A Creative Approach to Wound Management: Closure in a Patient with Multiple Co-Morbidities

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Introduction:

Podiatrists are in a unique position to be able to deliver the highest quality care to people suffering from foot wounds. This is due to the fact that podiatrists are experts in anatomy and biomechanics of the foot with background in both medicine and surgery. It is my belief that developing innovative approaches to healing chronic foot wounds is a field where podiatry can truly shine. The following is a photographic case presentation of a unique approach to wound healing in a diabetic. Utilizing a combination of advanced interventions, in conjunction with basic local wound care principles, this patient's seemingly hopeless wound bed was transformed into a healing wound. The end result was salvage of a limb and improved quality of life.

Materials and Methods:

Several advanced technologies were used in conjunction while providing basic principles of wound care. Repeated sharp debridement, autologous platelet rich plasma grafting, a bone graft substitute[1] with vancomycin, blood platelet aggregation inhibitor[2], silver-coated antimicrobial barrier[3] and bioengineered dermal substitute[4] were used during various stages, and in combination during the course of this patient's wound care. The site of service is a solo practitioner's podiatry office/ambulatory surgical center. Coordination of services is achieved with referral and communication between myself, the vascular surgeon and the primary care physician. The patient returned twice a week, once for dressing procedures, and once for tissue grafting. Re-evaluation and fine tuning of the patient plan of care was continuous during the process.

Case Presentation:

An obese, insulin dependent diabetic white male with a history of hypertension, coronary artery disease, peripheral vascular disease (PVD), arthritis, vision impairment, mild renal insufficiency, depression, gout and rheumatic fever presented with a mild ulceration on the plantar medial aspect of his left hallux at the IPJ in November, 2002. The patient, a very pleasant gentleman, is self employed as a general contractor, successfully running his local business for the last 35 years. Conservative care was unable to heal the wound. An amputation was performed at the 1st MPJ on 12/10/02. Pathology revealed chronic osteomylitis. The sight slowly healed without complications. The patient was started on a palliative foot care schedule, and displayed a mild increase in compliance with his diet and general health. His PVD progressed and he was seen for vascular consult. Additionally, he was seen by his PCP for continued medical management. In late December, 2003 the patient injured his left second toe. It rapidly turned gangrenous and he was scheduled for amputation of the left second toe at the MPJ. Postoperatively, he became very sick stating he had the flu. He was seen at home for his first postoperative visit. Removal of the bandage revealed thrombotic showering to the digits and forefoot resulting in extensive tissue necrosis. This thrombotic event was later confirmed by pathology. He was admitted with gangrene and renal insufficiency with a potassium of 7.4. The vascular surgeon was consulted and the PCP was in charge of controlling his renal insufficiency and resultant potassium spike. It was decided that the vascular surgeon would do an emergency transmetatarsal amputation that evening. He was discharged by the vascular surgeon with a poor prognosis and the recommendation of two weeks of hyperbaric oxygen (HBO) therapy followed by a below-knee amputation if the wound did not heal.

The patient returned to my office asking if there were other options available to salvage his limb. Clinical examination displayed a large stump wound which was malodorous, erythematous and edematous with increased temperature to touch. The sutures attempting to hold the forefoot closed were tightly stretched secondary to the edema resulting in local strangulation of already compromised tissues. Fluoroscopic examination performed in the office, revealed jagged edges of the mid-foot and multiple loose bone chips in the deep tissues of the wound. Culture and sensitivity revealed heavy growth of *Stenotrophomonas Maltophilia* and *Candida Parapsilosis*.

