



Use of Integra Dermal Matrix in the Treatment of Combat-Related Upper Extremity Soft Tissue Injuries



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Introduction

- Soft tissue reconstruction of the upper extremity is a challenging task.
 - Critical to provide robust, mobile, soft tissue coverage as soon as is safe following injury
 - Limited local tissue
 - Pediced & free flaps frequently employed
- In high-energy combat wounds (Image 1), coverage complicated by:
 - Wide zones of injury
 - Contamination
 - Impaired local perfusion
 - Metabolic disturbances
 - Coagulopathies.
- Integra Bilayer (“Integra”)
 - Initially for burn treatment
 - Bovine tendon collagen and Crosslinked GAG
 - Expanded use in traumatic wounds
 - Limited reports for upper extremity injuries
- We review a cohort of patients with combat-related upper extremity injuries treated with Integra and autologous skin-grafting



Image 1: Upper extremity radiograph with multiple fractures and diffuse embedded shrapnel

Technique

- Operative debridement**
 - Every 48-72 hours
 - Negative pressure (NPWT) or sterile dressings
 - Timing of Integra placement at surgeon's discretion
- Integra grafting**
 - Trimmed to size & secured to wound periphery
 - Dressing (NPWT where possible, fingers typically sterile dressing)
 - Extremity splinted to minimize shear stresses
 - Dressings changed every 3 days, incorporation assessed (Image 2)

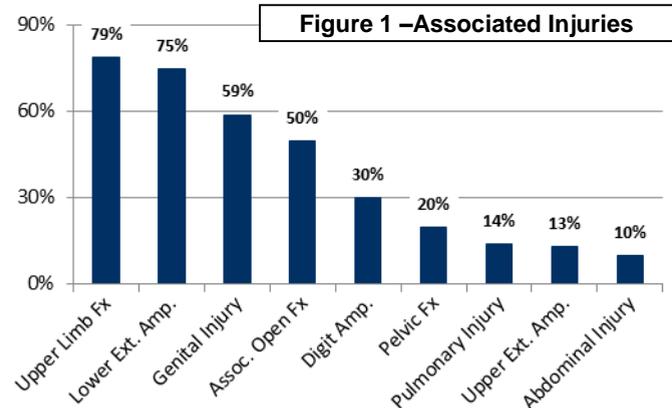


Image 2 (Left): Upper extremity soft tissue injury after Integra



Image 3 (Below): Upper extremity soft tissue injury following Integra and split-thickness skin grafting

- Autologous skin graft (Image 3)**
 - NPWT/sterile dressing applied
 - Take assessed POD#5



Results

- Sixty-one patients (69 wounds) met inclusion criteria
 - Mean age 24.6 years (range 19-38)
 - 100% male
 - 48% pre-injury history of tobacco use
 - 95% sustained IED blast injuries
 - Associated injuries were common (Fig 1)
- Wound size, location and treatment (Table 1)
- Infection
 - Six wounds with culture-positive infection
 - 50% polymicrobial, 33% Enterobacter, 17% Mucor
 - Treated with targeted antibiotic therapy
 - Skin grafted without recurrence or graft failure
- Integra Grafting
 - 74% single application, 24% two, 2% three
- Skin Grafting
 - 16 wounds treated with FTSG – All healed
 - 53 wounds treated with STSG
 - 93% excellent graft take
 - 4% initial take 70-90%
 - Treated with local wound care & healed
 - 4% initial graft failure
 - 1 re-grafted and healed
 - 1 amputation

Table 1: Wound characteristics and treatment by region

Wound Location	Distribution (n=69)	Size sq cm Median (range)	STSG (n=53)	FTSG (n=16)
Finger(s)	13 (19%)	6 (3-25)	1 (2%)	12 (75%)
Hand	8 (12%)	20.5 (16-128)	5 (9%)	3 (19%)
Forearm/wrist	37 (54%)	105 (4-374)	36 (68%)	1 (6%)
Arm/elbow	5 (7%)	500 (500-832)	5 (9%)	0 (0%)
Amputation	6 (8%)	26.5 (20-192)	6 (11%)	0 (0%)
Total	69 (100%)	56 (3-832)	53 (100%)	16 (100%)

Conclusions

- 97% of combat-related upper extremity wounds healed after treatment with serial debridement, Integra placement, and autologous skin grafting.
- Compares favorably with previously reported rates of 80-98% for upper extremity injuries treated with Integra & skin grafting.¹⁻³
- Comparable to the results of two smaller series (94 & 100%) reporting Integra and skin grafting in the treatment of combat wounds.^{4,5}
- We believe that this study validates the use of Integra in the treatment of traumatic upper extremity soft tissue wounds.
- Further study is needed to assess the long term functional outcomes of Integra treatment (Image 4) relative to traditional reconstructive procedures



Image 4: Representative image, 1.5 years post-treatment. Finger flexion & extension.

Methods

- Retrospective review of 61 active duty patients
 - Combat-related injuries of the upper extremity
 - Treated with Integra and autologous split- or full-thickness skin grafting (STSG and FTSG)
- Outcomes
 - Primary outcome: Wound healing
 - Secondary outcome: Percentage take of skin grafts
 - Effects of demographic & injury factors on healing

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