Novel Acellular Fish-skin Graft for Management of Chronic Venous Ulcers: A Case Study

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Statement of Purpose

Venous stasis ulcerations are a common vascular condition in our population today. With this, patients become susceptible to microbial invasion which can lead to serious complications, such as delayed healing, cellulitis, wound enlargement, debilitating pain, osteomyelitis and systemic illness[1]. Treatment can be very difficult, and only select wound care products have shown to be effective in treating non-healing wounds after other products have failed. This case study details application of a novel acellular fish-skin graft in a diabetic patient with a history of a chronic non-healing venous stasis ulceration.

Literature Review

Biomedically engineered tissue has shown great promise in restoring the wound bed in chronic non-healing wounds. Extracellular matrices (ECM) currently on the market are mainly mammalian in origin which presents the potential for autoimmune response, and requires extensive treatment to limit risk of prion transfer. There are also significant cultural issues and a major increase in ecological footprint to consider when it comes to bovine and porcine products. A novel acellular fish skin graft harvested from North-Atlantic cod addresses all of these issues, while utilizing the benefit of omega-3 fatty acids. The omega-3 fatty acids exhibit anti-inflammatory, antibacterial and antiviral characteristics that aid in the granulation and re-epithelialization of chronic non-healing wounds. Compared to other xenograft substitutes, the fish skin graft does not require antibiotics or aggressive treatment due to the lack of pathogens found common to North-Atlantic cod and humans [2,3]. This allows the ECM to preserve its structure and bioactive composition, increasing effectiveness.

Literature Review

In a study comparing the acellular fish skin graft against bovine skin graft, the fish skin showed significantly faster healing times and decreased the number of local infections [2,3,4]. This was attributed to the lipids and proteins found in the fish-skin matrix. Multiple authors have suggested omega-3 has antinociceptive properties. This explains the decrease in pain after application of the graft [2,3,4]. While the study was performed solely on acute full thickness wounds, it is believed that the graft may be applied to diabetic ulcers and chronic full thickness wounds as well. Yang et al, assessed the percentage of wound closure from baseline after 5 weeks of weekly fish-skin graft applications in 18 patients. The authors found that 40% of the patients' wounds closed within those 5 weeks[5]. While the results of this graft have been mostly positive, a larger study should be performed in the future to provide a better analysis of the product.

Case Study

68 year old male presented to the wound center with complaint of left lateral leg wound, proximal to the lateral malleolus (Figure 1). He stated the wound had been present for 1.5 years, and that he had previously treated the wound with medihoney and mupirocin. The patient stated there was pain around the wound with minimal drainage. He had past medical history of type 2 diabetes, hypertension and anemia with a past surgical history of bilateral ankle fusions after a fall 10 years ago. On physical examination, there was a proximal lateral left leg wound measuring 3.3cm length x 2.3cm width x 0.9cm depth with a 100% sloughy fibrotic base, no tunneling or undermining. There was some serosanguinous drainage and periwound edema.

Case Study

The patient was diagnosed with a chronic venous ulcer. Standard local wound care was started at the wound care center using various products and debridements for four months with minimal improvements. The decision was then made to apply an acellular fish skin graft onto the wound. Moving forward, the patient denied having any pain at the wound site. The graft incorporated well, and over the course of 4 months the wound decreased in size; currently measuring 0.9cm length x 0.5cm width x 0.1cm depth with a 100% granular base and minimal drainage (Figure 4).

Figure 1: initial presentation

Figure 2: 4 months local wound care

Figure 3: 1 week after graft

Figure 4: 6 months post graft

Analysis and Discussion

Venous stasis ulcers are the most common type of lower extremity ulceration. They are usually recurrent and persist for weeks, sometimes years. The recurrent nature increases morbidity and mortality risks in patients. Biomedically engineered tissue has shown great promise in restoring the wound bed in chronic non-healing wounds. The acellular fish graft used in this case study acted as an extracellular matrix structural protein that aided in the granulation and re-epithelialization of the chronic wound. The extracellular matrix is a key component to wound healing, and components of the ECM play a role in stimulating cell proliferation and differentiation. This aids in cell migration and mediates cellular response[7]. There are multiple ECM products that contain components essential for wound healing, but this graft has the added benefit of omega 3 fatty acids. After application of this graft the patient's wound began to heal. We believe that this graft, in combination with standard treatment of venous stasis ulcers, is an effective and superior method in the treatment of chronic venous stasis ulcerations.

References

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