

# Reverse-Flow First Dorsal Metacarpal Artery Flap for Index Fingertip Reconstruction

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**Abstract:** Dorsum of the hand is an ideal skin-flap donor site for coverage of hand or finger defects. We elevated 8 reverse-flow first dorsal metacarpal artery flap in 9 patients for soft-tissue cover of index fingertip injuries distal to distal interphalangeal joint with exposed bone. In 3 patients, the digital branch of the superficial radial nerve was coapted to the digital nerve. All flaps healed uneventfully, except for 1 patient in which partial necrosis of the flap occurred. Postoperative follow-up was 4–12 months (mean, 8 months). Reverse-flow first dorsal metacarpal artery flap is a good alternative for reconstruction of index fingertip injuries.

**Key Words:** first dorsal metacarpal artery

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Fingertip injuries are the most common type of injuries seen in the upper extremity.<sup>1</sup> When the severed part is available, the surgeon must always think of reimplantation, but usually the lost segment is unavailable and numerous techniques have been attempted to cover fingertip defects. Ideal reconstruction of fingertip injuries preserves finger length and provides good sensation and no pain in the activities of daily life. There are inordinate numbers of studies in the literature for reconstruction of fingertip injuries. Dorsal finger or hand skin is a good donor area, and various flaps have been proposed designed on the dorsum of the fingers or hand.<sup>2,3</sup> First dorsal metacarpal artery island flap was first described by Foucher and Braun as a “kite flap,”<sup>4</sup> and the reverse flow first dorsal metacarpal artery was first used clinically by Maruyama.<sup>5</sup> We recommend reverse flow first dorsal metacarpal artery flap for index fingertip amputations.

## Operative Technique

The operation is carried out under axillary block anesthesia and arm tourniquet. Depending on the amount of tissue loss to be covered, the flap may be extended to the dorsal wrist crease. The emergence of the first dorsal metacarpal artery (FDMA) from the dorsal radial artery is marked at the angle of the first and second metacarpals and is included in the skin island. The flap-margin incisions are made and the flap is raised from proximal to distal. The paratenon of the EPL is left intact while it is retracted and the FDMA is ligated at its emergence from the radial artery (Fig. 1). Zigzag or lazy-S incision is made from the flap to the defect on the dorsum of the index finger. Skin flaps are elevated just underneath the dermis. Then the flap is elevated over the first dorsal interosseous muscle to the second metacarpal neck. A large vein is not included in the pedicle as it may be engorged and hinder normal venous drainage.<sup>6</sup> The dorsal aponeurosis of the first dorsal interosseous muscle is incised and disinserted from the second metacarpal bone including the FDMA. For a neurosensory reconstruction, the dorsal digital branch of the superficial radial nerve may be included. At the level of the neck of the metacarpal bone, care is taken not to injure the constant deep perforator from palmar digital artery to dorsal metacarpal artery.<sup>7,8</sup> The flap is adapted to the defect, and the pedicle is skin grafted longitudinally. Then the tourniquet is deflated, and the flap turns pink in 10–15 minutes.

## Clinical Experience

Eight index fingers in 8 patients with defects distal to the distal interphalangeal joint were reconstructed by the reverse FDMA flap during a 20-month period from February 2003 to May 2004. All patients were male, with age range 18–54 years (mean 32) (Table 1). Mean follow-up was 8 months (minimum 4 months). All the flaps totally survived and skin grafts healed uneventfully, except for 1 patient in which partial necrosis of the flap occurred, in which the defect was left to heal by secondary intention. In 3 cases, the digital branches of the superficial radial nerve were coapted to digital nerves. All patients were satisfied and used the

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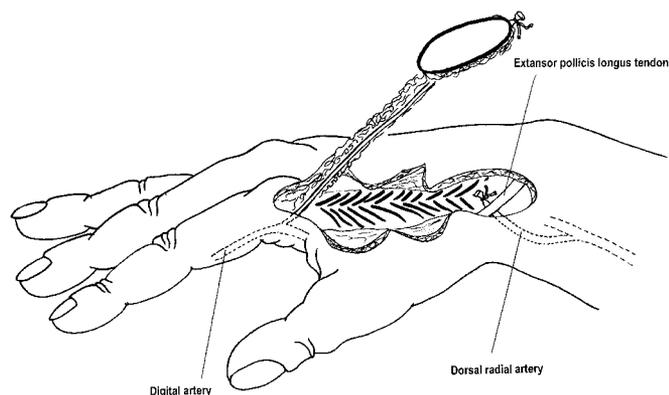
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index fingers without difficulty (Figs. 2 and 3). The mean static 2-point discrimination was 8 mm in the nerve-coapted group and 10 mm in the remaining.



