Utilization of Piscine Acellular Dermal Matrix for Coverage Over Tendon and Bone in Diabetics: A Case Series

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Introduction

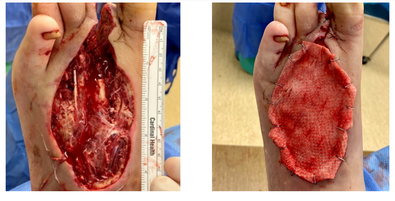
Diabetic foot ulcers (DFU) are complex clinical situations and have proven difficult to successfully manage. They are typically associated with high failure rates, amputations, increased morbidity, ultimately creating a considerable burden on health-care resources.

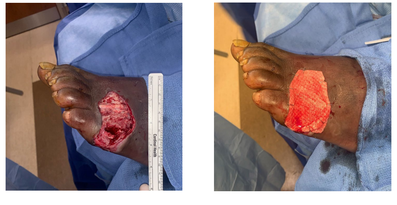
Management of lower extremity diabetic wounds include a spectrum of treatment modalities. While useful, they are often associated with complications.

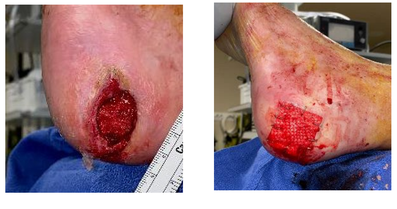
When treating chronic diabetic ulcerations, the wound care provider often turns to advanced allogenic or xenogenic skin graft substitutes for soft tissue coverage. The utilization of xenografts derived from piscine acellular dermal matrix (ADM) has emerged as a promising approach for coverage over tendon and bone defects. Piscine grafts have gained rapid recognition in wound care for their native dermal structural, porosity and biomechanical properties that favors rapid cell ingrowth and provides a natural bacterial barrier rich in Omega3 fatty acids. This case series aimed to evaluate the efficacy and clinical outcomes associated with the utilization of piscine ADM in a series of patients with tendon and bone defects.

Methods

A retrospective analysis was conducted on a series of 5 patients who underwent surgical grafting using piscine ADM for coverage over tendon and bone defects. Data regarding patient demographics, defect characteristics, surgical technique, postoperative outcomes, and complications were collected and analyzed. All patients were older than 18 years of age. Each patient had a history of DM2. Each patient had exposed osseous and tendinous structures at the site of graft application. All patients underwent extensive surgical debridement, deep and irregular defects were filled to the level of epidermal tissue with fish skin particulate graft, and then secured with a more traditional sheet form of fish skin graft. Deep cultures were obtained, and parenteral antibiotics were initiated, as necessary. Patients received standard of care treatment at routine follow-up until complete healing was obtained.







Results

All wounds had irregular wound surfaces with exposed bone and tendon. Following the first week of initial fish skin graft application complete granulation tissue and coverage of depth, tendon and bone was noted in all wounds without need for negative pressure. The piscine ADM was successfully integrated and provided adequate coverage in all cases, resulting in improved wound healing, reduced infection rates, and enhanced functional recovery. No cases of graft rejection or significant complications were reported during the follow-up period.




Discussion

Only about 30% of diabetic foot ulcers (DFU) are able to heal within 20 weeks. However, there is promising research indicating that fish skin grafts can play a significant role in improving wound healing outcomes. These grafts contain Omega-3 fatty acids, including EPA and DHA, which help reduce the inflammatory response, enabling the wound to transition from a chronic inflammatory state to an acute one. In a study conducted by Magnusson et al., fish skin grafts demonstrated superior support for the three-dimensional ingrowth of cells compared to dehydrated human amnion membrane. This suggests that fish skin grafts provide a favorable environment for cell growth and tissue repair. Furthermore, the particulate form of fish skin grafts has shown potential benefits, as it may facilitate more rapid incorporation into the wound site by optimizing the surface area to mass ratio while preserving the three-dimensionality, porosity, and natural complexity of intact fish skin. Our own research findings align with the results of a study by Lullove et al., showing that 67% of DFUs without exposed bone or tendon, treated with weekly fish skin graft sheets alongside standard care, achieved complete closure compared to only 32% in the group treated without fish skin grafts. These promising outcomes suggest that fish skin grafts hold significant promise as an adjunctive therapy for enhancing DFU healing.

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