

## Collagen and Wound Care, a Comprehensive Study

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The role of collagen as an agent in wound healing stems from its unique qualities that facilitate wound healing, cell regeneration, and clotting. Collagen is a protein naturally found within the body, particularly within the skin, teeth, bones, ligaments and tendons, and connective tissues. One of the physiological roles that collagen plays within the body is providing elasticity to the skin. Collagen is the most abundant and widespread functional protein in the body and naturally contributes to wound healing. It performs similarly when applied as a skin graft to a flesh or burn wound. When Collagen is used as a primary dressing in direct contact with a chronic wound, studies have shown that collagen is a safe and extremely effective treatment.<sup>1</sup>

Collagen is a non-toxic, naturally occurring organic material that is already familiarized by the patient's cells, which dramatically decreases the likelihood of a stimulated inflammatory response, infection, and outright rejection of the collagen dressing or graft. Since the presence of collagen promotes the deposition of new collagen fibers, this acts as a scaffold for cellular migration and adhesion. The re-epithelialization of the wound is a major factor on whether the wound site will heal quickly and appropriately. It's important to also consider how collagen will break down within the wound site. Collagen is considered bioresorbable, or biodegradable, meaning it does not need to be removed from the wound site. This reduces the risk of trauma and pain during dressing changes, as well as preventing the loss of fluid and protection against infection. As the collagen breaks down in the flesh wound, the amino acids released by this recycling process can be reused by the epithelial cells. As collagen disbands in the wound site, its components induce Growth Factors, such as Cytokines (small proteins that are important in controlling activity and growth of cells) that aid in the remedial process. It is now well known that collagen and collagen-derived fragments control many cellular functions, including differentiation and cell shape, migration, and synthesis of a number of proteins. These properties make collagen an ideal wound therapy agent to improve and accelerate the healing process.<sup>2</sup>

In a clinical study, *Wound Healing Modulation Through the Local Application of Powder Collagen-Derived Treatments in an Excisional Cutaneous Murine Model*, developed by Selma-Benito Martínez from the Biomedical Networking Research Center in Madrid, compared the effects of wound repair of two collagen-based powder product, a non-hydrolyzed commercial collagen derived from bovine cartilage, and a hydrolyzed bovine dermal collagen powder. This study found that the patients treated with a collagen-based product experiences significantly more healing benefits than those within the control group. It was noted that after 18 days, animals treated with the new collagen treatment showed accelerated wound closure, significantly increased epithelialization, and more organized repair tissue. These findings suggest that the new collagen treatment, compared to the untreated control group, produces significantly faster wound closure and, at the same time, promotes a slight progression of the reparative process compared with the rest of the group. In the experimental groups that were treated with a collagen based product, reduce granulation tissue formation with homogeneous thickness was recognized, as well as the presence of fewer inflammatory cells. The untreated control group exhibited more inflammation and less organized repair tissue, respectively.<sup>3</sup> There is multiple different types of

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<sup>1</sup> Shu, Hongxin; Xia, Zhiyu. *The Clinical Efficacy of Collagen Dressing on Chronic Wounds: A Meta-analysis of 11 Randomized Controlled Trials*. National Library of Medicine (NIH). August 2022.

<sup>2</sup> Simmons, Rachel. *Role of Collagen in Wound Care*. SCAPA Healthcare. January 2022.

<sup>3</sup> Benito-Martínez, Selma; Pérez-Köhler, Bárbara. *Wound Healing Modulation through the Local Application of Powder Collagen-Derived Treatments in an Excisional Cutaneous Murine Model*. MDPI Biomedicines. April 2022.

collagen dressings and grafts on the medical market, including gels, pastes, polymers, oxidized regenerated cellulose (ORC), and ethylene diamine tetraacetic acid (EDTA). The collagen within these products are usually sourced from porcine, bovine, equine, or avian purified derivatives. Many collagen dressings are made up of Type 1 (native) collagen, while some dressings contain denatured collagen. Some dressings might contain ingredients, such as cellulose derivatives that enhance absorbency, comfort, and flexibility, while also maintaining a moist wound environment essential for the promotion of adequate wound healing. Pore size and surface area can also vary, aiding in the management and maintenance of the dressings on the chronic wound site. Some collagen products also contain an anti-microbial agent that helps deter pathogens from entering and invading the wound site. To conclude this article, extensive research has shown that collagen-based products produce a remarkable increase in fibroblast (cells that aid in the formation of connective tissues) production, and increase the deposition of aligned collagen fibers by attracting said fibroblasts and cause a direct migration of cells. Since collagen has hydrophilic properties, this can encourage fibroblast permeation, and help in the uptake and bioavailability of fibronectin (Extracellular matrix component key to controlling cell behavior and adhesion).<sup>4</sup> In addition, collagen dressings help preserve leukocytes (white blood cell aiding in contracting diseases), macrophages (facilitate the elimination of damaged and diseased cells), fibroblasts, and epithelial cells. With this being said, collagen based products can be a key component in the regeneration, anti-inflammation, and re-epithelialization, and successful wound closure of chronic, non-healing wounds in veterinary and human medicine.

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<sup>4</sup> Brett, David. *A Review of Collagen and Collagen-Based Wound Dressings*. Wound Management Division, Smith & Nephew. National Institutes of Health. December 2008.