in a rat model of SCI. Such a model will serve as a potential mechanism for curing SCI and other neurological defects in humans.