Reconstruction of Fingertip Injuries: Surgical Tips and Avoiding Complications

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The fingertip is the most commonly injured part of the hand. When replantation of a fingertip amputation is not possible, flap reconstruction may be necessary for a functional and aesthetically pleasing outcome. This paper reviews commonly utilized reconstruction techniques with a focus on technical tricks and potential complications and how to avoid them, with illustrative cases. *(J Hand Surg Am. 2015;40(5):1016–1024. Copyright © 2015 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Complication, fingertip, injury, reconstruction, surgical tip.

The fingertip, defined as the portion of the finger distal to the insertion of the flexor and extensor tendons, is the most commonly injured part of the hand.[1,2] The unique anatomy and specialized structure of the fingertip make it critical for functions such as sensation, fine handling, and gripping. As such, it is important to be familiar with the treatment options available for such injuries in order to provide a good functional and aesthetic outcome for patients.

Although replantation of an amputated fingertip may be the best way to achieve aesthetic and functional reconstruction, this is not always possible.[3] Factors including mechanism of injury, preservation and condition of the amputated part, ischemia time, availability of a trained team at an institution, and adequacy of resources can substantially influence and even preclude the capability of performing a distal replantation. Fingertip flap reconstruction then becomes important.

Several techniques have been described for fingertip reconstruction with good functional and cosmetic outcomes. Different factors must be considered when choosing one surgical technique over another. Most important, the characteristics of the injury will dictate what type of reconstruction is available. Other factors that are evaluated can be divided into patient factors (hand dominance, occupation, age, expectations, previous injuries, smoking status, comorbidities), surgeon factors (previous experience, training, microsurgical skills), and institution factors (operating room availability, equipment and team availability). The purpose of this paper is to provide a review of specific reconstructive methods and to focus on surgical pearls, possible complications, and measures to avoid these complications. Table 1 outlines each of the techniques described in this paper.

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INDICATIONS AND CONTRAINDICATIONS

Fingertip reconstruction is indicated for restoration of good padding of the finger that will allow for adequate grip function, restoration of sensation, and a good aesthetic result in the setting where replantation is not possible and shortening with revision amputation is not desirable. Although every effort should be made to provide recovery of sensation, this will vary and depends on several factors including the technique utilized, patient age, smoking status, and comorbidities. Depending upon the geometry, location, and mechanism of the injury, one technique may be preferred over another. Specific indications for particular techniques are discussed with each technique described.

The surgical procedure can vary from simple to complex. The longer and more complex procedures will be preferred for patients of younger age and with

TABLE 1. Techniques, Indications, and Technical Tips to Avoid Complications

Technique	Indications/Contraindications	Technical Tips to Avoid Complications
Healing by secondary intention	• < 1.0–1.5 cm^2–sized defect • No exposed bone	• Thoroughly initially clean and debride. • Limit dressing changes to once a week. • Limit manipulation during dressing changes.
V-Y flap	• Dorsal oblique or transverse defects • Contraindicated in volar oblique defects • < 1.0-cm–sized defect	• Apex of triangle should be at a DIP joint crease. • Base of triangle should not be wider than the nail plate. • Avoid tight sutures to prevent hook nail deformity. • Use gentle traction with skin hook for flap tension during proximal dissection.
Thenar flap	• Volar oblique defects for index and middle finger • Contraindicated in ring and little fingers or any pathology that may predispose to joint stiffness	• Flap can be elevated distally or in an "H" pattern. • Thenar H flap can mitigate the need for skin graft for donor site and be closed primarily. • Elevate flap as close to thumb metacarpophalangeal joint but remain superficial because neurovascular structures are just deep to flap.
Cross-finger flap	• Volar oblique defects for any or multiple digits • Contraindications similar to thenar flap	• Use clear plane above paratenon of extensor tendon. • Transverse incisions of flap should be at the PIP and DIP joints to ensure inclusion of artery supplying the flap. • Longitudinal incision can be placed between palmar and dorsal glabrous skin to provide a larger flap width. • Releasing Cleland ligament will provide increased separation of digits and improved comfort for patient.
Antegrade neurovascular island flap	• Volar, transverse, or radial/ulnar oblique defects • Contraindicated on radial side of index and ulnar side of little digit owing to arterial dominance of digits	• Avoid skeletonizing the neurovascular pedicle. • Leaving fat pad around neurovascular bundle will preserve vena commitantes, allowing flap drainage. • Early active and gentle passive range of motion will prevent scar formation and contractures.
Retrograde vascular island flap	• Larger volar, transverse, or radial/ulnar oblique defects • Contraindications similar to antegrade island flap	• Zig-zag approach connecting donor and receptor area allows better exposure and less scar retraction. • Avoid skeletonizing pedicle by leaving some fat pad attached. • Ligating distal vessels with a suture instead of a ligaclip leaves less of a bump in the fat pad after healing. • Early active and gentle passive range of motion.
Toe pulp transfer	• Large defects involving full pulp loss • Relatively contraindicated in older patients, smokers, or patients with previous vascular disease	• Use a foot that will match on the site of injury. • Use the digital artery of the foot to anastamose to the digital artery of finger whenever possible, although the dorsalis pedis artery can also be used. • Best veins for receptor area are located at the metacarpophalangeal joint dorsally.

no comorbidities. Indeed, when the amputated part is available and in good condition with short ischemia time and in a young patient, fingertip replantation of a distal injury may be favored over reconstruction of the amputation.

SURGICAL ANATOMY

A good understanding of fingertip anatomy is crucial to appropriate management. The skin and epidermis of the volar fingertip is thick with deep papillary ridges. Underneath this layer lies a highly vascular fibrofatty tissue constituting the finger pulp. Stability of the finger pulp results from fibrous septae that radiate from the periosteum of the distal phalanx to the skin, with fatty tissue within that scaffold network to provide padding. The fingertip has a rich vascular supply from the terminal branches of the digital arteries. The thumb, index, and middle fingers have a dominant ulnar digital artery; in the ring and little fingers, the dominant is the radial digital artery. The 2 digital arteries anastomose as transverse palmar arches in 3 consistent locations: at the level of the C1 (proximal transverse palmar arch) and C2 (middle transverse