The Healing Power of Nature

Limb Salvage Utilizing Omega-3 Fish Skin Graft: A Case Report

Britain Wetzel, DPM[1]; James LaPolla Jr., DPM[2]

[1]East Liverpool City Hospital Foot and Ankle Surgery PGY-3 Resident, [2]NEO Foot, Ankle, and Wound Center Attending Physician

INTRODUCTION

It is estimated that diabetic ulcerations and infections cost the U.S. $9-13 million annually.[1] These ulcerations are insidious in nature, extending themselves to morbidity and mortality.[2] Four out of ten patients with diabetic ulcerations will undergo an amputation; within five years, seven out of ten will die.[2] As such, limb salvage is critical to reducing mortality and the financial burden of an amputation. Thus, advanced therapies that augment limb salvage are needed. In this case study, the authors show that Fish Skin Graft (FSG), an acellular dermal matrix featuring omega-3 fatty acids, three-dimensional structure, and intact biological and mechanical properties like the host tissue, can promote angiogenesis, leading to faster healing and limb salvage.

METHODS

A 57-year-old male presented to our service for treatment of a right foot diabetic wound infection. The patient had been following with an outside wound care center for a plantar foot blister from shoe gear irritation that deroofed to reveal an ulcer. However, due to the COVID-19 pandemic, his treatment was interrupted as he was unable able to attend his routine appointments. Unfortunately, lack of treatment allowed the infection to migrate to the flexor tendon sheath, which later developed into a gas infection. The patient presented with a fever, became septic, and was transferred to the emergency room, where he was admitted.

Due to the severity, the admitting physician recommended a belowknee amputation (BKA); however, the patient requested limb salvage. The patient was informed that a BKA was a faster alternative, but that limb salvage was an option due to vascular status. Patient underwent an aggressive excisional debridement for source control of his lower extremity infection. The surgical wound extended to the level of bone/tendon.

A second surgery was needed four days postop to remove additional infected tissue. At four weeks, signs of infection had diminished, including erythema and swelling. A metabolic panel confirmed that the infection had resolved, and negative therapy treatment was initiated. Prior to his FSG application postdebridement, he had the following wound care treatment modalities: incision and drainage, surgical and office excisional debridements, wound vac therapy, Versajet debridement, Prisma application, Peg-assist offloading, and antibiotics.

FSG was selected due to its bacteriostatic properties and known cellular ingrowth. The patient underwent several applications of the FSG and was able to reach full epithelization via secondary intent. The FSG rapidly regenerated the tissue and preserved the limb. Further, the patient had preserved function and could return to his place of employment.

Four months after his initial wound onset, patient had his first Kerecis xenograft application in July 2020. He continued routine wound care and had a subsequent Kerecis graft applications in September and October 2020. With each graft application, the wound was debrided to the level of healthy, viable tissue and graft was secured with suture or steri-strips. Bolster dressing was applied to prevent any disturbance to the graft due to shear force.

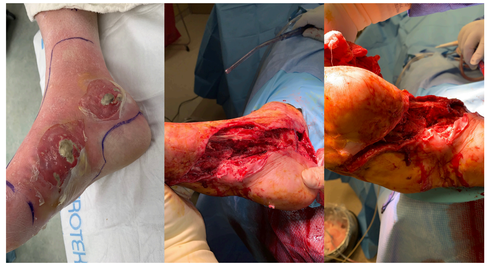

Figure 1. Right lower extremity pre- and post-surgical debridement to layer of bone/tendon.

Figure 2. Appearance of wound pre- and post-op of first Kerecis application

Figure 3. Appearance of wound pre- and post-op of second Kerecis application

Figure 4. Continued progression of re-epithelialization after third Kerecis application (top left and right) to healed status (bottom)

RESULTS

In November 2020, the right foot wound had re-epithelialized and there were no signs of infection. Patient was classified as healed and discharged from wound care to continue follow-up as routine diabetic foot care. At the time of discharge, patient used bandages to prevent shoe gear irritation. He was able to return to normal shoe wear, and his first time wearing normal shoes was to renew his wedding vows. To date, there has been no wound recurrence. Patient continues to follow with the practice for routine diabetic foot care.

DISCUSSION

In this single case, FSG significantly improved the patient's quality of life. FSG is minimally processed, preserving the native structure, biological components, and Omega-3 fatty acids. The FSG augments cell ingrowth and angiogenesis, moving wounds through the wound healing cascade faster than competitive products.[3,4] These properties, combined with the bacteriostatic properties and proven superior cosmetic outcomes, make FSG an excellent choice during limb salvage treatment[5,6]. Future, more significant prospective studies should evaluate the effectiveness of FSG in complicated limb salvage patients.

References:

1. Raghav A, Khan ZA, Labala RK, Ahmad J, Noor S, Mishra BK. Financial burden of diabetic foot ulcers to world: a progressive topic to discuss always.
Ther Adv Endocrinol Metab. 2018 Jan;9(1):29-31. doi: 10.1177/2042018817744513. Epub 2017 Dec 12. PMID: 29344337; PMCID: PMC5761954.
2. Winters C, Kirsner RS, Margolis DJ, Lantis JC. Cost Effectiveness of Fish Skin Grafts Versus Standard of Care on Wound Healing of Chronic Diabetic Foot Ulcers: A Retrospective Comparative Cohort Study. Wounds. 2020 Oct;32(10):283-290. PMID: 33370245.
3. Magnusson S, Baldursson BT, Kjartansson H, Rolfsson O, Sigurjonsson GF. Regenerative and Antibacterial Properties of Acellular Fish Skin Grafts and
Human Amnion/Chorion Membrane: Implications for Tissue Preservation in Combat Casualty Care. Mil Med. 2017 Mar;182(S1):383-388. doi: 10.7205/MILMED-D-16-00142. PMID: 28291503.
4. Stone R 2nd, Saathoff EC, Larson DA, Wall JT, Wienandt NA, Magnusson S, Kjartansson H, Natesan S, Christy RJ. Accelerated Wound Closure of Deep
Partial Thickness Burns with Acellular Fish Skin Graft. Int J Mol Sci. 2021 Feb 4;22(4):1590. doi: 10.3390/ijms22041590. PMID: 33557424; PMCID:
PMC7915828.
5. Baldursson BT, Kjartansson H, Konrádsdóttir F, Gudnason P, Sigurjonsson GF, Lund SH. Healing rate and autoimmune safety of full-thickness wounds
treated with fish skin acellular dermal matrix versus porcine small-intestine submucosa: a noninferiority study. Int J Low Extrem Wounds. 2015
Mar;14(1):37-43. doi: 10.1177/1534734615573661. Epub 2015 Mar 9. PMID: 25759413.
6. Wallner, C.; Holtermann, J.; Drysch, M.; Schmidt, S.; Reinkemeier, F.; Wagner, J.M.; Dadras, M.; Sogorski, A.; Houschyar, K.S.; Becerikli, M.; Lehnhardt, M.;
Behr, B. The Use of Intact Fish Skin as a Novel Treatment Method for Deep Dermal

NORTHEAST OHIO FOOT, ANKLE & WOUND CENTER, INC.