Sciatic Nerve Regeneration Using Laminin-Fibronectin Double Coated Collagen Fiber Graft in Rats
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It has been reported that laminin (LN) and fibronectin (FN) stimulated the growth of regenerating peripheral nerve fibers and simultaneously suppressed the excessive invasion of fibroblastic perineural cells and macrophages in the nerve graft isotransplantation. In the present study, we implanted polyethylene telephthalate (PET) braid tube grafts filled with longitudinal LN and FN double coated collagen fiber bundles (LN-FN grafts) to regenerate peripheral nerves of rats. Grafts included uncoated collagen fibers were used as control. A 1cm defect on the right sciatic nerve was filled with a graft. At 30 days after implantation, many fibroblastic cells had invaded the gaps between collagen at the middle portion of the control grafts. In the LN-FN grafts new nerves were markedly increased in number. After 60 days, all artificial collagen elements were completely degraded and absorbed in both grafts. The LN-FN grafts showed prominent myelinated and unmyelinated nerve fibers surrounded by perineural cells, but the controls contained massive collagenous connective tissue matrix around the nerve fasciculi which were rather sparse. To evaluate the regeneration of the nerves through the grafts, we recorded action potentials from two electrodes which had been placed in front of and behind the grafts. At 30 days, only descending action potentials suggesting predominant regeneration of motor neurons were evoked and rather extent in the LN-FN grafts. Descending and ascending action potentials were evoked in both grafts at 60 days, and the maximum stimuli for descending action potentials in the LN-FN and control grafts were 3.1 and 8.0 mA, respectively. However, wave patterns showed somewhat delayed conduction velocities compared with the normal. These results suggested that LN and FN promote elongation of regenerated axons in the collagen and that PET tubes as an outcase fro the grafts should be replaced by a biodegradable material in order to reduce a secondary entrapping.