Use of Acellular Fish-Skin Particulate for the Management of Complex Diabetic Foot Ulcerations: A Case Series

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Introduction:

Diabetic foot ulcers (DFUs) remain one of the most devastating complications of diabetes mellitus and are associated with significant morbidity, hospitalization, and increased mortality[1]. Globally, more than 536.6 million individuals are currently living with diabetes, with projections estimating an increase to 783.2 million by 2045[2]. Approximately 25% of patients with diabetes will develop a diabetic foot ulcer during their lifetime[2].

DFUs are implicated in up to 84% of diabetes-related lower extremity amputations[3–4]. Management of University of Texas (UT) Grade 2–3 wounds can be particularly challenging due to depth, tunneling, and exposure of tendon or bone. These wounds are associated with high rates of complications including infection, graft failure, dehiscence, and limb loss[5].

Recent studies have demonstrated improved healing outcomes with the use of acellular fish-skin grafts compared with standard wound care, with one systematic review reporting a mean healing rate of 68.8% versus 42.5% with standard care[8].

Purpose:

To evaluate the use of fragmented acellular fish-skin graft in the treatment of complex UT Grade 2–3 diabetic foot ulcerations.

Methods:

A retrospective case series was performed including 20 patients with 20 wounds with UT Grade 2–3 diabetic foot ulcerations treated at the University of Texas Health Science Center at San Antonio between January 2024 and February 2026. All patients had type 2 diabetes, neuropathy, and full-thickness UT Grade 2–3 ulcerations.

At the time of graft application:

•All wounds underwent aggressive surgical debridement of nonviable soft tissue and bone to achieve a healthy bleeding wound bed.

•Fragmented acellular fish-skin graft was used to fill deep wound defects.

•Sheet graft coverage was applied in 50% of wounds to provide additional surface coverage.

•Deep tissue cultures were obtained in the operating room and culture-directed antibiotics were administered when indicated.

Patients were followed longitudinally until, Complete epithelialization, Delayed primary closure, or Split-thickness skin graft (STSG). Wound closure was defined as complete epithelialization or surgical closure with split-thickness skin graft.

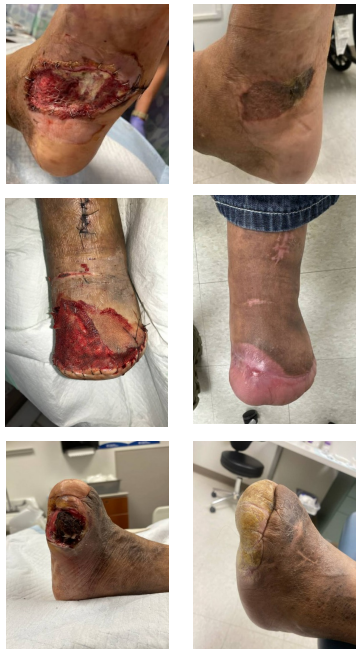
During follow-up visits, wounds were assessed, debrided if necessary, measured, and photographically documented. Offloading and compression therapy were utilized throughout the postoperative course as clinically indicated.

Results:

Twenty patients with complex diabetic foot ulcerations were included.

Patient characteristics included:

- Mean age: 57.8 years
- Mean HbA1c: 9.23%
- Chronic kidney disease: 75%
- Peripheral arterial disease: 45%
- Charcot neuroarthropathy: 30%
- Prior minor amputation: 60%
- Prior major amputation: 35%



Outcomes Measured	Results
UT Grade 2 wounds	4/20 (20%)
UT Grade 3 wounds	16/20 (80%)
Mean initial wound area	41.19cm^2 (range 1.5-143cm^2)
STSG Applied	55% (11/20)
Major Amputations	3 BKA
Minor Minor Amputations	1 TMA
% closed at 16 weeks	30% (6/20)
% closed at 20 weeks	40% (8/20)
% closed at 24 weeks	45% (9/20)
Mean time to 50% Healed (days)	60.333 (9 - 193)
Mean time to Epithelialization /STSG (days)	96.54 (6 - 242)

Discussion:

The healing timeline observed in our cohort is consistent with outcomes reported in the Odinn trial for complex University of Texas (UT) grade 2–3 diabetic foot ulcers[7]. In Odinn, approximately 44% of wounds achieved closure by 16 weeks with advanced graft therapy compared with 26% using standard of care[7]. In our series, 30% of wounds closed by 16 weeks, increasing to 40% by 20 weeks and 45% by 24 weeks.

The wounds treated were severe, with 80% classified as UT Grade 3 and a mean initial wound area of 41.19 cm^2, representing a challenging cohort. More than half of patients (55%) required split-thickness skin grafting as part of staged reconstruction.

Despite this complexity, the mean time to epithelialization/STSG was 96.5 days (~13.8 weeks), which falls within the expected healing window for advanced diabetic foot ulcers. These findings suggest piscine graft therapy can achieve healing trajectories comparable to those reported in large trials despite treating more severe wounds.

Conclusion:

In this cohort of complex UT grade 2–3 diabetic foot ulcers, healing outcomes were comparable to those reported in the Odinn trial. These findings suggest that the treatment approach used in this cohort can achieve healing trajectories similar to those reported in multicenter trials despite the high-risk nature of this patient population.

References:

1.Lavery LA, Oz OK, Bhavan K, David K. Wukich. Diabetic foot syndrome in the twenty-first century. Clin Podiatr Med Surg. 2019;36(3):355-359. doi:10.1016/j.cpm.2019.02.002

2.Lavery LA, Suludere MA, Attinger CE, et al. WHS (Wound Healing Society) guidelines update: Diabetic foot ulcer treatment guidelines. Wound Repair Regen. 2024;32(1):34-46. doi:10.1111/wrr.13133

3.Lavery LA, Armstrong DG, Wunderlich RP, Tredwell J, Boulton AJM. Diabetic foot syndrome: Evaluating the prevalence and incidence of foot pathology in Mexican Americans and non-Hispanic whites from a diabetes disease management cohort. Diabetes Care. 2003;26(5):1435-1438.

4.Chung J, Modrall JG, Ahn C, Lavery LA, Valentine RJ. Multidisciplinary care improves amputation-free survival in patients with chronic critical limb ischemia. J Vasc Surg. 2015;61(1):162-169. doi:10.1016/j.jvs.2014.05.101

5.Shakir S, Messa CA IV, 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

6.Dardari D, Piaggesi A, Potier L, et al. Intact fish skin graft to treat deep diabetic foot ulcers. NEJM Evidence. 2024;3(12):EVIDoa2400171. doi:10.1056/EVIDoa2400171

7.Ruiz-Muñoz M, Martinez-Barrios FJ, Cervera-Garvi P, et al. Fish skin grafts versus standard of care on wound healing of chronic diabetic foot ulcers: A systematic review and meta-analysis. Prim Care Diabetes. 2024;18(3):291-298. doi:10.1016/j.pcd.2024.03.008

Acknowledgements:

Dr. Ian Barron is a paid consultant for Kerecis, LLC