

Use of Integra in the Management of Complex Hand Wounds From Cancer Resection and Nonburn Trauma

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Michael Reynolds¹, David A. Kelly¹, Nicholas J. Walker¹,
 Clayton Crantford¹, and Anthony J. Defranzo¹

Abstract

Background: Despite extensive use of Integra in burn reconstruction, little has been published regarding its utility in complex hand wounds from nonburn trauma or cancer resection. This study aimed to review outcomes following Integra use for hand reconstruction following cancer resection or nonburn trauma with exposed bone, joints, and/or tendons. **Methods:** Retrospective review was performed of patients undergoing hand reconstruction with Integra for exposed bones, joints, or tendons over a 6-year period at a single institution. **Results:** Fourteen patients underwent hand reconstruction using Integra, 8 following cancer resection and 6 following acute nonburn trauma. The mean defect size was 19 cm², 79% had exposed tendon without peritenon, 43% had exposed bone without periosteum, and 28% had exposed joint capsule. Mean time from Integra to skin graft was 11.3 days, and negative-pressure wound therapy did not significantly decrease the mean time from Integra to skin graft placement ($P = .76$). Overall, 13 patients achieved successful reconstruction with mean skin graft take of 97%, and 1 required revision amputation at the proximal interphalangeal (PIP) joint. Six months postoperative, 92% patients had return of preoperative hand function. Without any surgical revision, 85% of patients were extremely satisfied with the aesthetic result and 15% were fairly satisfied. **Conclusions:** Integra is an effective method to treat complex hand wounds with exposed bone, joints, and/or tendons. This technique can be used in the office, lessens the need for local or free flap coverage, and provides an excellent aesthetic outcome. Integra should be considered a viable option in hand reconstruction algorithm.

Keywords: hand wound, hand injury, hand trauma, complex hand wounds, Integra hand, hand cancer, exposed tendon hand, exposed joint hand, exposed bone hand, Integra

Introduction

The management of complex wounds involving the hand presents a difficult challenge to the reconstructive surgeon. The composite structural anatomy of the hand and paucity of overlying soft tissue often leads to denuded vital structures following trauma or surgical insult, such as bones, tendons, and joints. Inability to primarily close the resulting wound often leaves these vital structures exposed without an adequately vascularized overlying soft tissue, vulnerable to desiccation and infection. In addition, exposed bone, tendon, or cartilage does not have sufficient vascularity to support a granulation bed for reepithelialization or neovascularization for skin graft survival.⁹ These reconstructive difficulties have led to the frequent use of local, regional, and microvascular free flaps for closure of complex hand wounds.

Integra (Integra Life Sciences, Plainsboro, New Jersey) is a bilaminar dermal regeneration template, composed of a silicone protective sheet overlying a matrix composed of bovine collagen and glycosaminoglycans derived from shark chondroitin-6-sulfate. It is well known among burn surgeons who have been using it to develop a neodermis in treatment of full-thickness burns since it was originally described by Burke et al.^{2,4} In addition, it has shown to have success in reconstruction of nonburn-related complex tissue

¹Wake Forest Baptist Health, Winston-Salem, NC, USA

Corresponding Author:

Nicholas J. Walker, Department of Plastic and Reconstructive Surgery, Wake Forest Baptist Health, 1 Medical Center Blvd, Winston-Salem, NC 27157, USA.

Email: njwalker@wakehealth.edu

defects.⁶ Although the use of Integra has been well documented in burn reconstruction, little has been published regarding the utility of Integra to cover hand wounds associated with exposed bone, joints, and/or tendons from non-burn trauma or cancer resection.

This study reviews the outcomes of 14 consecutive cases that used Integra for hand reconstruction following cancer resection or nonburn trauma with exposed bone, joints, and/or tendons.

Methods

Between June 2006 and April 2012, 14 patients with complex hand wounds from cancer resection and nonburn trauma were treated with Integra by our plastic surgery department at Wake Forest Baptist Hospital. A retrospective review was performed for data on patient demographics (Table 1), wound characteristics and etiology, use of negative-pressure wound therapy (NPWT), time to coverage with skin graft placement, complications, total active motion (TAM) postoperatively, and patient satisfaction (Table 2).

Results

Overall, 9 males and 5 females with a mean age of 62.5 years were treated with Integra for coverage of complex hand wounds. The majority of patients, 79%, had exposed tendon without peritenon, 43% had exposed bone without periosteum, and 28% had exposed joint capsule. Of the 14 patients, 8 required hand reconstruction after cancer resection, and the remaining 6 patients presented with wounds attributed to acute nonburn trauma. The mean soft tissue defect was 19 cm² (range, 2-80 cm²). Refer to Figures 1-3 for examples of complex hand wounds treated with Integra.

