

Wound Healing: Mechanisms, Advanced Management, and the Evolving Role of the Dermatologist

Wilhelmina Lam, DO, MPH¹; Alec Lawson, BA^{1,2}; Aysham Chaudry, DO¹; Alexandra DeVries, BS^{1,3}; Mark S. Nestor MD, PhD^{1,4,5}

¹Center for Clinical and Cosmetic Research, Aventura, FL; ²Arizona College of Osteopathic Medicine, Glendale, AZ; ³Rocky Vista University College of Osteopathic Medicine, Parker, CO;

⁴Department of Dermatology and Cutaneous Surgery, University of Miami Miller School of Medicine Miami, Miami, FL; ⁵Department of Surgery, Division of Plastic Surgery, University of Miami Miller School of Medicine Miami, Miami, FL

ABSTRACT

Cutaneous wound healing is a complex process, and dermatology offers a critical perspective given the pathophysiology of wounds. Chronic wounds, defined as wounds that persist without significant healing after four weeks of conservative management, such as diabetic foot ulcers, venous and arterial ulcers, pressure injuries, and non-healing surgical wounds, stall in normal healing stages, creating a pro-inflammatory and non-resolving microenvironment. Current management focuses on systemic optimization and local wound management, while emerging therapies like tissue-engineered substitutes, negative pressure therapy, hyperbaric oxygen, and cellular and acellular matrix-like products are gaining traction as treatment options. Dermatologists bring expertise in cutaneous pathophysiology that can enhance multidisciplinary models of care and improve clinical outcomes.

BACKGROUND

Wound healing is a coordinated process of hemostasis, inflammation, proliferation, and remodeling that restores skin integrity. While acute wounds typically resolve within four weeks, chronic wounds often stall due to ischemia, infection, neuropathy, or persistent inflammation. These wounds are marked by disrupted angiogenesis, impaired growth factor signaling, and abnormal extracellular matrix dynamics.

METHODS

Articles on PubMed and Semantic Scholar (2020–2025) were reviewed, supplemented by citation tracking and authors' expert opinion.

RESULTS

Venous ulcers:

Venous ulcers result from venous hypertension and valve dysfunction, causing pooling and tissue breakdown. Management includes compression therapy, debridement, infection control, and use of medical foods such as diosmin. Advanced dressings such as CAMPs have been shown to better facilitate wound closure.

Arterial ulcers:

Arterial ulcers arise from peripheral arterial disease and ischemia. Revascularization is key, with local care using non-adherent dressings to protect fragile tissue and CAMP-based dressings may enhance healing where perfusion is partially restored but tissue remains compromised. Medical management includes antiplatelet therapy, risk factor modification, and exercise programs.

Diabetic foot ulcers (DFUs):

DFUs reflect a multifactorial interplay between neuropathy, ischemia, and metabolic dysregulation, leading to impaired healing and high infection risk. Standard care includes strict glycemic control, pressure offloading, debridement, and infection control, as well as the use of CAMP dressings to aid healing in the setting of complex cases.

Pressure ulcers:

Pressure injuries develop from sustained pressure at bony prominences causing ischemia and necrosis. Care involves pressure relief, debridement, and infection control, while CAMPs may aid in granulation and epithelialization when conventional measures stall.



Figure 1: Patient 1 distal lower extremity chronic non-healing surgical wound pre-allograft



Figure 2: Patient 2 distal lower extremity chronic non-healing surgical wound pre-allograft



Figure 1A: Patient 1 distal lower extremity after five allograft applications



Figure 2A: Patient 2 distal lower extremity after three allograft applications

RESULTS (CONT.)

Chronic non-healing surgical wounds:

Chronic surgical wounds often result from infection or ischemia, with debridement as the gold standard to remove necrotic tissue and prepare the wound bed. CAMPs can facilitate re-epithelialization and granulation in anatomically challenging sites such as the scalp and distal lower extremities, where vascularity and mechanical stress can impede healing (Figures 1-2).

Chronic wounds persist due to impaired growth factor signaling and poor structural support, creating a pro-inflammatory microenvironment. Standard care focuses on local wound management and systemic optimization, while newer therapies include tissue-engineered substitutes, negative pressure therapy, hyperbaric oxygen, and growth factor applications. Cellular and acellular matrix-like products (CAMPs) have emerged as a promising treatment to restore growth factor activity and structural support.

DISCUSSION & CONCLUSION

Chronic wound subtypes are multifactorial but share overlapping management strategies, with advanced dressings such as CAMPs becoming increasingly integrated into practice. Although wound care is currently led by other specialties, dermatology's unique expertise in cutaneous biology positions it to retake a more central role in advancing both clinical care and innovation, while continuing to strengthen multidisciplinary collaboration.

REFERENCES & DISCLOSURES

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