Bioengineered graft

- Review of Gaps in the Clinical Indications and Use of Neural Conduits and Artificial Grafts for Nerve Repair and Reconstruction
- Coaxial Bioprinting of Schwann Cells and Neural Stem Cells in a Three-Dimensional Microenvironment for the Repair of Peripheral Nerve Defects
- Prevention of nerve growth and evoked pain with a nerve cap graft device
- Forebrain neural progenitors effectively integrate into host brain circuits and improve neural function after ischemic stroke
- In Vitro Validation of Pulsed Electromagnetic Field (PEMF) as an Effective Countermeasure Against Inflammatory-Mediated Intervertebral Disc Degeneration
- Overcoming challenges of clinical cell therapies for Parkinson's disease with photobiomodulation
- Personalized Stem Cell-Based Regeneration in Spinal Cord Injury Care
- Pig models in translational surgery

A **bioengineered graft** refers to a tissue or organ graft that has been created through biological engineering techniques. These grafts are typically designed to replace or repair damaged tissues in the body and can be made from a variety of materials, including biological tissues, synthetic materials, or a combination of both. The primary goal of bioengineered grafts is to improve healing, reduce the risk of rejection, and enhance the function of the tissue or organ being replaced.

Bioengineered grafts can be used in various medical fields, including neurosurgery for spinal or nerve repairs, **cardiovascular surgery** for blood vessel replacements, **orthopedic surgery** for joint and bone repairs, and even **cosmetic surgery** for skin grafts.

Advancements in **tissue engineering** have made it possible to create more complex grafts by utilizing stem cells, 3D printing, and other biotechnologies to mimic the properties of natural tissues. This is particularly important for improving outcomes in patients who require transplantation or repair of tissues that are difficult to regenerate naturally.

A study explores the efficacy of a neural graft constructed using adipose mesenchymal stem cells (ADSC), acellular microtissues (MTs), and chitosan in the treatment of peripheral nerve defects.

Stem cell therapy with acellular MTs provided a suitable microenvironment for axonal regeneration and compensated for the lack of repair cells in the neural ducts of male 8-week-old Sprague Dawley rats.

In vitro, acellular MTs retained the intrinsic extracellular matrix and improved the narrow microstructure of acellular nerves, thereby enhancing cell functionality. In vivo, neuroelectrophysiological studies, gait analysis, and sciatic nerve histology demonstrated the regenerative effects of active acellular MT. The Chitosan + Acellular-MT + ADSC group exhibited superior myelin sheath quality and improved neurological and motor function recovery.

Active acellular-MTs pre-cellularized with ADSC hold promise as a safe and effective clinical method for peripheral nerve defect treatment [1)].

The study on the chitosan/acellular matrix-based neural graft carrying mesenchymal stem cells presents a promising approach for enhancing peripheral nerve repair. The combination of adipose-derived stem cells (ADSC) and acellular microtissues (MTs) encapsulated in chitosan scaffolds demonstrated positive outcomes in both in vitro and in vivo models, showing improved nerve regeneration, myelin sheath quality, and functional recovery. These results suggest that this innovative graft could provide a potential solution for treating peripheral nerve defects.

However, the study's impact is limited by certain weaknesses, such as the lack of detailed control groups, short-term follow-up, and insufficient mechanistic insights into the regeneration process. Further studies, including long-term evaluations, larger sample sizes, and a more thorough understanding of the cellular mechanisms, are necessary to confirm the clinical applicability and safety of this approach in humans. Despite these limitations, the study lays a promising foundation for future research in regenerative medicine and peripheral nerve repair.

[1]
Zhang Z, Li M, Cheng G, Wang P, Zhou C, Liu Y, Duan X, Wang J, Xie F, Zhu Y, Zhang J. A chitosan/acellular matrix-based neural graft carrying mesenchymal stem cells to promote peripheral nerve repair. Stem Cell Res Ther. 2024 Dec 31;15(1):503. doi: 10.1186/s13287-024-04093-5. PMID: 39736729.