The first dorsal metacarpal artery flap was used in 23 patients for coverage of soft tissue hand defects. This flap was used as a fasciocutaneous flap or as a fascial flap. Vascularized periosteum or tendon can also be raised with the flap. (J Hand Surg 1994;19A:32-38.)

Coverage of soft tissue hand defects often requires a skin flap. Distant flaps have been extensively used in hand coverage either as tube pedicle, direct random, or axial flaps. Prolonged immobilization and the dependent position encourage hand edema and joint stiffness. Microvascular transfer of free flaps is a lengthy procedure and is recommended when local tissue is not available. Local flaps derived from tissue adjacent to the primary defect have a better match regarding skin quality, thickness, and color. The operation can be done in a single stage with minimal immobilization of the hand. The dorsal index skin has been widely used for thumb resurfacing either as a pedicled flap or as an island flap. Based on our anatomic study of the first dorsal metacarpal artery (FDMA), this flap has been used in 23 patients for coverage.

**Materials and Methods**

Starting from July 1986, 23 FDMA flaps have been used for hand coverage. Twelve were done at the Kuwait Red Crescent Hospital for treatment of Afghan refugees in Peshawar, Pakistan. The remaining 11 patients were operated on at Ain Shams University Hospital, Cairo, Egypt. Nineteen patients were male and four were female, age range 2-40 years. The flap was used as a fasciocutaneous flap in 18 patients and a fascial in 5 (Table 1). In five of the fasciocutaneous flaps, the FDMA was used in an island design. The anatomic location and indication of these flaps is shown in Table 2.

In three of the patients with fasciocutaneous flaps, a vascularized tendon was incorporated in the

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<th>Table 2. Anatomical Indication of Proximally Based FDMA Fasciocutaneous Flaps</th>
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<td>First web space reconstruction</td>
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<td>Posttraumatic</td>
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<td>Thumb dorsal surface</td>
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<tr>
<td>Electric burn*</td>
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* Vascularized tendon included with the flap.
Figure 1. (A) Electrical burn of the left thumb with loss of the extensor pollicis longus tendon and open metacarpophalangeal joint. (B) Design of a proximally based pedicled flap (dotted line). The dashed line presents the extensor indicis proprius tendon to be raised with the flap. (C) Pedicled FDMA fasciocutaneous flap. The underlying extensor indicis proprius tendon is included in the flap. The FDMA is seen shining through the fascia in the proximal part of the flap. (D) Postoperative view. (E) Late postoperative view.
flap (Table 2). The extensor indicis proprius was used in one patient with burned extensor pollicis longus over the metacarpophalangeal joint of the thumb (Fig. 1). The extensor digitorum communis for the index was used in two patients with lost long or ring finger extensor tendon at the metacarpophalangeal joint (Fig. 2).

In one patient, the flap was used as a reversed flow fasciocutaneous flap for coverage of a contracted first web space. In this patient, the dorsal interosseous (IO) fascia was raised with the overlying skin graft applied 10 months before. This graft was used for coverage of the dorsum of the hand following deep thermal burn. The fasciocutaneous flap was advanced in a V-Y manner, and a split thickness skin graft was applied to the proximal defect.

The flap was used as a fascial flap in five patients with a primary skin graft over the fascia. In two of these patients, the fascia was transposed to cover the exposed nearby metacarpal. In the remaining three patients, the flap was used as a reversed flow flap to cover (1) exposed bone at the ulnar side of the index proximal phalanx, (2) exposed index metacarpophalangeal joint after capsulectomy in a post-burn hand, and (3) an index amputation stump (Fig. 3). In this patient, the radial nerve was sutured to the ulnar digital nerve of the index to restore sensation over the amputation stump.

Pedicled Flap

After checking the pulse of the radial and ulnar branches of the FDMA (FDMAr and FDMAu) against the first and second metacarpals, the flap is drawn over the dorsum of the index, thumb, or back of the hand according to the position of the skin defect. The proximally based flap is rotated around the point of origin of the artery at the base of the first IO space. The flap can be used to cover the thumb, either palmarly or dorsally, the ulnar surface of the dorsum of the hand, and the wrist, as well as the palm up to the third metacarpal. The flap easily reaches the proximal part of the thumb almost to its tip (Fig. 4).
Figure 3. (A) Amputation stumps after mine blast injury with exposed proximal phalanx at the index stump. (B) Diagrammatic presentation of distally based FDMA fascial flap. Skin flaps were raised to expose the dorsal interosseous fascia, the FDMA, and the superficial radial nerve branches. (C) Intraoperative view. Distally based dorsal interosseous fascia is raised including the radial nerve. (D) Early postoperative view (5 days postoperatively). (E) Postoperative view (3 weeks postoperatively).
Figure 4. (A) Thumb avulsion injury with exposed tendon over most of its palmar surface. (B) Island flap raised from the dorsal surface of the index to cover the palmar surface of the thumb. The remaining skin has been cut longitudinally on the lateral surface of the thumb for about $\frac{1}{2}$ cm to avoid pressure on the pedicle. Skin flaps are raised to expose the pedicle of the flap. (Figure continues)

The skin over the first web space is not included in the flap. When this skin is raised with the flap, the flap should be enlarged ulnarily towards the third metacarpal so that this skin extension lies on the web space to avoid grafting with secondary contracture of the space.

