SCIENTIFIC ARTICLE

Extended Step-Advancement Flap for Avulsed Amputated Fingertip—A New Technique to Preserve Finger Length: Case Series

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Purpose The conventional step-advancement flap does not restore fingertip length after avulsion amputation with projecting bone owing to the limited size of the distal triangular flap. To overcome this problem, the extended step advancement flap using the stepladder principle, described in this article, provides an extended distal triangular flap that can be wrapped around the projecting tip of the distal phalanx while avoiding longitudinal volar scarring. The purposes of this study were to present a modification of the original step-advancement technique and to report on results in 6 patients.

Methods Between 2007 and 2009, 6 men (mean age, 29 y; range, 18–45 y) presented with a large projecting tip of exposed bone of the distal phalanx after avulsion injury. All 6 had reconstruction using the described technique. After surgery, the finger was immobilized with a splint, followed by rehabilitation. During the follow-up of 9 to 12 months, we clinically assessed flap-site skin quality, scar contractures, and finger mobility. We measured the finger's range of motion with a goniometer. Sensibility was evaluated using the static 2-point discrimination test.

Results The postoperative course was uneventful. All flaps survived completely, except one that had mild marginal necrosis. We observed near-total active range of motion in all patients. The average static 2-point discrimination was 4 mm with a range of 3 to 5 mm. All patients resumed normal daily activities after 8 weeks.

Conclusions The extended step-advancement flap is ideal for closure of challenging fingertip amputation wounds because it maintains length and minimizes scars while providing a well-padded, sensate tip. It is a viable alternative to replantation of the fingertip. *(J Hand Surg 2011;36A:129–134. © 2011 Published by Elsevier Inc. on behalf of the American Society for Surgery of the Hand.)*

Type of study/level of evidence Therapeutic IV.

Key words: Extended flap, step-advancement, fingertip.

Fingertip injuries are among the most frequent injuries that hand surgeons are asked to treat. Although microsurgical techniques have enabled replantation of even very distal tip amputations, it is relatively uncommon for a distal tip injury to be suitable for replantation.[1] However, when the amputated part is not suitable for replantation, an alternative tool for reconstructing the distal phalanx with preservation of the finger length should be available.

Evans and Martin first reported the step-advance-

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Received for publication January 8, 2010; accepted in revised form October 12, 2010.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

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0363-5023/11/36A01-0024$36.00/0
doi:10.1016/j.jhsa.2010.10.008

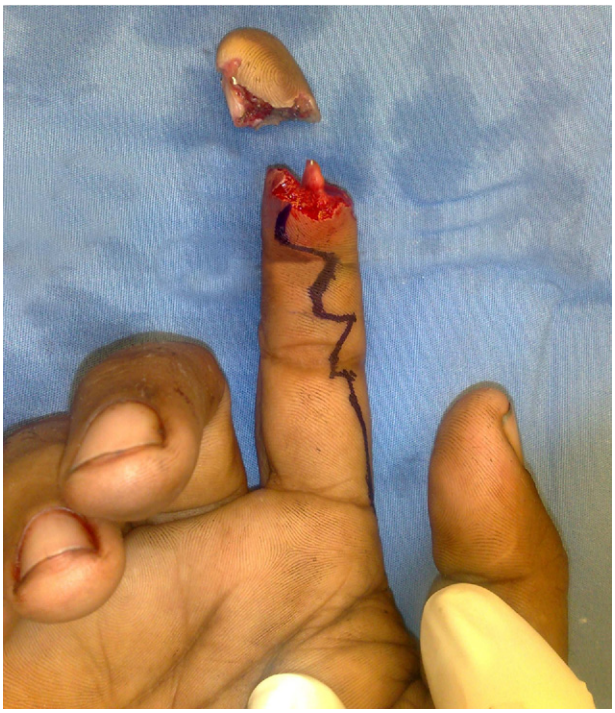

FIGURE 1: Preoperative view demonstrates the fingertip defect and flap markings. Note the projecting bone of the distal phalanx. Flap marking demonstrates the volar triangles of the stepladder principle.

