

# Refinements and Secondary Surgery After Flap Reconstruction of the Traumatized Hand

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## KEYWORDS

- Traumatized hand • Flap reconstruction • Secondary flap elevation • Secondary procedures
- Functional refinements

## KEY POINTS

- The need for refinement and secondary surgery should be taken into consideration during the initial flap selection process.
- Muscle flaps may achieve better contour than bulky fasciocutaneous flaps.
- Fasciocutaneous flaps permit easier secondary flap elevation, and thereby provide versatile soft tissue coverage in the setting of anticipated secondary reconstruction of the traumatized hand.
- The need for secondary procedures can be classified based on the type of tissue that requires revision after initial reconstruction.

## INTRODUCTION

Secondary refinements after flap reconstruction of the traumatized hand depend on the type of flap used during primary reconstruction, in addition to the functional and aesthetic problems subsequently encountered. Achieving optimal hand function is the ultimate goal after encountering mutilating trauma to the hand. Several prerequisites should be fulfilled in order to attain this goal. Such requirements include the acquisition of adaptable and ample soft tissue coverage, bony stabilization, adequate joint mobility, smooth-gliding tendons, functional muscle strength, and restoration of sensation.<sup>1</sup>

## FLAP RECONSTRUCTION

An anticipatory operative plan is fundamental to ensuring optimal soft tissue coverage of the hand

during the process of establishing functional restoration, while taking care to minimize donor-site morbidity. Multiple factors contribute to flap selection. Most of these factors are attributed to matching the characteristics of the original defect: size, contour, location, and quality of tissues missing from the defect. The most common currently used flaps for reconstruction of the traumatized hand include musculocutaneous, muscle, fasciocutaneous, and fascial flaps.

### ***Musculocutaneous and Muscle Flaps***

Musculocutaneous and muscle flaps can be obtained from muscles such as the latissimus dorsi, rectus abdominis, serratus anterior, and gracilis. Most of these flaps are used as muscle-only flaps, and are subsequently covered with skin graft. Superiority of soft tissue coverage with a muscle-only

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flap versus a myocutaneous flap remains equivocal.<sup>2</sup> Advantages of these flaps include their ranges in dimensions, ability to eliminate dead space in sizable defects, and rich blood supply. An additional benefit of these musculocutaneous and muscle flaps is their suitability for antibiotic delivery. For this reason, they have been the flaps of choice in defects complicated by extensive contamination, in addition to osteomyelitis.<sup>3</sup> These flaps also atrophy after denervation, and they contour well after their initial bulky size (Fig. 1). Despite these benefits, these flaps have some disadvantages. The color mismatch and appearance of the overlying skin graft may cause an unappealing appearance. If revision is required, these flaps are difficult to debulk and cannot be split into layers to allow tunneling of tendons or nerves. In addition, the donor site loses motor function.

### **Fasciocutaneous Flaps**

Common fasciocutaneous flaps include the lateral arm, anterolateral thigh (Box 1), radial forearm, scapula, and parascapular flaps. Their pliable nature allows straightforward flap re-elevation, in addition to flexible contouring to the size and shape of the original wound. Although these flaps offer increased flexibility, the amount of donor tissue is limited by the ability to achieve primary



**Fig. 1.** (A) Initial reconstruction of a large defect over the antecubital fossa extending distally to the midforearm, with a latissimus dorsi muscle flap. (B) The same defect 6 months from the original flap reconstruction. The bulkiness of the original flap has atrophied, and now shows good contour.

#### **Box 1**

#### **Latest advances: outcomes of the anterolateral thigh flap**

The anterolateral thigh flap offers versatility in size and shape. Flap thickness may easily be adjusted to match the needs of the soft tissue defect, including additional harvest of the tensor fasciae latae to reconstruct tendon and soft tissue deficiencies simultaneously. In the past, concern about the anatomic variability of its cutaneous blood supply limited the flap's use.<sup>3</sup> However, Wei and colleagues' study of 672 anterolateral thigh flaps showed that these flaps could be harvested without regard for the origin of the cutaneous blood supply (ie, septocutaneous or musculocutaneous). Furthermore, the study showed a 1.79% total and 2.53% partial flap failure rate. Given these results, Wei and colleagues<sup>4</sup> concluded that the anterolateral flap may be substituted for almost any flap required in most soft tissue reconstructions.

closure of the donor defect. In addition, their advantageous thin, and pliable characteristics may not be found in obese patients, given these patients' greater flap thickness.<sup>3</sup> Bulky fasciocutaneous flaps have a biscuit appearance that may be difficult to revise (Fig. 2).

### **Fascial Flaps**

Common fascial flaps include temporoparietal, anterolateral thigh, radial forearm (Fig. 3), and lateral arm flaps. These flaps are a variant of the fasciocutaneous flaps, harvested by leaving the overlying skin intact. These flaps provide even more flexibility than fasciocutaneous flaps, because they are extremely thin. Fascial flaps are excellent for coverage of exposed tendons. These tendons



**Fig. 2.** A large dorsal hand defect is reconstructed with a radial forearm fasciocutaneous flap, in addition to a skin graft for proximal coverage. The radial forearm flap has a bulky appearance.

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