Improvement in Nerve Regeneration Through a Decellularized Nerve Graft by Supplementation With Bone Marrow Stromal Cells in Fibrin.

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Abstract:

Acellular nerve grafting is often inferior as well as an inadequate alternative to autografting for the repair of long gaps in peripheral nerves. Moreover, the injection method is not perfect. During the injection of cells, the syringe can destroy the acellular nerve structure and the limited accumulation of seed cells. To resolve this problem, we constructed a nerve graft by acellular nerve grafting. Bone marrow-mesenchymal stromal cells (BM-MSCs) were affixed with fibrin glue and injected inside or around the graft, which was then used to repair a 15-mm nerve defect in rats. The acellular nerve graft maintained its structure and composition, and its tensile strength was decreased, as determined by two-photon microscopy and a tensile testing device. In vitro, MSCs embedded in fibrin glue survived and secreted growth factors such as nerve growth factor (NGF) and brain-derived neurotrophic factor (BDNF). We repaired 15-mm Sprague-Dawley rat sciatic nerve defects using this nerve graft construction, and MSCs injected around the graft helped improve nerve regeneration and functional recovery of peripheral nerve lesions as determined by functional analysis and histology. Therefore, we conclude that supplying MSCs in fibrin glue around acellular nerves is successful in maintaining the nerve structure and can support nerve regeneration similar to the direct injection of MSCs into the acellular nerve for long nerve defects but may avoid destroying the nerve graft. The technique is simple and is another option for stem cell transplantation.