

Sciatic nerve repair with tissue engineered nerve: olfactory ensheathing cells seeded poly (lactic-co-glycolic acid) conduit in an animal model

Abstract

Background and Aim: Synthetic nerve conduits have been sought for repair of nerve defects as the autologous nerve grafts causes donor site morbidity and possess other drawbacks. Many strategies have been investigated to improve nerve regeneration through synthetic nerve guided conduits. Olfactory ensheathing cells (OECs) that share both Schwann cell and astrocytic characteristics have been shown to promote axonal regeneration after transplantation. The present study was driven by the hypothesis that tissue-engineered poly(lactic-co-glycolic acid) (PLGA) seeded with OECs would improve peripheral nerve regeneration in a long sciatic nerve defect. Materials and Methods: Sciatic nerve gap of 15 mm was created in six adult female Sprague-Dawley rats and implanted with PLGA seeded with OECs. The nerve regeneration was assessed electrophysiologically at 2, 4 and 6 weeks following implantation. Histopathological examination, scanning electron microscopic (SEM) examination and immunohistochemical analysis were performed at the end of the study. Results: Nerve conduction studies revealed a significant improvement of nerve conduction velocities whereby the mean nerve conduction velocity increases from 4.2 ± 0.4 m/s at week 2 to 27.3 ± 5.7 m/s at week 6 post-implantation ($P < 0.0001$). Histological analysis revealed presence of spindle-shaped cells. Immunohistochemical analysis further demonstrated the expression of S100 protein in both cell nucleus and the cytoplasm in these cells, hence confirming their Schwann cell-like property. Under SEM, these cells were found to be actively secreting extracellular matrix. Conclusion: Tissue-engineered PLGA conduit seeded with OECs provided a permissive environment to facilitate nerve regeneration in a small animal model.

Keyword: Olfactory ensheathing cells; Poly (lactic-co-glycolic acid); Sciatic nerve defect; Tissue engineering