Successful Limb Salvage Utilizing a Fragmented Fish Skin Graft Following Osteomyelitis of the Fibular After Open Fracture- A Case Report

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Introduction

Traumatic open fractures of the ankle often result in tissue loss and severe damage to the surrounding soft tissues, leading to complications in wound healing, closure, and increased risk of infection, including osteomyelitis. While there isn't a universally accepted standard technique for wound healing, the use of fish skin grafts has shown consistent advantages, including enhanced and expedited wound healing, reduced frequency of dressing changes, decreased pain, and decreased expenses.[1]

Management of lower extremity wounds includes a spectrum of treatment modalities. These range from offloading techniques, debridement, skin substitutes, surgical primary closure, skin grafting, local flaps, and free fasciocutaenous flaps. Each method can be useful, but they are often associated with complications including wound dehiscence, deep infection, graft failure, donor site morbidity, and flap loss causing subsequent amputation.[2,3]

A novel particulate variant of fish skin graft has recently become accessible. Intact fish skin grafts have gained considerable recognition in wound care due to their inherent dermal structure, porosity, and biomechanical properties, promoting rapid cell ingrowth and serving as a natural bacterial barrier enriched with Omega-3 fatty acids.[4] The handling properties of this new particulate form enable direct graft contact, even in traditionally challenging areas.

Methods

We illustrate a case report where a piscine acellar dermal matrix was utilized for reconstruction and salvage in a patient with lymphedema following open bimalleolar ankle fracture with subsequent lateral dehiscence and osteomyelitis. Despite multiple surgical interventions and antibiotic therapy, the wound remained non-healing, jeopardizing limb viability. To address the extensive soft tissue defect and promote wound healing, a fragmented fish skin xenograft was applied to the wound bed. The graft provided a biocompatible scaffold, aiding in wound closure and supporting tissue regeneration. Intramedullary nail TTC arthrodesis and external fixation was then performed.

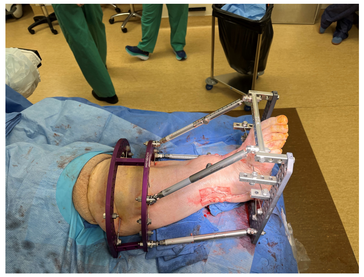
Initial Intervention and Application

A 67-year-old female with uncontrolled lymphedema presented to the office of the author with a chronic ulceration to the lateral ankle. She had underwent prior hardware removal from the fibula following infected nonunion of the fibula with another provider. She was taken to the OR for further hardware removal, partial fibula excision, and bone biopsies of the remaining fibula and tibia. Initial application of fish skin graft was applied to the ulceration site covering exposed tendon, muscle and bone.



Second Intervention and 2nd Graft Application

Bone biopsies returned without osteomyelitis. She was then taken for intramedullary nail TTC arthrodesis and external fixation. Further fish skin graft was applied at the 2nd intervention.




Results

Following the application of the fragmented fish skin graft, the wound demonstrated significant improvement, including granulation tissue formation and wound contraction. The graft integrated well with the surrounding tissues, promoting revascularization and accelerating wound healing. Complete arthrodesis with stability noted at the TTC site. Ultimately, limb salvage was achieved, with the patient experiencing restoration of function and no signs of recurrent infection during the follow-up period. Complete epithelization was present at 47 days.



Discussion

Fish skin grafts have been shown to reduce inflammatory responses and advance proinflammatory cytokines in wounds through the graft's natural source of omega-3 polyunsaturated fatty acids, EPA and DHA. The importance of this reduced inflammatory response is allowing the wound to transition from a chronic inflammatory state into an acute wound. This case report demonstrates the successful utilization of a fragmented fish skin graft as a valuable adjunct in limb salvage following osteomyelitis of the fibula after an open fracture. The unique properties of fish skin grafts, including their high collagen content, innate antimicrobial properties, and ability to modulate the wound microenvironment, contribute to improved wound healing and tissue regeneration. Fragmented fish skin grafts offer a promising alternative for managing complex soft tissue defects and promoting successful limb salvage. Further research and prospective studies are warranted to validate these findings and explore the broader applications of fish skin xenografts in limb salvage procedures.

References

1. Ibrahim M, Ayyoubi HS, Alkhairi LA, Tabbaa H, Elkins I, Narvel R. Fish Skin Grafts Versus Alternative Wound Dressings in Wound Care: A Systematic Review of the Literature. Cureus. 2023 Mar 19;15(3):e36348. doi: 10.7759/cureus.36348. PMID: 37082504; PMCID: PMC10111873.
2. Shakir S, Messa CA 4th, Broach RB, et al. Indications and Limitations of Bilayer Wound Matrix-Based Lower Extremity Reconstruction: A Multidisciplinary Case-Control Study of 191 Wounds. Plast Reconstr Surg. 2020;145(3):813–822. doi:10.1097/PRS.0000000000006609
3. Wagstaff, Marcus J.d., et al. "Biodegradable Temporising Matrix (BTM) for the Reconstruction of Defects Following Serial Debridement for Necrotising Fasciitis: A Case Series." Burns Open, vol. 3, no. 1, 2019, pp. 12–30., doi:10.1016/j.burnso.2018.10.002
4. Magnusson S, Winters C, Baldursson BT, Kjartansson H, Rolfsson O, Sigurjonsson GF. Acceleration of wound healing through utilization of fish skin containing omega-3 fatty acids. Today's Wound Clinic. 2016;10(5):26–29.

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