All wounds were evaluated at approximately 1 week following Integra placement for adequate incorporation of the Integra and readiness for skin graft placement. Overall, 13 of 14 patients (93%) had successful reconstruction using Integra, with 1 patient requiring revision amputation at the PIP joint after failure of Integra. Eight patients had subsequent full-thickness skin graft placement, and 5 had split-thickness skin grafting, with the mean time from Integra placement to skin graft of 11.3 days. Negative-pressure wound therapy was used in 7 of 14 patients, but this did not significantly decrease the mean time from Integra to skin graft placement (NPWT 11.8 days vs no NPWT 10.6 days, $P = .76$).

Patients were followed in our clinic after skin graft placement for an average of 26 months (range, 2.7-84.7 months). The mean percent skin graft take was 97%, and any areas of inadequate graft adherence were observed with nonoperative wound care until epithelialization of the area occurred.

Following complete wound healing and subsequent therapy, 8 of 13 patients (62%) had excellent TAM, 4 of 13

Table 1. Patient Demographics.

Male	9
Female	5
Mean age, y	62.5
Diabetes	6
Smoker	3
Peripheral vascular disease	5
Radiation	0
Mean follow-up, mo	26
Mean size of defect, cm ²	19

(31%) had good TAM, and 1 of 13 (7%) had poor TAM. Six months postoperative, 12 of 13 patients (92%) were noted to have complete return of preoperative hand function. Without any surgical revision, 85% of patients were extremely satisfied with their final aesthetic result, and 15% were fairly satisfied.

Conclusion

Despite its successful use in burn reconstruction, the use of Integra for treatment of hand wounds related to nonburn trauma and cancer resection is not well represented in the literature.

Weigert et al¹⁰ reported the use of Integra for coverage of severe traumatic hand wounds in 15 patients and noted its successful use in 87% of their patients with good function and aesthetic outcomes. This is consistent with our findings of successful reconstruction in 93% of patients, and excellent or good TAM in 93%.

Shores et al⁸ quoted their rate of split-thickness skin graft take to be 95.5% (range, 85%-100%) when placed on Integra covering exposed tendon without peritenon in wounds of the upper extremity measuring an average of 30.3 (range, 4-96 cm²). We observed a slightly better rate of skin graft take of 97%, but this may be attributed to an overall smaller mean wound size of 19 cm².

In addition to providing reliable coverage of hand wounds with good postoperative function, 85% of our patients were extremely satisfied with their aesthetic result. High patient satisfaction combined with low donor-site morbidity affirms that Integra is a viable and effective option for treatment complex hand wounds.

In the presence of a healthy wound bed absent of necrotic tissue and infection, such as defects seen following Mohs resections, Integra offers a reconstructive option for immediate coverage of the wound that can be performed in the office under local anesthesia. In addition, patients can achieve definitive coverage of the wound 1 to 2 weeks after Integra placement, as evidenced by our mean time to skin grafting of 11.3 days.

Although the current study presents a limited sample size of patients, it adds to the growing body of evidence that

Table 2. Wound Characteristics, Treatment Variables, and Outcomes.

Case	Age/sex	Diagnosis	Size, cm ²	Exposed tendon	Peritenon intact	Exposed bone	Exposed joint	NPWT	Days till skin graft	Skin graft type	Skin graft take, %	TAM grade
1	80/M	SCC	30.5	+	-	-	-	+	11	FTSG	100	Excellent
2	80/M	Melanoma	10.5	+	-	+	-	-	10	FTSG	100	Excellent
3	68/F	Trauma	80	+	-	-	-	+	28	STSG	95	Good
4	62/F	SCC	20	+	-	-	-	+	7	STSG	90	Good
5	83/M	SCC	4	+	-	-	+	-	10	FTSG	100	Excellent
6	88/F	SCC	16	+	-	-	-	+	20	STSG	100	Good
7	79/M	SCC	3	+	-	-	-	-	14	FTSG	90	Excellent
8	51/M	Trauma	4	+	-	+	+	+	7	STSG	90	Fair
9	33/F	Trauma	4	+	-	+	+	+	7	FTSG	95	Good
10	54/M	SCC	6	-	+	+	-	-	13	FTSG	98	Excellent
11	32/M	Trauma	3	+	-	-	+	-	Not placed	-	-	-
12	54/F	Trauma	2	-	-	+	-	-	11	FTSG	100	Excellent
13	57/M	SCC	3	-	-	+	-	-	6	FTSG	98	Excellent
14	54/M	Trauma	80	+	-	-	-	+	3	STSG	100	Excellent

Note. NPWT = negative-pressure wound therapy; TAM = total active motion; FTSG = full thickness skin graft; STSG = split thickness skin graft.

