Optimizing Functional and Aesthetic Outcomes of Upper Limb Soft Tissue Reconstruction

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KEYWORDS

• Functional outcomes • Aesthetic outcomes • Upper limb • Soft tissue • Reconstruction

KEY POINTS

- Optimal functional and aesthetic outcomes for hand reconstruction depend on optimizing the ideal flap for any given defect.
- Having a wider range of flap options in the armamentarium provides more flexibility in achieving these goals.
- The hand and reconstructive surgeon has to consider multiple factors before surgery and flap selection: patient body habitus, flap donor site options, and characteristics relative to the recipient site defect.
- Anatomic and functional variations should be taken into consideration in selecting the type of reconstruction.
- Local flaps provide reconstruction of the defects with like tissues and prevent additional morbidity to the other areas of the body.
- Adjuncts like primary donor site closure, suprafascial flap harvest, use of full-thickness skin grafting, and local rotation flaps can all improve the donor site closure and cosmesis.
- Free tissue transfer provides a wide variety of options for upper extremity reconstruction.
- Having a greater availability of flap choices allows surgeons to be more selective in choosing the optimal fasciocutaneous flap donor site.
- Targeted debulking, redefining topographic regions by designing asymmetric skin excisions, and recreating natural crease lines that border adjacent aesthetic units may improve the aesthetic outcome.
- Measures such as peripheral flap thinning, recipient skin edge elevation and resection to healthy nonscarred tissue, and meticulous inset for muscle flaps with proper overlap and native skin marsupialization may all improve the aesthetic outcomes after upper extremity reconstruction.

INTRODUCTION

Posttraumatic hand deformities represent a unique challenge for hand and reconstructive surgeons. Goals of treatment should include not only restoration of function but also restoration of preinjury aesthetics. The hand and upper extremity play an important role socially and form the fundamental basis of communication and self-expression. Although restoring hand function remains a

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principal consideration, special attention needs to be placed on the final reconstructed hand appearance. We have long moved past the goal of only achieving wound closure and restoring function. Success in hand reconstruction is now measured by reestablishing preinjury function and, just as importantly, preinjury aesthetic appearance. Careful flap donor site selection and flap inset both play a critical role in achieving these goals.

Hand, wrist, and distal forearm injuries are common and frequently present with exposed bone, tendons, muscle, and nerves. The immediate priority is adequate debridement of the devitalized tissue, fracture fixation to create a stable reconstructive platform, and repair of tendon and all critical neurovascular structures. Once these goals have been achieved, attention can be concentrated on optimizing soft tissue coverage.[1–12] Various options exist for soft tissue closure, including local, regional, and distant pedicle flaps as well as free flaps.[13–19] Because of the distinct contour characteristics and relative paucity of subcutaneous tissue in the hand, posttraumatic flap reconstructions may require secondary debulking to improve contour. Optimal flap selection is determined by replacing like with like and minimizing donor site morbidity. A beautiful reconstruction resulting in a poor or disfiguring donor site is a neutral outcome and trade-off and should be avoided. Careful selection of flap type and donor site, as well as meticulous flap insetting and aesthetic unit–directed preparation of the recipient site yield better results.[20,21] In this article, the aspects of optimal flap selection, inset, recipient site preparation, and secondary revisions to maximize aesthetic outcome are discussed.

Before any flap-based soft tissue coverage, proper wound debridement remains fundamental (Fig. 1). Low infection rates are reported after hand trauma, even in cases of significant contamination or bone or hardware exposure. In a series reported by Parrett and colleagues[22] with total 125 free flaps in 124 patients, reported infection rate was 4.8%, with a mean follow-up of 18 months. These investigators attributed this relatively low infection rate to aggressive debridement and rapid flap coverage. All patients underwent initial debridement within the first 24 hours of the trauma, with repeated debridement as indicated (mean of 1.6 per patient). The flap coverage was performed with a mean time of 5.6 days from the time of injury.[22]

PATIENT BODY HABITUS

Flap selection should take into consideration patient body habitus, body mass index (BMI), and available donor sites. Donor site characteristics such as skin color, dermal and subcutaneous tissue thickness, glabrous versus nonglabrous skin, and associated flap pedicle length all play a determining role. Ideally, skin defects should be replaced with like-skin flaps, which have the advantage of being reelevated for secondary surgeries. Patients with a high BMI are often better served with muscle flaps or fascial flaps. Muscle flaps atrophy and contour accordingly, whereas large and thick fasciocutaneous flaps may require significant debulking. Adipose tissue distribution in the body also varies, for example, patients with an unsuitable and thick anterolateral thigh (ALT) donor site may have an excellent scapular or thoracodorsal artery perforator (TDAP) flap donor site. In patients with a high BMI, flaps such as groin or superficial circumflex iliac artery perforator, sural artery perforator, TDAP, and scapular as well as adipofascial flaps may be excellent alternatives because of their relative thinness (Fig. 2).

ANATOMIC LOCATION

The type of reconstruction for the upper extremity is highly dependent on the anatomic location of the

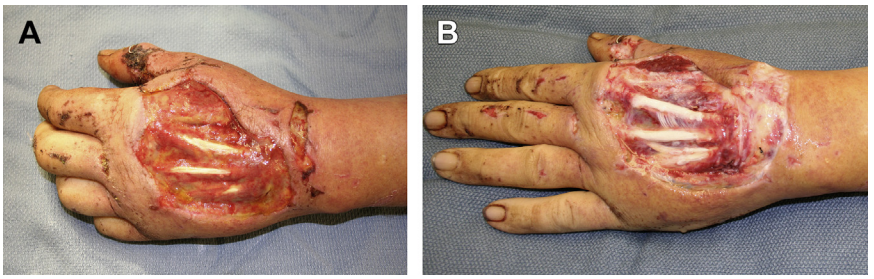

Fig. 1. (*A*) Dorsal degloving left hand injury before surgical debridement. (*B*) Dorsal degloving injury after aggressive wound debridement. Debridement was started just outside the zone of injury to enter a natural untraumatized tissue plane, similar to extirpating a tumor. An upper extremity tourniquet was used during the debridement to minimize bleeding and facilitate debridement. Note that the smaller proximal wound found in (*A*) was combined with the larger one to create a single uniform wound aesthetic unit.