**FIGURE 1.** Reverse-flow flap elevation from proximal to distal direction. The FDMA branch of the dorsal radial artery is ligated at its emergence under the extensor pollicis longus tendon. The flap circulation is via a deep perforator from the digital artery.

## DISCUSSION

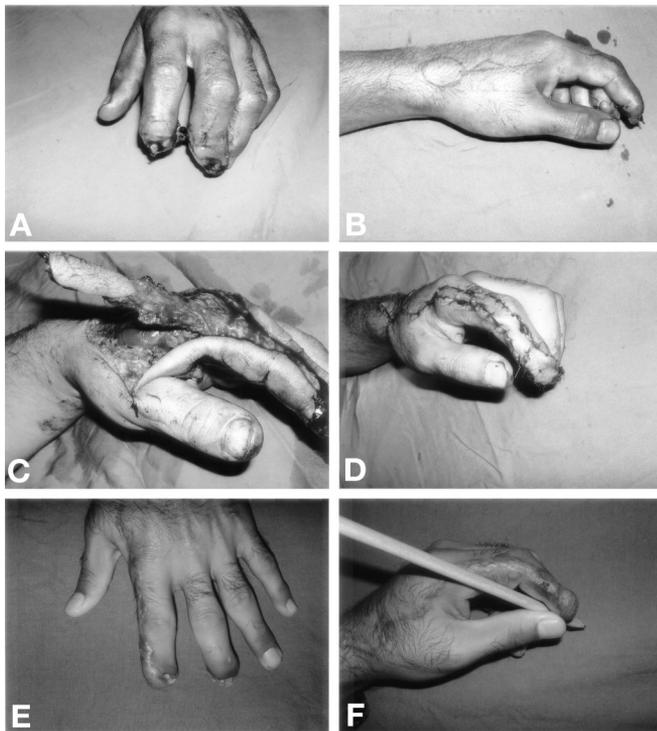
The primary goal of reconstruction of fingertip injuries is restoration of function without bone shortening, that is covering of the defect with a skin flap. Most of the flaps used in fingertip reconstruction are not perfect. Commonly used homodigital volar advancement flaps such as Atasoy V-Y,<sup>9</sup> bipediced advancement flap,<sup>10</sup> or Hueston flap<sup>11</sup> result in volar digital scars that may impair sensation. Heterodigital flaps lead to immobilization of the finger, leading to joint stiffness; need multiple-stage operations; and result in an unacceptable donor-site scar.<sup>12</sup> Reverse digital artery flaps, first described by Lai et al,<sup>13</sup> sacrifice one of the digital arteries and leave a volar finger scar.

Reverse dorsal digital or metacarpal flaps have the advantage of a dorsally located scar instead of a volar or lateral finger scar. Bene et al<sup>2</sup> have studied the vascular pattern of the finger dorsum in detail and defined a reverse dorsal digital island flap for fingertip reconstruction. But it may suffer vascular insufficiency to some extent, and partial flap losses may be observed.<sup>14</sup>

