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Marine Collagen as a Bioactive Material in Wound Healing

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Abstract

Marine collagen, derived from marine sources such as fish skin, scales, and bones, has garnered increasing attention in the field of wound healing due to its unique properties and versatile applications. Marine collagen offers several advantages over mammalian-derived collagen, including abundant availability, lower risk of disease transmission, and superior biocompatibility. Its resemblance to human collagen, particularly type I collagen, makes it an ideal candidate for promoting tissue regeneration and wound closure. This abstract presents a comprehensive review of the current state of research on marine collagen as a bioactive material for wound healing.

Keywords: Marine collagen; Disease transmission; Tissue regeneration; Wound healing

Introduction

Wound healing is a complex biological process crucial for the restoration of tissue integrity and function following injury or trauma. Despite significant advancements in wound care, challenges such as delayed healing, chronic wounds, and risk of infection persist, highlighting the need for innovative approaches to enhance the healing process. Marine collagen, derived from marine sources such as fish skin, scales, and bones, has emerged as a promising bioactive material for wound healing applications [1]. This introduction provides an overview of the unique properties and potential applications of marine collagen in the context of wound healing. Unlike mammalian-derived collagen, marine collagen offers several advantages, including abundant availability, lower risk of disease transmission, and superior biocompatibility. These characteristics make marine collagen an attractive alternative for promoting tissue regeneration and wound closure [2, 3].

Description

The biochemical composition of marine collagen, rich in essential amino acids such as glycine, proline, and hydroxyproline, closely resembles that of human collagen, particularly type I collagen found abundantly in the extracellular matrix of skin tissue. This structural similarity facilitates the integration of marine collagen into the wound site, promoting cell adhesion, proliferation, and extracellular matrix synthesis [4]. Moreover, marine collagen exhibits inherent bioactive properties that contribute to its efficacy in wound healing. These properties include antimicrobial activity, anti-inflammatory effects, and the ability to stimulate angiogenesis, all of which are essential for orchestrating the various phases of the wound healing process. Marine collagen's capacity to modulate immune responses and promote tissue remodeling further enhances its therapeutic potential in wound management [5, 6].

In addition to its biological properties, marine collagen can be processed into various forms, including hydrogels, films, scaffolds, and nanoparticles, to suit different wound healing applications [7]. These marine collagen-based biomaterials offer versatile platforms for delivering bioactive molecules, controlling drug release kinetics, and providing mechanical support to the wound site, thereby enhancing the efficacy of wound dressings and tissue engineering constructs [8]. Furthermore, preclinical and clinical studies investigating the effectiveness of marine collagen-based wound dressings and therapies have shown promising results in promoting wound healing, reducing inflammation, and improving clinical outcomes [9]. However, challenges such as standardization of processing methods, regulatory considerations, and commercialization hurdles need to be addressed to facilitate the widespread adoption of marine collagen-based products in clinical practice [10].

Conclusion

In conclusion, marine collagen represents a promising bioactive material for wound healing, offering unique advantages in terms of biocompatibility, bioactivity, and versatility. With further research and development, marine collagen-based therapies have the potential to address the unmet needs in wound care and significantly improve outcomes for patients with acute and chronic wounds.

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