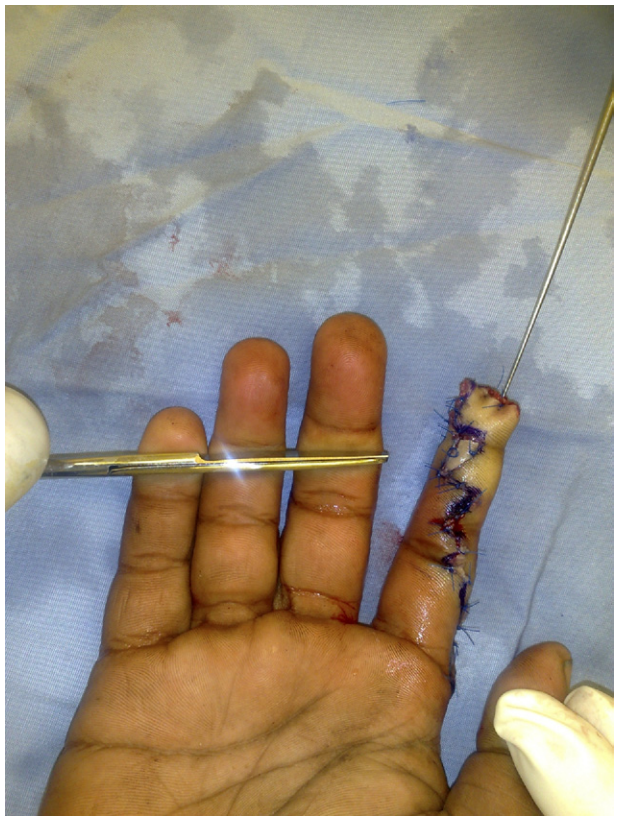

FIGURE 2: Skin closure of the flap and flap donor site.

ment flap in 13 patients in 1988[2]; since then, we could find no additional published articles concerning this flap. The flap was based on one neurovascular bundle that could be elevated on either side of the digit. The volar incisions comprised 3 triangular flaps and the dorsal incision was just dorsal to the line of the neurovascular bundle. The flap was then moved toward the amputated fingertip by engaging each triangular flap one step distally on the stepladder principle. The flap could not be formed into a tube owing to the limited size of the distal triangular flap. To overcome this problem, we report a modification that enables the distal triangular flap to be wrapped around the projecting bone. The extended step advancement flap described in this article comprises a larger vascular territory of the distal dorsal skin of the finger, forming a wider distal triangular flap of ample skin that can be wrapped around the projecting tip of the distal phalanx and reshaped as a new fingertip with full tactile sensitivity and no longitudinal volar scarring. For cases of avulsion amputation of the fingertip in which replantation is usually impossible, use of the extended step-advancement flap, described in this study, should be considered. The purpose of this study was to report on the extended step advancement flap and its results in 6 patients.

PATIENTS AND METHODS

We used the extended step-advancement flap to reconstruct avulsion amputation of the fingertip with large projections of bone (Figs. 1, 2) in 6 men ages 18 to 43 years (average, 29 y). Four of the 6 injuries were on the dominant hand, at the distal two thirds of the distal phalanx in 2 patients, at the distal interphalangeal (DIP) joint in 2 patients, and at the middle third in 2 patients; on the index finger in 4 patients, the little finger in 1 patient, and the ring finger in 1 patient. The average length and width of the fingertip defect were 2.1 × 1.5 cm (range, 1.5 × 1.7 to 2.1 × 2.2 cm). The average length of the projecting bone was 1 cm.

We observed patients for an average of 11 months (range, 9–12 mo) after surgery, during which time they were questioned about hypersensitivity, numbness, and pain. We used the Weber test[3] to measure static 2-point discrimination and measured the finger's range of motion with a goniometer (Table 1).

Surgical technique

Axillary block anesthesia is used with arm tourniquet control and loupe magnification. The patency of the digital arteries of the injured finger is confirmed by digital Allen's test and Doppler examination. The flap is