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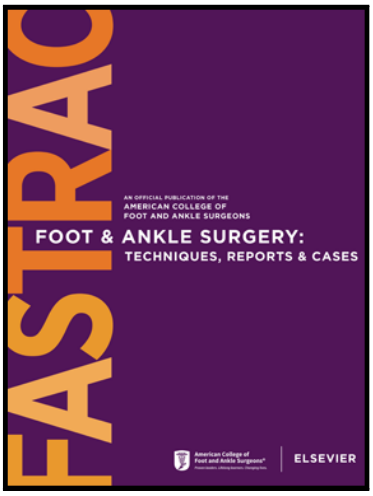

Traumatic Amputation: Healing the Acute Lawn Mower Injury- A Case Report

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Case Reports and Series

Traumatic Amputation: Healing the Acute Lawn Mower Injury- A Case Report

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Abstract

Background: An estimated 84,944 lawn mower injuries occur annually in the United States, of those 16.2% involving the lower extremity.[1] Often, a significant soft tissue deficit is present leaving limited reconstructive options available to the surgeon or wound care provider. Split-thickness skin graft (STSG) has long been considered the mainstay for treatment of large skin defects caused by traumatic wounds. Issues related to graft loss, scar contracture, loss of elasticity, adhesions to tendons and unfavorable aesthetic results are regarded as limitations of skin grafting alone.[2] As a result, acellular dermal matrices have seen an increase in usage due to their potential to overcome these limitations. [3]

Keywords: dermal, matrix, traumatic, amputation, wound care, xenograft

In this case report, we used an acellular fish skin dermal matrix due to its native dermal structure, porosity and biomechanical properties. It also provides a natural bacterial barrier rich in Omega-3 fatty acids.[4] Compared to xenografts derived from other species, fish skin matrices have been show to have lower risks of disease transmission and autoimmune responses, and are additional reasons as to why we chose to utilize this graft in this setting.[4]

Case Report

A 19-year-old male with no significant PMH sustained a traumatic partial amputation of the left 2nd digit due to a lawn mower injury. He was transferred to a level 1 trauma center for further evaluation by the foot and ankle surgical service. The injury site was flushed with copious amounts of sterile saline in the ED and a temporary dressing was applied. Radiographs confirmed partial amputation of the 2nd digit with remnant 2nd digit proximal phalanx left comminuted. No other osseous injuries were identified.

The following morning, he was taken to the OR for debridement of non-viable soft tissue and amputation of the remaining 2nd digit proximal phalanx. There was inadequate soft tissue to close the amputation site, and there was exposure of the first metatarsophalangeal joint due to the loss of the dorsal joint capsule. Particulate form of a fish skin acellar dermal matrix (Kerecis Micrograft) was packed into the amputation site and covered the dorsal first metatarsophalangeal joint. The remainder of the de-gloved dorsal foot was covered with a sheet form of the fish skin acellar dermal matrix (Kerecis SurgiClose).

The acelluar dermal matrix had 100% incorporation within the first week, covering all tendinous and osseous structures with granulation tissue. No signs of infection were represent, and the wound bed was appropriate for split thickness skin grafting. 15 days following the initial acellar dermal matrix application the patient went to the OR for repeat debridement and application of STSG. Complete "take" of the graft was noted with 100% healing at 2 weeks s/p STSG. 8 weeks s/p STSG the patient remained healed with minimal scaring/contracture and no pain.

Discussion

Lawn mower injuries provide unique challenges due to the potential extent of soft tissue loss and the severely contaminated nature of the wounds. Exposed osseous and relatively avascular tendinous structures add to the complexity of the injury. Appropriate surgical debridement of non-viable tissue along with local wound care is often necessary. Following appropriate debridement, the remaining soft tissue deficit may very well be much larger than what was previously seen. Such injuries may not be amenable to primary closure, therefore, healing through secondary intention is often needed.

Split thickness skin grafting has been used for thousands of years for reconstruction of deficits not amenable to primary closure.[4] When applied to clean, vascularized beds, STSG's have shown favorable results across a spectrum of wounds including diabetic and chronic venous stasis ulcerations, as well as those which are trauma induced.[4–6] Unfortunately, obtaining a healthy and clean wound bed can be difficult, especially in the case of traumatic injuries. While STSG's provide great coverage with ultimate healing of various wounds, they should not be placed over inadequately perfused or prepared wound sites.[7] As such, the evolution of various allo-, xeno-, and synthetic grafting materials has allowed physicians to better manage these difficult wounds by supporting the growth of healthy granular tissue. These grafts have both shared and unique advantages and disadvantages that when compared amongst each other.

Allografts, being derived from human skin, carry the notable advantage of representing natural skin. While the grafts themselves have been shown to promote epithelialization of wound beds, the availability of donors limits the amount of graft available.[8] Additionally, allogenic grafts carry the risks of disease transmission, increased inflammatory responses, and potential graft rejection.[9] Synthetic grafts, in contrast, are widely available and have seen an increase in usage. Typically made from natural polymers, artificial grafts also have been shown to cause less of an inflammatory reaction and decreased chance of rejection, both of which are seen with more frequency in allogeneic grafts.[9] However, these skin substitutes are usually void of basement membranes and generally lack any semblance of natural skin.[10]

Xenografts are those taken from one animal species and transferred to another. Historically, porcine grafts were the most common used due to their similar physical properties to that of human skin. These grafts, while abundant, have numerous flaws which include higher risks of viral and bacterial disease transmission, longer healing times, and increased risk of hypertrophic scar formation.[4] Due to its derivation from porcine species, cultural and religious aspects must also be taken into account prior to its application.[4] More recently, skin substitutes sourced from fish have seen an increase in usage due to their advantages over traditional grafting materials, including porcine grafts. To date, piscine acellular dermal matrices have been used successfully across a wide spectrum of pathologies, from burns and traumatic wounds to chronic ulcerations frequently seen in diabetes and venous stasis.[11,12] Baldursson et al. demonstrated in their study that these grafts demonstrated significantly faster healing times compared to their porcine derived counterparts.[13] On a cellular level, the grafts have been shown to be free of risk in terms of adverse autogenic responses as well as viral and bacterial transmission.[4,13] Their proven efficacy in wound healing combined with an abundant supply indicate that their use can be sustainable, efficient, and cost effective.[11]

In this case report, we presented a patient who suffered a traumatic amputation of a lesser digit with significant soft tissue injury. Surgical debridement with amputation of the remnant second toe was performed with an adjunctive application of a fish skin graft. This allowed for rapid granulation of the wound bed allowing for split-thickness skin grafting two weeks after the initial injury. The patient ultimately underwent a full recovery with no limitations.

Based on the outcome of this case report, the utilization of a piscine skin acellular dermal matrix appears to be a viable option to optimize traumatic wounds for STSG. It is our hope this can provide future clinical and surgical guidance to practitioners with similar traumatic wounds in the future.

Financial Disclosure

None reported

Informed Patient Consent

Complete informed consent was obtained from the patient for the publication of this study and accompanying images.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Figure 1: Initial presentation to the emergency department

Figure 2: Status-post amputation with dermal matric application

Figure 3: 3 days status-post dermal matrix application

Figure 4: 7 days status-post dermal matrix application

Figure 5: 2 weeks after STSG

Figure 6: 8 weeks after STSG