Bioabsorbable borate-based glass fiber matrix for diabetic foot ulcer: A post-surgical intervention

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Introduction

Chronic diabetic foot ulcers are a common and debilitating complication of diabetes mellitus, often resulting in amputations if not effectively managed. Conventional wound therapies, such as dressings, debridement, antibiotics, frequently fail to promote healing in complex wounds, necessitating the use of advanced wound care products.[1] Skin substitutes, which are designed to support the healing process, are increasingly employed in managing challenging ulcers.

Bioactive Glass Wound Matrix (BGWM) is a novel skin substitute that has emerged as a promising therapeutic option. Bioabsorbable borate-based glass fiber matrices are specifically engineered to be biocompatible and support the body's natural wound healing process. Safe, effective, and efficient for treating minor to complex wounds, they are intended for the management of both acute and chronic wounds, including partial- and full-thickness wounds, pressure ulcers, venous ulcers, diabetic ulcers, chronic vascular ulcers, tunneled/undermined wounds, surgical wounds (such as donor sites/grafts and post-Mohs surgery), post-laser surgery wounds, podiatric wounds, wound dehiscence, trauma wounds (abrasions, lacerations, first- and second-degree burns, and skin tears), and draining wounds.

This case study explores the application of BGWM in the management of a non-healing diabetic foot wound following surgical intervention.

Background

A 47-year-old male with a past medical history of diabetes presented to the Emergency Department at SSM Health DePaul Hospital. The patient reported that two months ago, he stepped on a vacuum cord and developed an ulceration on the plantar aspect of his right foot. He has peripheral neuropathy, so he did not notice the wound or experience any pain. He presented to the ER when he developed chills, and the wound became malodorous with increased drainage and swelling in the right foot.

Physical examination of the plantar aspect of the right forefoot revealed a full-thickness ulceration measuring 3.5 cm x 4 cm x 4.5 cm, which tunneled from the plantar to the proximal area, with crepitus and gas gangrene.

Figures 1 and 2: Patient’s right lower extremity on ER consultation

Procedure

The patient was taken to the OR for an emergent washout to achieve primary control of the osteomyelitis infection and gas gangrene. Post-operative X-rays showed persistent signs of crepitus and gas on film, and MRI confirmed osteomyelitis involving the 4th and 5th rays. As a result, the patient was taken back to the OR for debridement of all non-viable bone and soft tissue, during which 4th and 5th ray resections were performed. Following the procedure, negative pressure wound therapy (NPWT) was initiated to optimize the physiological conditions necessary for wound healing by applying sub-atmospheric pressure, which helps reduce inflammatory exudate and promotes granulation tissue formation.[2]

Figure 3: Post-operative Incision and Drainage with 4th and 5th ray resections

In the photograph below the patient has been on NWPT for about 7-8 weeks, with changes performed three times a week by our in-house Podiatry service and wound care team. Once the patient was cleared for discharge, our Podiatry clinic (Midwest Podiatry & Associates) began conducting NWPT changes in our office to support the initial wound healing process.

Figure 4: Started with NWPT application to help aid with wound healing

Results

Skin substitutes were discussed with the patient to aid in wound healing. We informed him about the Advanced Wound Matrix glass graft application, and the patient agreed to proceed with the graft application. During each office visit, wound debridement was performed, and five applications of the graft were applied to the wound.

Figures 5-10: Application of Bioabsorbable borate-based glass fiber matrix

Radiological Imaging

Figures 11 and 12: Pre-op (left) and post-op (right) imaging before and after 4th and 5th ray resection

Discussion & Conclusion

In this case we demonstrated the successful use of BGWM for a diabetic foot ulcer.

In a 2021 study by Armstrong et al. they similarly demonstrated efficacy of this matrix. The study was a parallel, two-group, single-blind randomized controlled trial study where a total of 40 patients received either the current standard-of-care treatment (collagen alginate dressing) plus BGWM or standard-of-care treatment alone.[4] Each treatment group consisted of 20 patients with Type 1 or 2 diabetes with a non-infected wound larger than 1 cm^2 that had been present at least one month. If multiple diabetic foot ulcers were eligible for treatment, "the largest wound was selected, provided it met area requirements (the index wound)," the researchers noted.[4] After 12 weeks, the researchers assessed the wounds and found that 70% of the BGWM-treated wounds healed, compared to 25% of those treated with standard-of-care alone.[4] Additionally, the mean percent area reduction for BGWM-treated wounds was 79%, compared to 37% in the standard-of-care group.[4]

BGWM shows promise in the healing of complex diabetic lower extremity wounds. Multiple specialties including podiatry and wound care team members showed be aware of this novel tool and its use for chronic non-healing and surgical wounds in the future.

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