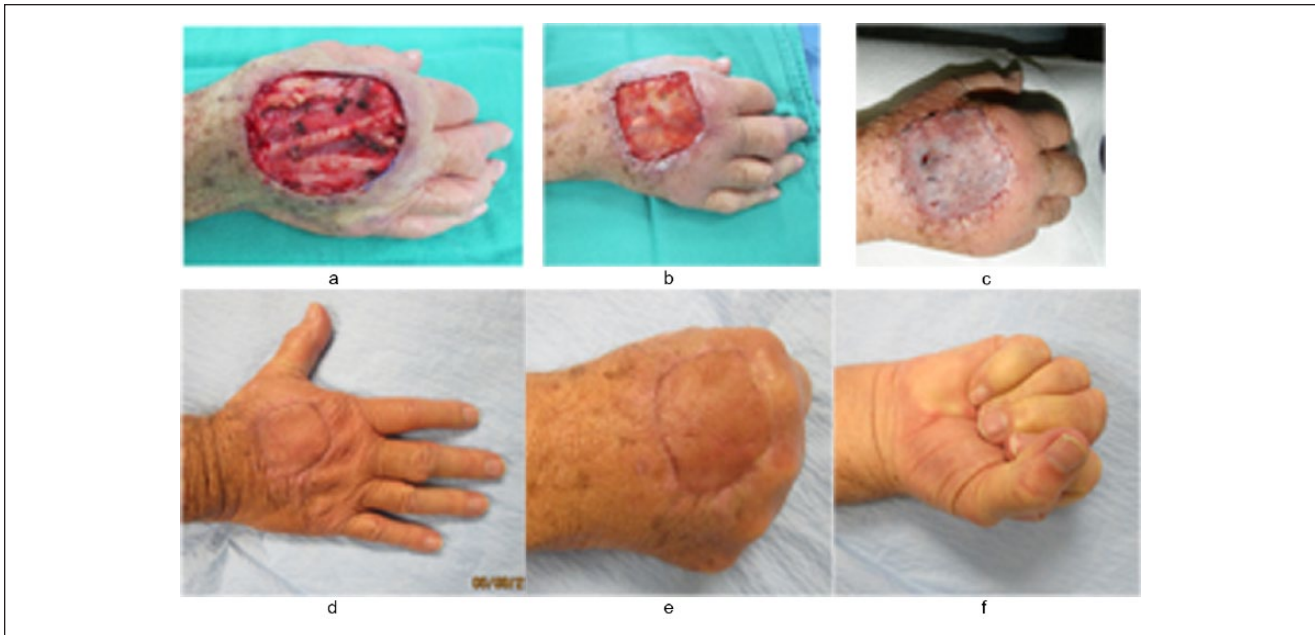


Figure 1. Case 1: 80-year-old man with squamous cell carcinoma (SCC) of the right dorsal hand. a, 30.5-cm² wound following excision of SCC, with tendon exposed and areas of absent peritendon. b, Incorporation of Integra after 11 days of negative-pressure wound therapy. c, Skin graft with 100% take upon follow-up at 1 week. d-f, Complete healing of wound at 4-month follow-up with excellent total active motion.



Figure 2. Case 2: 80-year-old man with subungual melanoma in situ of left dorsal thumb. a, 10.5-cm² wound following incorporation of Integra over previously exposed bone and tendon on postoperative day 10. b, Skin graft with 100% take upon follow-up at 2 weeks. c-d, Complete healing of wound at 4-month follow-up with excellent total active motion.



Figure 3. Case 5: 83-year-old man with squamous cell carcinoma of left dorsal ring finger. a, 4-cm² wound following excision with tendon exposed and lack of peritenon. b-d, Complete healing of wound at 6-week follow-up with excellent total active motion.

Integra is a safe and effective method to treat complex hand wounds from nonburn trauma and cancer resection with exposed bone, joints, and/or tendons.^{1,3,7,9,10} It allows for neovascularized tissue to form over exposed or denuded structures within these wounds,⁵ creating a more robust vascularized tissue bed for neovascularization of subsequently placed skin grafts. Its use in complex hand wounds offers a reconstructive alternative to more extensive treatment options utilizing flap transfer and their accompanying donor-site morbidity. Integra is a convenient and effective reconstructive option for coverage of complex hand wounds following cancer resection or nonburn trauma, which provides high patient satisfaction and excellent postoperative functional recovery.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

This article does not contain any studies with human or animal subjects.

Statement of Informed Consent

Informed consent was obtained from all individual participants included in the study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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