Under tourniquet control, the flap is elevated, from distal to proximal, superficial to the extensor tendon paratenon. At the second metacarpal neck a large perforator is always present and should be ligated.

If the flap is used as a transposition flap (as for web space reconstruction), the IO fascia is released from both the first and second metacarpals taking care to avoid injury to FDMAu.

Island Flaps

An S-shaped skin incision over the first dorsal IO muscle is used for an island flap. The skin flaps are dissected subdermally to the level of the metacarpal bones preserving the superficial veins and the deeper radial nerve with its accompanying artery in the pedicle of the flap. The IO fascia is then released from the metacarpal and is included with the flap. No perforating vessels are seen during elevation of the fascia from the muscle. The fascia is released from the bone until the flap can reach the defect without tension, protecting the FDMA, which can be seen through the fascia. A subcutaneous tunnel is then developed, and the flap is rotated without twisting the pedicle. The pedicle can be compressed at the thumb interphalangeal joint; it is thus preferable to elongate the skin portion of the flap proximally and open the lateral side of the thumb to avoid pressure on the pedicle. When an extensor tendon is included in the flap, care is taken to avoid injury to the paratenon or disruption of the fine vessels supplying the tendon.

Reversed Flow Flaps

For reversed flow fascial flaps, the fascia is exposed as in the island flap. The FDMA is ligated at its origin from the radial artery. The IO fascia is
Figure 4. (continued) (C) Intraoperative view—FDMA island fasciocutaneous flap. The flap is reaching almost to the tip of the thumb. (D) Postoperative view.

The donor defect of the fasciocutaneous flaps was covered by a split-thickness graft in 13 patients and a full thickness graft in 2 young female patients. In three patients, primary closure of the defect was possible.

Results

In the 18 patients with fasciocutaneous flaps, there was no flap necrosis, even when bleeding was scanty from island flaps at the time of tourniquet release.

The skin grafts applied to the donor area were satisfactory, including a full thickness graft in two young females. Finger extension was excellent in patients with tendon transfer. Patients were allowed to move their hand freely 3 weeks after the operation. No hand therapy program was used after the transfer. One patient complained of hair growth on the thumb palmar surface and was treated by electroepilation.

Discussion

The vascularity of the FDMA flap is maintained if the whole IO fascia is included. This avoids the need for meticulous dissection of the artery or raising the flap on a nondominant branch. The flap is useful for coverage of full thickness defect in the hand. Its elevation does not sacrifice a major arm artery like radial or the ulnar artery flaps, nor does it require the tedious dissection for the posterior interosseous artery flap.

As an island sensory flap, the FDMA flap has proved to be very useful in resurfacing of distal palmar defect of the thumb as noted by Small and Brenner. This contradicts previous claims that the flap cannot reach beyond the middle of the thumb distal phalanx. To accomplish this, release of the IO fascia from the metacarpal down to the origin of the artery in the apex of the IO space is required.
In first web space reconstruction, the FDMA flap has been used in minor, moderate, and major contractures. The flap is the method of choice in severe contractures where release results in an uneven surface with exposed tendons, nerves, and vessels. Splints were not applied in these patients, and there was no recurrence of the contracture. In minor contractures, the donor area could be directly closed by simple sutures.

The extensor tendons in the intermetacarpal region are supplied through the paratenon. This vascularized tendon graft can be transferred with the flap. This technique was used three times in this series with satisfactory finger extension.

Inclusion of the radial nerve in the reversed flow fascial flap increases the versatility of this flap. However, flap sensation was not adequately tested in this series, which consists of Afgan rebels (Mogahedeen), farmers, and manual workers. Once cured of their skin defects, these patients were not usually available for follow-up visits.

Although split-thickness skin graft over the donor area of the flap provides a satisfactory cover, a full-thickness graft was used in young female patients for a better color match. Grafts applied over the metacarpophalangeal joint were not lost contrary to the results of Small and Brenner. A single complication of the FDMA flap in this series was hair growth over the palmar surface of the thumb.

References