The patient was informed of his treatment options. First, I explained that his wound would take longer than two weeks to heal. I explained that a multi-faceted approach to his condition was needed, and although HBO is successful for many wounds, his case was in need of a more aggressive approach. Each of the issues preventing his wound to heal needed to be addressed. Vascular felt that he was not a candidate for bypass secondary to his cardiac status and previous harvesting of veins for CABG, but his ischemia needed to be addressed. Blood platelet aggregation inhibitor[2], 100 mg, BID on an empty stomach was started to increase distal perfusion. This is an off label use of the medication indicated for the treatment of intermittent claudication, and the patient was informed of this prior to starting the medication. Nosocomial infection and osteomylitis needed to be controlled. This was addressed with vancomycin-impregnated bone graft substitute[1] beads placed in the wound and an antibiotic[6] 500 mg QD for bacteria in the soft tissues. An antifungal agent[7] 100mg BID was used to eradicate yeast isolated in the culture. Necrotic tissues needed to be removed from the wound bed. This involved removal of bone chips, remodeling of bone surfaces, with aggressive excision of all necrotic soft tissues including muscle, tendon, subcutaneous tissue and skin. Local bioburden was addressed topically with a silver-coated antimicrobial barrier[3]. A moist wound environment was achieved with the use of a hydrogel[5]. Once the basic wound care principles were addressed, advanced healing techniques could be utilized for rapid closure of a limb with poor prognosis. Cellular components and growth factors were delivered to the wound with weekly applications of bioengineered dermal substitute[4] and autologous platelet-rich plasma grafting. A bioengineered dermal substitute[4] was used as a base layer. The remaining defect was filled with an autologous platelet rich plasma graft. This combination delivers two separate cellular components to the wound bed, prepared for healing, with all of the growth factors associated with fibroblasts and platelets. The production of healthy granulation tissue and rapid healing of his wound was appreciated on a weekly basis.

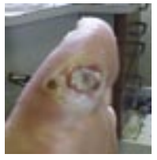
Discussion:

It is my belief that being trained in the field of podiatry has provided us with an amazing opportunity to address chronic foot wounds. Advances in wound care products allow for a small practice to deliver state of the art techniques to the patient without the need for hospitalization. In my experience, the bioengineered dermal substitute[4] is an amazing stand-alone product for healing diabetic foot wounds. When combined with concentrated autologous platelets, the fibroblasts in the bioengineered dermal substitute[4] appear to amplify their healing response. I hypothesize that this is because of the growth factors supplied by the platelets acting on the fibroblasts. Patient selection is important, as is the practicing of the fundamentals of proper wound care. This includes diminishing bioburden, elimination of necrotic tissues and ensuring proper blood flow. Nutritional status is another important facet of wound care that can also be addressed by the podiatrist in the form of recommendations for vitamin supplementation and healthy diet with adequate hydration. Glucose control and revascularization requires referral to the PCP/endocrinologist and vascular surgeon respectively.

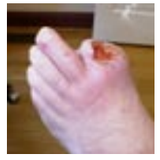
Results:

Using the basic principles of wound healing and a combination of advanced wound care products and techniques, I was able to salvage a patient's limb and restore his quality of life. Utilizing the cellular components of a bioengineered dermal substitute[4] and concentrated autologous platelet grafts, a wound with an overall poor prognosis was able to be turned around and successfully healed in an office setting.

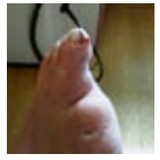
November 04, 2002
- Initial Presentation

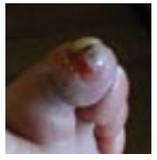


January 27, 2003
- Delayed healing of left 1st MPJ amputation

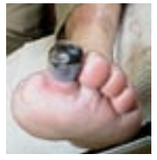


January 16, 2004
- Trauma to left second toe. Note closure of 1st MPJ amp not 100% complete.

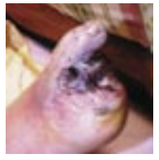




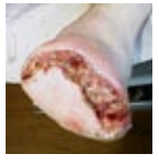
January 19, 2004
- Preoperative condition



February 3, 2004
- Home visit resulting in transmetatarsal amputation



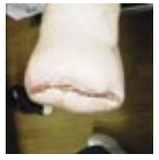
March 15, 2004
- Prior to use of DERMAGRAFT°



March 25, 2004
- Second application of DERMAGRAFT°

June 7, 2004
- Patient following 8 applications of DERMAGRAFT°

June 22, 2004



1 OSTEOSET® Pellets, Wright Medical Technology, Inc., Arlington, Texas
2 PLETAL® (cilostazol), Otsuka America Pharmaceutical, Inc., Rockville, Md.
3 ACTICOAT° (with SIL-CRYST™ Nanocrystals), Smith & Nephew, Inc., Largo, Fla.
4 DERMAGRAFT° Human Fibroblast-Derived Dermal Substitute, Smith & Nephew, Inc., Largo, Fla.
5 SOLOSITE° Wound Gel, Smith & Nephew, Inc., Largo, Fla.
6 LEVAQUIN®, Ortho-McNeil, Raritan, N.J.
7 SPORANOX®, Johnson & Johnson, Inc., New Brunswick, N.J.

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