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Harnessing Placental Derived Biomaterials for Enhanced Wound Healing

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INTRODUCTION

Chronic wounds pose a substantial burden on patients and healthcare systems, often exhibiting persistent inflammation and hindering the progression of wound healing. Placental-derived biomaterials have long been recognized for their remarkable properties, including biocompatibility, biodegradability, angiogenic, anti-inflammatory, antimicrobial, antifibrotic, immunomodulatory, and immune privileged features. For over a century, these biomaterials have been utilized in wound management, offering an extracellular matrix (ECM) scaffold that mimics native tissue, encouraging ECM remodeling, cell migration, proliferation, and differentiation. The safety and efficacy of placental-derived biomaterials in wound healing are well-established in the literature, though more research is required to assess various aspects such as source, preservation techniques, decellularization status, design, and clinical applications.

DESCRIPTION

Complex wounds that are difficult to heal present a significant clinical challenge and are accompanied by considerable patient morbidity. Chronic wounds often remain stuck in the inflammatory phase of wound healing, leading to an imbalance of pro-inflammatory cytokines, proteolytic enzymes, and protease inhibitors. This results in elevated levels of matrix metalloproteinases (MMPs) that damage the ECM. Placental-derived biomaterials offer a promising strategy for treating nonhealing wounds due to their biocompatibility, biodegradability, and low immunogenicity making them ideal for medical applications. Research has shown that these biomaterials promote wound healing by providing an ECM scaffold for tissue repair exerting anti-inflammatory effects facilitating cell migration and promoting regeneration. Despite these promising findings, more evidence is required to evaluate the use of placental-derived injectable scaffolds for wound healing. Wound healing is a complex and dynamic process involving several cellular and molecular events, including homeostasis, inflammation, cell migration, proliferation, and tissue remodeling. It can be divided into three distinct phases: Inflammatory, proliferative, and remodelling it is beyond the scope of this review. Wound healing is a remarkable process through which the body restores and regenerates damaged tissue following an injury. This intricate and dynamic phenomenon encompasses a diverse array of cellular and molecular events, orchestrating a harmonious sequence of homeostasis, inflammation, cell migration, proliferation, and tissue remodeling. Wound healing is divided into three distinct phases: Inflammatory, proliferative, and remodelling. The existing research establishes placental-derived biomaterials as a safe and effective treatment for the management of complex ulcers. The clinical application of placental-derived scaffolds in wound healing has shown positive outcomes, particularly for managing complex ulcers. However, further research is essential to understand how various factors, such as the source, preservation techniques, decellularization methods, design, forms, frequency of application, and administration methods of placental-derived biomaterials, influence clinical outcomes.

CONCLUSION

Studies comparing the efficacy of decellularized and non-decellularized placental-derived biomaterials in wound management are warranted. Placental-derived biomaterials hold tremendous promise in wound healing, offering a safe and effective treatment option for complex wounds. As the field continues to evolve, understanding the impact of different variables on clinical outcomes will be crucial in optimizing their use. While this review primarily focuses on placental-derived scaffolds, it is essential to acknowledge the potential of placental-derived cell-based therapy as well, which may further enhance wound healing outcomes. Future research efforts should aim to bridge the existing gaps and unlock the full potential of placental-derived biomaterials in wound management.

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