SKIN

BRIEF ARTICLE

Type I Collagen Matrix with Polyhexylmethylene Biguanide in a Chronic Lower Extremity Wound

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ABSTRACT

Chronic wounds pose a significant healthcare challenge, affecting millions of individuals and incurring substantial healthcare costs. In this case study, we present the successful treatment of a chronic lower extremity wound in an 80-year-old female using PuraPly™, a Type I collagen matrix embedded with polyhexylmethylene biguanide (PHMB). The patient initially sustained the injury, which had become infected and resistant to conventional treatments. After applying PuraPly™, the wound showed rapid improvement, ultimately resulting in complete closure. Our findings highlight the utility of PuraPly™ as an effective intervention for chronic wounds, thereby improving treatment outcomes and the quality of life for these patients.

INTRODUCTION

Wound healing is a complex sequence of exchanges involving cells and mediators. This process can be categorized into four interconnected stages: hemostasis, inflammation, proliferation, and remodeling. In contrast to the conventional wound healing pattern, the progression of chronic wounds deviates from this linear model, and an extended inflammatory phase is frequently observed.[1] Elevated levels of neutrophils are commonly detected in slowly healing wounds and are linked to the deterioration of newly synthesized collagen.[2] Bacterial infection and biofilms have a crucial role in impaired healing and recurrence, as biofilms shield bacteria from systemic antibiotics and form a polymicrobial population, making antibiotic treatment less effective.[1]

Chronic wounds affect nearly 2.5% of the population in the United States.[3] In 2014, it was estimated that chronic wounds affected 8.2 million people on Medicare, resulting in an estimated cost of between $31.7 billion and $96.8 billion.[4] On the individual patient level, chronic wounds harm quality of life due to wound odor, discharge, pain, activity restrictions, and affected sleep patterns.[5] Therefore, investigating novel treatments to aid in treating chronic wounds provides benefits at both the individual patient and systemic levels. We present the case of an 80-year-old woman with a three-month lower extremity wound treated with the skin substitute PuraPly™.

CASE REPORT

An 80-year-old woman presented to the clinic with an eight-centimeter open, purulent ulcer

on the right medial ankle sustained from falling on a stump approximately three months prior (**Figure 1**). She subsequently went to the emergency department, where the wound was cleaned and sutured. After three weeks, the sutures were removed at her primary care physician's office, and the wound later became infected. Over the next few months, she saw various specialists, including dermatology, podiatry, finally, and orthopedic wound care, who planned to apply porcine skin to the wound.

At our encounter, we applied PuraPly™ Antimicrobial Wound Matrix, dressed the wound with sterile gauze, and advised the patient to keep it undisturbed for a week. The wound healed without complications and almost completely closed at the two-week follow-up, even though the patient went on a trip to Argentina that involved a lot of walking (**Figure 2**). A new scar replaces the granulation tissue three months after PuraPly™ application (six months post-initial injury) (**Figure 3**).

DISCUSSION

PuraPly™ Antimicrobial Wound Matrix is a bilayer Type I collagen dressing embedded with polyhexamethylene biguanide (PHMB). The porcine-derived collagen material is biocompatible and purified of all pathogenic, inflammatory, and immunologic antigens. The two layers are cross-linked with ethyl dimethylamine carboxylic acid and soaked in PHMB. The cross-linked bilayer is then laminated and fenestrated to increase resistance to degradation and allow for drainage.[6] This 'skin substitute' demonstrates no microbial resistance, low microbial tolerance, high tissue compatibility/host-cell tolerability, and long duration of action.

This Type I collagen in PuraPly™ helps with the synthesis of new proteins and helps the wound maintain a moist environment, while the PHMB provides innate antimicrobial properties.[7]. Its positive charge interacts with negatively charged phospholipids in the microbial membranes, forming cytotoxic pores, and causing bacteriolysis. Unlike antibiotics, this physical property does not rely on the cellular activity of the microbes, thus being able to kill quiescent cells.[8] PHMB has a broad antimicrobial spectrum, including gram-positive and gram-negative bacteria and fungi, and is effective at preventing polymicrobial infection and biofilm development.[9]

Silver-impregnated dressings are commonly used in chronic wounds with potent antimicrobial properties against bacteria, fungi, and viruses. In a comparative study of acute and chronic wounds, after 11 days, PuraPly™ reduced MRSA counts to 3.27 log Colony Forming Units/gram (CFU/g), a substantial decrease compared to Dermal Scaffold with Silver (DRSAg: 4.89 log CFU/g), Antimicrobial Hydrofiber Wound Dressing (AHWD: 3.89 log CFU/g), and Antimicrobial Wound Gel (AWG: 5.34 log CFU/g).[9] Silver-impregnated dressings are more effective in the early stages of wound healing but not in chronic wound care since it does not promote wound healing and damage fibroblasts in the extracellular matrix.[10]

When used after wound debridement, PuraPly™ allows the wound to leave the inflammatory phase while providing a stable matrix for cellular growth and proliferation. Other applications include following Mohs surgery[11] and on post-surgical wounds, venous, diabetic, and pressure ulcers.[7] PuraPly™ accelerates healing, improving wound areas, depth, and volume. The median time to closure was 17 weeks, with a

Figure 1. Wound of right ankle on initial presentation. Image from the patient.

Figure 2. Healed right ankle wound two weeks after PuraPly™ application.

Figure 3. Healed right ankle wound at six months post initial injury.

73% closure rate tested over 307 wounds.[7] In another study of 43 wounds closed with PuraPly™ treatment, 41 achieved complete wound closure with a mean time to closure of 5.0 weeks.[12]

CONCLUSION

Managing chronic wounds is challenging due to the multiple factors contributing to impaired healing. In contrast to traditional silver-based therapies, which often fail to promote wound healing effectively, PuraPly™ demonstrates a unique combination of collagen's wound-maintaining properties and the potent antimicrobial effects of PHMB.

Chronic wounds have a detrimental impact on individual quality of life and healthcare expenditures. Thus, finding innovative treatment strategies is paramount. The success observed in this case study underscores the potential of PuraPly™ as a promising tool in managing wounds. The authors encourage further exploration of PuraPly™ and similar advanced wound care approaches to refine and expand the treatment options available for chronic wounds. Ultimately, this will improve patient outcomes and reduce the burden on the individual patient and healthcare system.

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