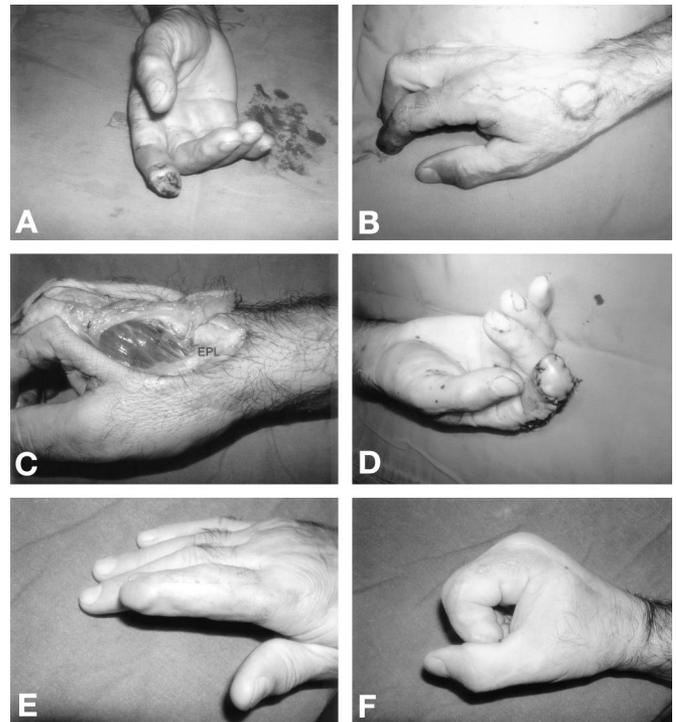
Reverse-flow first dorsal metacarpal artery flap is derived from the kite flap, which is an extremely reliable flap.<sup>7</sup>

**TABLE 1.** Details of Patients Who Had Operations

Case	Age	Sex	Occupation	Cause	Lesion	Flap Size	Additional Procedure	Result
1	38	M	Furniture maker	Milling machine	Left hand, distal phalanx of index finger amputated at 1/2 level	3 × 3 cm		Good
2	32	M	Farmer	Agricultural machine	Right hand, two thirds of index finger distal phalanx amputation	3 × 2 cm	Nerve coaptation	Partial necrosis
3	18	M	Iron worker	Press	Right hand, half of distal phalanx of index finger amputation and third-finger distal phalanx crush injury	3 × 2 cm	Nerve coaptation	Good
4	28	M	Carpenter	Plane	Left hand, ulnar side tissue loss of distal phalanx of index finger	3 × 1 cm		Good
5	54	M	Driver	Motor strap	Right hand, half amputation of distal phalanx of index finger	3 × 3 cm	Nerve coaptation	Good
6	30	M	Butcher	Knife	Left hand, radial-side tissue loss of distal phalanx of index finger	3 × 1 cm		Good
7	21	F	None	Crush injury	Right hand, amputation of total distal phalanx	3 × 2 cm		Good
8	32	M	Carpenter	Plane	Right hand, dorsal skin, tendon and partial bone loss of distal and middle phalanx	3 × 5 cm		Good



**FIGURE 2.** (Case 3) A, The index finger was amputated at the level of the nailbed, and third finger distal phalanx was crushed. B, The flap was planned at the level of the dorsal wrist crease. C, Intraoperative view of the flap. D, Perioperative view of the flap with the pedicle skin grafted. E, Well-healed fingertip at 4 months postoperatively. F, The finger flexion was full, with patient satisfaction.



**FIGURE 3.** (Case 5) A, Index finger amputated just proximal to the nailbed 2 weeks before. B, Flap designed at the level of the dorsal wrist crease. C, Close-up view of the emergence of the dorsal radial artery (EPL, extensor pollicis longus tendon). D, Perioperative view of the flap. E, Preoperative view of the flap. E, F, Postoperative fifth-month view of the patient with full flexion of the finger.

First dorsal metacarpal artery is a constant and reliable artery supplying both direct-flow and reverse-flow flaps.

Oberlin et al<sup>15</sup> first confirmed the existence of a vascular anastomosis between the dorsal and palmar networks, and Dautel and Merle<sup>16</sup> have first shown in cadaver dissections that reverse island flaps could be elevated on dorsal metacarpal arteries, and Maruyama<sup>5</sup> has first performed the reverse dorsal metacarpal artery flap clinically.

Although the second dorsal metacarpal artery is larger in diameter than the first, the entire length of the second dorsal metacarpal artery cannot be mobilized up to its origin at the dorsal arch because of the crossing over of the extensor tendons.<sup>7</sup>

Reverse dorsal digital or metacarpal flaps are reliable, with ample tissue available, and do not require the sacrificing of a digital artery. Dissection of the flap is a straightforward, 1-stage procedure, and immobilization of the finger is minimal. It can be used for both volar and dorsal oblique fingertip defects. It may be elevated as a sensorial flap if the dorsal digital branch of the radial nerve is included.

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