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Olfactory Ectomesenchymal Stem Cells as a Potential Source in Nerve Tissue Engineering: A Letter

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Dear Editor,

Olfactory ectomesenchymal stem cells (OE-MSCs), which belong to the group of adult stem cells, exhibit multipotent characteristics and originate from the ectoderm with neural crest properties. These cells are extracted and isolated from the lamina propria layer of the olfactory mucosa (1). This novel group of MSCs has distinct advantages over their counterparts. Specifically, they possess a non-invasive tissue extraction process, high proliferation capacity, and telomerase activity compared to other types of MSCs. These cells have the extraordinary potential for self-renewal and differentiation into various cell lineages, including osteoblasts, adipocytes, and nerve cells, due to their neural crest origin (2). Olfactory ectomesenchymal stem cells play a role in several regenerative mechanisms, including angiogenic and immunomodulatory characteristics (3). One of the primary benefits of utilizing these cells for transplantation is their low potential for ethical issues, in addition to their inherent immunomodulatory properties, such as the release of anti-inflammatory cytokines like TGF-β and low immunogenicity (expressing very low levels of MHC class I and no MHC class II) (4). Olfactory ectomesenchymal stem cells can differentiate into nerve cells through multiple mechanisms, including mechanotransduction receptors, gene transfection, and signaling pathway activation (3).

Nerve tissue engineering and the application of biomaterial-based scaffolds are rapidly advancing fields in neuronal regeneration. For example, the utilization of scaffold structures mimics the extracellular matrix (ECM) biochemical and biophysical properties in the central nervous system (CNS) and peripheral nervous system (PNS) (5). In addition, the components of bioengineered scaffolds play a crucial role in determining stem cell fate. The strategic positioning of the scaffold containing stem cells at the site of central or peripheral nerve injury, combined with the activation of the cell mechanochemical receptors, prompts the differentiation of the stem cells into the damaged neurons and facilitates tissue regeneration (6).

An interesting review article was recently published by Rahbaran et al. in the "Cellular & Molecular Biology Letters Journal" about the use of OE-MSCs in CNS regeneration for Parkinson's disease (PD) and Alzheimer's disease (AD). These stem cells differentiate into dopaminergic and cholinergic-like neurons in PD and AD, respectively (7). Furthermore, a scientific article authored by Hamidabadi et al., published in the "Brain Behavioral Research Journal," sheds light on the therapeutic potential of OE-MSCs for the management of spinal cord injury (SCI) (8).

Another article by Askarzadeh et al. in the "Macromolecular Bioscience Journal" discusses the use of OE-MSCs for the treatment of sciatic nerve injuries, which affect PNS regeneration. Advances in the treatment of sciatic nerve injuries have led to the development of nerve conduits implanted with or without stem cells and inserted into the lesion site. The expression of neural markers is a complex process involving the regulation of multiple signaling pathways

(9). In addition, Entezari et al. reported in their article published in the "Basic and Clinical Neuroscience Journal" about the trans-differentiation of OE-MSCs into Schwann-like cells associated with PNS regeneration (10).

According to the results of preclinical studies, it can be concluded that OE-MSCs, with or without scaffolds, offer hope for more effective cell-based therapy in nerve tissue engineering in the future. However, these studies face a significant challenge in that the specific signaling pathways involved have yet to be thoroughly investigated. Further research into these pathways may yield important findings.

Footnotes

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