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Enhancing sciatic nerve regeneration with osteopontin-loaded acellular nerve allografts in rats: Effects on macrophage polarization

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Highlights

- Inflammation is vital for nerve regeneration it eliminates growth-inhibiting components and creates a supportive environment for axonal regrowth.
- Macrophages are essential for peripheral nerve regeneration and play a crucial role in the immune response and tissue repair.
- Osteopontin is a multifunctional glycoprotein with both pro-inflammatory and anti-inflammatory properties. This dual functionality of osteopontin highlights its complex role in immune response modulation.

Abstract

Osteopontin (OPN) is a multifunctional matrix glycoprotein with neuroprotective and immunomodulatory properties. This study explored the potential of OPN-loaded acellular nerve allografts (ANAs) to repair sciatic nerves in male Wistar rats. The research also delved into the impact of OPN on macrophage phenotypes. We reconstructed a 10 mm nerve gap with ANAs containing OPN at 2 nM and 4 nM. The sciatic functional index (SFI) and paw withdrawal reflex latency (WRL) showed the significant efficacy of ANA/OPN (2 nM) in enhancement of target organ reinnervation and subsequent sensorimotor recovery compared to other groups. Electrophysiological and histomorphometric analyses further supported the regenerative properties of ANA/OPN (2 nM). Additionally, ANA/OPN (2 nM) promoted macrophage polarization towards an M2 phenotype and reduced proinflammatory cytokines at the injury site. In conclusion, the study suggested that ANA loaded with 2 nM OPN effectively repaired transected sciatic nerves in rats, potentially through enhancing axonal sprouting and exerting anti-inflammatory effects.