Diabetic foot ulcerations (DFUs) are a global health epidemic that affect a patient’s quality of life and functional abilities. Associated complications are the leading cause of infection, amputation and hospitalization. 1,2,5 This case study demonstrates the importance of remaining mindful and vigilant in addressing chronic non-healing wounds caused by DFUs, while also systematically identifying the underlying cause and treatment options.

Impaired wound healing in the diabetic population is attributed to various complications, such as peripheral vascular disease affecting the microcirculation, inability to fight infection, and the hyperglycemic effects on fibroblasts and collagen. Hyperglycemia can also affect nervous tissue, resulting in peripheral neuropathy and tendons, which can then result in contracture deformities since equinus. This may further contribute to the formation of DFUs and the chronicity and recurrence of such wounds. 2,3,4,5,6

The use of split thickness skin grafts (STSG) dates back to 2500 B.C., when the Hindu would use the technique to cover nasal defects as a result of punishment. The technique was initially described in 1872 by Ollier and Thiéry. Today, this technique is used for covering defects that are too large to be closed primarily after lesion removal, burn treatment, and to assist in initiating the healing process of chronic non-healing wounds. 6,7 From a biomechanical perspective, limited ankle joint dorsiflexion or equinus is directly associated with increased plantar pressures during ambulation, and may contribute to the development of DFUs. Achilles tendon lengthening is known to reduce equinus and decrease plantar pressure during ambulation, making this type of procedure a treatment option for DFUs when indicated. 8

The leg states that trauma, neuropathy and deformity are believed to be the most common contributing factors to DFU development. It is, therefore, imperative that preventative measures are taken and wound closure is achieved in an efficient manner to decrease treatment costs, amputation rate, morbidity and mortality. 5,6 In an effort to mitigate the effects of these factors on the wound healing process, it is believed that off-loading the wound during the treatment process is critical to successful healing. There are numerous methods that promote wound healing. Among the most well-known methods is autografting, which is associated with complete offloading via non-removable casting techniques. 9,10

Case Study

This case study involves a 43-year-old male with history of controlled type II diabetes mellitus and hypertension, with a chronic non-healing right foot wound of forty-eight months following a transmetatarsal amputation and multiple attempts at conservative care. On initial presentation, the right foot stump wound was full thickness with central necrotic tissue and positive probe to bone. Examination also revealed a pronounced ankle joint plantarflexion contracture, which was contributing to the chronicity of the wound. The patient underwent multiple surgical debridements of the wound and resection of the necrotic bone with concomitant intravenous antibiotic therapy. A secondary surgical procedure included a STSG application to the right foot wound, with correction of the ankle joint contracture and external fixation.

Our patient initially presented following failure to thrive with conservative care for a non-healing wound at his surgical site following transmetatarsal amputation. Figure 1: Initial presentation of the wound on the right foot stump with central necrotic tissue and positive probe to bone. Figure 2: Completed closure of the wound at 9 months post-operatively from the initial procedure and 4 months post-operatively from the revision procedure. Due to the numerous failed attempts and the presentation with necrotic tissue, it was deemed necessary to provide more aggressive treatment in order to salvage the limb. The decision for autograft treatment was made in an effort to promote the best chance of healing based on the history of the wound, the size of the wound, the patient’s vascular supply, and controlled comorbidities. Correction of the ankle joint plantarflexion contracture was critical to surgically assist in offloading the STSG site as well as minimizing the risk of a recurrence. External fixation not only maintained reduction of the equinus, but also allowed for early feeding of the wound. The tendoachillodes lengthening was critical and the graft successfully took allowing for the wound to progressively close over the course of five months. Five months post-operatively the patient was instructed to wear an offloading boot during ambulation. The patient was non- compliant and ambulated without the boot, leading to re-erection of the wound site. This wound became infected, resulting in the need for a revision procedure for surgical debridement and resection of infected bone. Following this revision, a synthetic allograft was applied to the wound and the patient placed in non-weight bearing status once again. The wound successfully healed six months post-operatively from the revision procedure.

Analysis and Discussion

It is estimated that more than 29 million Americans are affected by diabetes, 25% of these patients will develop DFUs during their lifetime, and that 80% of lower extremity amputations are caused by DFUs. 1,2,3,4,5,6,7 With the numerous pedal complications associated with this disease process, diabetic care has become a common aspect of podiatric clinical practice. However, just as there are complications associated with wound care processes, there are numerous complications associated with wound healing in the diabetic patient that can result in a chronic non-healing or recurring wound.

When treating a DFU, ensuring that the wound is adequately perfused, free of infection, and that the patient is receiving optimal healing potential. 8 The initial treatment of DFUs today is conservative care, which includes surgical debridement, treatment of underlying infection, topical applications and treatment of underlying associated conditions. However, when complications result in chronic non-healing wounds, it is imperative to find alternative treatments that initiate or accelerate healing in order to more efficiently treat and prevent further complications. STSG studies have demonstrated the ability to promote wound healing and closure in chronic DFUs when patients meet the grafting criteria. 2,3,4,5,6,7,8 Additionally, in an effort to reduce the potential for recurrence of the wound, it is important to ensure that all factors contributing to the wound have been addressed. It is well understood in the literature that the hyperglycemic state associated with diabetes mellitus can lead to the contracture of tendons, which can result in the increase in plantar pressures when affecting the Achilles tendon. Tendoachillodes lengthening has been well documented in the literature to reduce plantar pressures and reduce the risk of diabetic ulcer recurrence when equinus is a contributing factor. 9,10 However, to provide optimal wound healing potential, it is crucial to off-load the wound in order to reduce the potential trauma to the area or the biomechanical breakdown of the delicate diabetic integument. 9,5,6,10

This case demonstrates the importance of remaining attentive and mindful when treating chronic non-healing wounds. Due to the high rate of chronic non-healing wounds, complications ultimately leading to more proximal amputations, it is crucial to make every effort to successfully treat such wounds efficiently. Multiple failed attempts to heal a wound with conservative measures should create suspicion that other factors may have been contributing to the failure and that the approach of treatment may need to be altered in order to promote optimal results.

Figure 3: Initial application of the STSG in the operating room with additional bar cover on the external fixator for protection. Figure 4: Wound healing progression # weeks post-operatively. Figure 5: Wound healing progression # weeks post-operatively.

References
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