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Bi-Layer Electro-Conductive Nanofibrous Conduits for Peripheral Nerve Regeneration

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Abstract : Injury of peripheral nervous system (PNS) can lead to loss of sensation or movement. To date, one of the challenges for surgeons is repairing large gaps in PNS. To solve this problem, nerve conduits have been developed. Conduits produced by means of electrospinning can mimic extracellular matrix and provide enough surface for further functionalization. In this research, a conductive bilayer nerve conduit with poly caprolactone (PCL), poly (lactic acid co glycolic acid) (PLGA) and MWCNT for promoting peripheral nerve regeneration was fabricated. The conduit was made of longitudinally aligned PLGA nanofibrous sheets in the lumen to promote nerve regeneration and randomly oriented PCL nanofibers on the outer surface for mechanical support. The intra-luminal guidance channel was made out of conductive aligned nanofibrous rolled sheets which are coated with laminin via dopamine. Different properties of electrospun scaffolds were investigated by using contact angle, mechanical strength, degradation time, scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy (XPS). The SEM analysis was shown that size range of nanofibrous mat were about 600-750 nm and MWCNTs deposited between nanofibers. The XPS result was shown that laminin attached to the nanofibers surface successfully. The contact-angle and tensile tests analysis revealed that scaffolds have good hydrophilicity and enough mechanical strength. In vitro studies demonstrated that this conductive surface was able to enhance the attachment and proliferation of PC12 and Schwann cells. We concluded that this bilayer composite conduit has good potential for nerve regeneration.

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