The Use of Bilayer Dermal Regeneration Matrix for the Treatment of a Pediatric Traumatic Lawn Mower Injury: A Case Study

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Introduction

- In 2015, the United States Consumer Product Safety Commission reported that more than 274,000 adults and 12,000 children were injured by lawn mowers[1].
- Lacerations, burns, open fractures, and damage to skin, muscles, ligaments, tendons, and bones are all common findings following lawn mower injuries.
- These findings can place patients at a greater risk for significant tissue loss and pose a challenge for surgeons to repair due to the complexity of these traumatic injuries.
- The Food and Drug Administration (FDA) has approved a bilayer dermal regeneration matrix (BDRM $^{\Delta}$) consisting of cross linked bovine collagen and glycosaminoglycans coupled with a semi-permeable silicone layer for the treatment of traumatic wounds with exposed muscles, ligaments, tendons, and bones[2].
- To our knowledge, there are no case reports in the literature of the application of a BDRM$^{\Delta}$ alone for pediatric traumatic injuries with exposed bone.

Case Study and Surgical Procedure

We present the case of a 14 year old male patient who sustained a lawn mower injury, which resulted in multiple foot lacerations, open fractures to several toes of the right foot, and an open wound with a soft tissue deficit overlying the right hallux, after the entire nail and matrix was sheared off, leaving the entire dorsal aspect of the distal phalangeal bone exposed (Figure 1). The patient was admitted to the hospital and taken to the operating room within 4 hours of injury. 1 gram of Ancef and 900 milligrams of Clindamycin were given intravenously in the emergency department and operating room, respectively.

Surgical intervention included debridement and irrigation of open fractured toes 1, 2, and 3 of the right foot and a partial amputation of the right 2nd toe distal phalanx. Tissue advancement was performed and wounds of the 1st, 2nd , and 3rd toes of the right foot were closed and re-approximated using 5-0 nylon (Figure 2). However, there was inadequate soft tissue coverage over the right hallux wound, leaving exposed cortical phalangeal bone, raising a concern for salvage of the right hallux.

The serial progression of a pediatric traumatic hallux wound in an attempt at salvage with use of a Bilayer Dermal Regeneration Matrix $^{\Delta}$

Figure 1: Initial Presentation

Figure 2: Status Post Repair of Lacerations

Figure 3: Hallux Wound Bed Preparation

Figure 4: Post Operative Week 1

Figure 5: Post Operative Week 4

Figure 6: At 16 Month Follow Up

Case Study and Surgical Procedure Continued

A BDRM$^{\Delta}$ was used to replace the inadequate soft tissue coverage of the right hallux wound. The dorsal surface of the exposed right hallux distal phalanx was prepared by removing the exposed cortical bone down to the level of healthy bleeding cancellous bone (Figure 3). The BDRM$^{\Delta}$ was meshed (1:1 ratio), applied to the right hallux wound, and anchored in place with 5-0 monocryl suture. Care was taken to ensure proper conformation and contact between the BDRM $^{\Delta}$ and the wound bed. A dry sterile dressing and mild compression were applied.

Results

The patient was discharged from the hospital on post operative day one and followed, in the office, weekly (Figures 4 and 5).

The patient completed a 10 day course of Keflex 500mg tablets by mouth, three times daily, and was allowed to bear weight as tolerated in a surgical shoe. Once the BDRM$^{\Delta}$ was incorporated into the wound bed, local wound care was performed using saline dressings and lastly silver sulfadiazine cream until wound closure.

Complete wound closure was achieved by week 12. The patient's postoperative course was complication free.

Serial radiographs during his recovery up to one year post-operatively failed to show any evidence of osseous changes that would be concerning for osteomyelitis. At 16 months post-operatively, the patient remains healed (Figure 6).

Discussion

To our knowledge, there are no case reports in the literature of the application of an acellular dermal matrix$^{\Delta}$ for pediatric traumatic lawn mower injuries with exposed bone, without the additional use of soft tissue flap(s), negative pressure wound therapy (NPWT), and/or application of a split thickness or full thickness skin graft (STSG and FTSG, respectively)[3,4,5].

Using this acellular dermal matrix$^{\Delta}$ in lieu of a STSG or FTSG reduces the possible risks and complications associated with a STSG and FTSG, as well as decreases the operating time, due to the relative ease of use and availability of the acellular dermal matrix to surgeons.

These qualities can make this acellular dermal matrix$^{\Delta}$ a practical and cost effective alternative to a STSG or FTSG, in the presence of exposed bone in the foot.

Our case study demonstrates that a bilayer dermal regeneration matrix$^{\Delta}$ can effectively and safely be used to assist in the formation of granulation tissue and ultimate complete wound healing in the pediatric patient with exposed bone.

Key

Δ INTEGRA™ Matrix Wound Dressing (Integra Life Sciences, Plainsboro, NJ, USA)

Conclusion

- Traumatic lawn mower injuries in children and adults with exposed muscles, ligaments, tendons, and/or bone often pose a challenge for surgeons to repair.
- Our case study shows an easy to use and readily available bilayer dermal regeneration matrix$^{\Delta}$, which proved to be a safe and practical treatment option for a traumatic wound with exposed bone, as seen in our pediatric patient.

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