

EXPLORING THE IMPACT OF MESENCHYMAL STEM CELLS ON CHRONIC WOUND REPAIR

Taralunga Maxim¹, Nacu Viorel², Taralunga Tatiana³, Bour Alin⁴

¹ Department of Reconstructive and Plastic Surgery, Emergency Medicine Institute, Chisinau, Republic of Moldova.

² Human Tissue Bank, Traumatology and Orthopedy Hospital, Chisinau, Republic of Moldova.

³ Laboratory of Tissue Engineering and Cell Culture, *Nicolae Testemitanu* State University of Medicine and Pharmacy, Chisinau, Republic of Moldova.

⁴ Department of Surgery N.5, *Nicolae Testemitanu* State University of Medicine and Pharmacy, Chisinau, Republic of Moldova.

Introduction: Chronic wounds are a significant medical concern, especially among the aging population, with conditions like diabetic ulcers, and venous leg ulcers being prominent examples. These wounds often fail to heal due to various factors such as impaired cellular regeneration, prolonged inflammation, and poor vascularization. Mesenchymal stem cells (MSCs), known for their multipotency and regenerative potential, have emerged as a promising therapeutic strategy for chronic wound healing. This review evaluates the current understanding of MSCs' role in chronic wound healing, highlighting their mechanisms of action and clinical relevance.

Materials and Methods: The reviewed studies included a variety of in vitro and in vivo models, alongside clinical trials, investigating the effects of MSCs on chronic wound healing. Key databases like PubMed and Scopus were searched using terms such as "mesenchymal stem cells," "chronic wound healing," and "wound regeneration." Both preclinical and clinical studies published within the last decade were included to assess the potential of MSC therapies in chronic wound management. Research focused on the mechanisms of MSCs, including their ability to modulate inflammation, promote angiogenesis, and enhance tissue regeneration.

Results: Mesenchymal stem cells have demonstrated considerable promise in chronic wound treatment. In vitro studies have shown that MSCs can enhance fibroblast proliferation, collagen synthesis, and extracellular matrix formation, which are crucial for wound healing. In vivo, MSCs have been shown to reduce inflammation by modulating immune responses, thereby preventing excessive scar tissue formation. Furthermore, their paracrine factors—such as growth factors, cytokines, and extracellular vesicles—play a significant role in promoting angiogenesis, epithelialization, and tissue remodeling. Clinical trials have also reported improved healing rates, reduced infection, and enhanced tissue regeneration in patients with chronic wounds following MSC therapy.

Conclusion: Mesenchymal stem cells offer a promising therapeutic option for chronic wound management due to their regenerative and immunomodulatory properties. While preclinical data and early-stage clinical studies are promising, more large-scale, well-designed clinical trials are necessary to establish optimal treatment protocols, dosages, and long-term efficacy. MSCs could potentially transform the management of chronic wounds, providing a much-needed solution for a condition that remains a major challenge in healthcare today.

Keywords: mesenchymal stem cells, wound process, chronic wounds.