The Reverse Cross Finger Flap

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The reverse cross finger flap is usually performed on patients with deep dorsal digital skin, nailbed, and extensor tendon injuries that cannot be repaired and grafted. These patients will require additional dorsal digital flaps from the adjacent fingers. *(J Hand Surg Am. 2016;41(1):122–128. Copyright © 2016 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Cross finger, flap, reconstruction, reverse, subcutaneous.

The principle of the reverse subcutaneous tissue transfer was introduced in 1973[1] to cover a heel defect. In 1978[2] this principle was used to cover an exposed distal interphalangeal (IP) joint. Since 1979 this procedure has been used successfully by the current author's practice in many cases of digital injuries with avulsion of full-thickness dorsal skin and extensor tendon injuries, to support skin graft and cover exposed bone, joints, and the nailbed.

The reverse cross finger flap is technically more difficult than the regular cross finger flap.

INDICATIONS AND CONTRAINDICATIONS

The reverse cross finger flap is indicated in these situations:

1. Reconstruction of an eponychial skinfold and coverage of an exposed extensor tendon near the IP joint
2. Reconstruction of large, full-thickness, sterile matrix nailbed defects with exposed distal phalanx
3. Coverage of a contused, repaired, or grafted extensor tendon denuded of paratenon
4. Boutonniere deformity with poor-quality skin over the proximal interphalangeal (PIP) joint after burn or avulsion injury
5. Full-thickness coverage of complete avulsion of the nailbed, germinal matrix, and surrounding skin of digits. In such an injury of the index finger, the alternative procedure is a cross thumb to index flap.[3]
6. As an elective case to correct a deformity of the digit and apply a reverse cross finger flap

There are no contraindications except extensive dorsal skin loss and injuries to the adjacent digits.

SURGICAL ANATOMY

Preferred donor areas are the dorsal aspect of the middle and proximal phalanges of the adjacent fingers. Because of the thinness and lack of adequate subcutaneous tissue at the dorsum of the distal IP and PIP joint areas, these regions are not satisfactory, and if possible they should be avoided.

SURGICAL TECHNIQUE

Axillary block or regional anesthesia and arm tourniquet are preferred, depending on the patient's condition. After routine preparation and draping of the upper extremity, a properly located, sized, and designed flap is marked. This is usually obliquely located at the dorsum of the middle phalanx about 1 cm longer and about 4 to 5 mm wider than the defect. Under loupe magnification, a thin full-thickness skin flap with intact subdermal vascular plexus is elevated based on the

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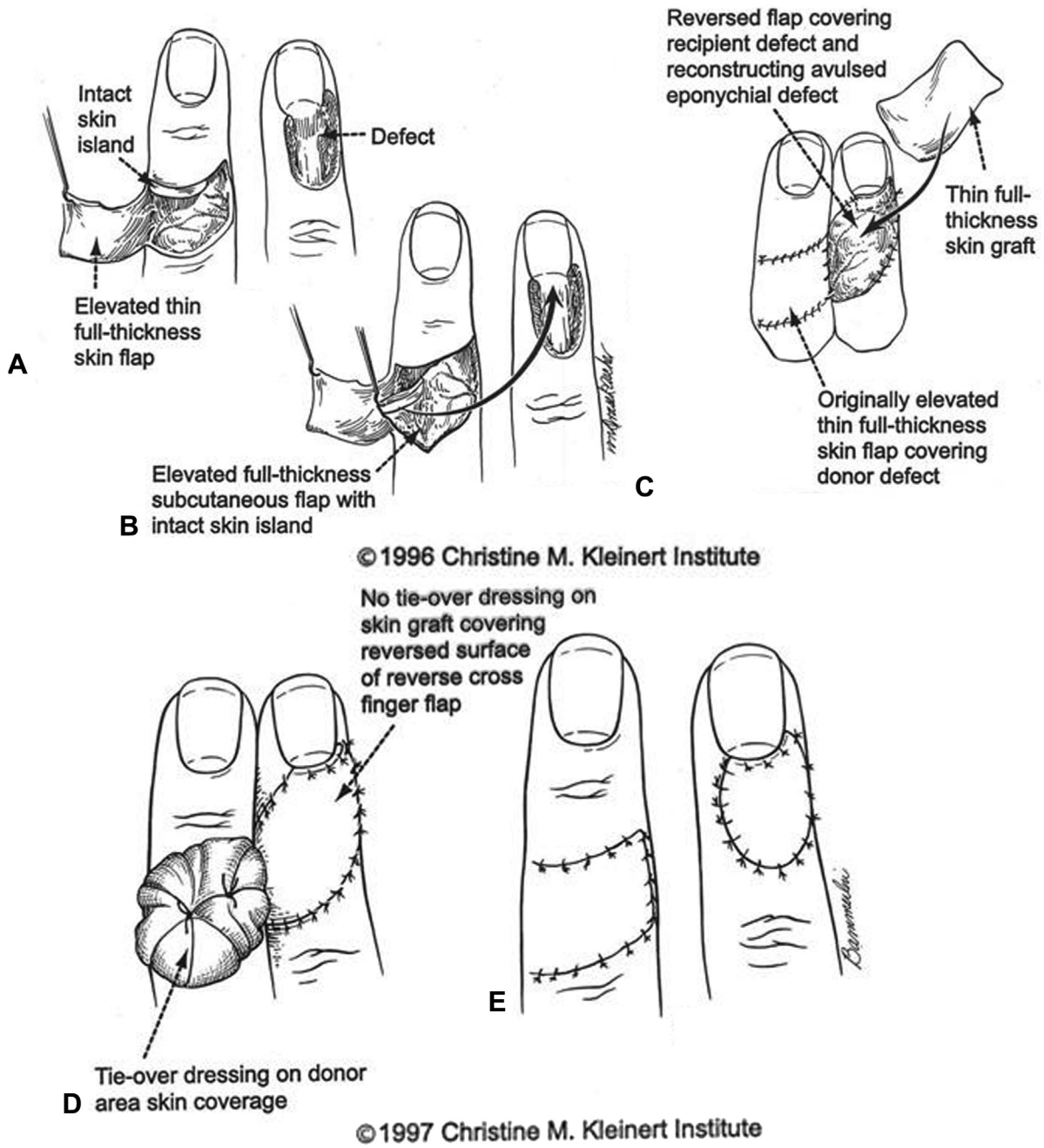

FIGURE 1: A–C Eponychial skinfold reconstruction and coverage of nail root and exposed extensor tendon with de-epithelialized reverse cross finger flap. After reversing, the preserved small oblique skin island forms the inner surface of the eponychium, as demonstrated in (B). **D** Tie-over dressing on donor skin graft site. There ws no tie-over dressing on the skin graft covering the reversed surface of the reverse cross finger flap. **E** Division of flap in 14 days. **F** Reconstruction of eponychial skinfold and coverage of exposed extensor tendon near the distal IP joint. Elevation of thin full-thickness skin flap in the opposite direction. Note the intact small oblique skin island on the dermal flap, which will form the inner surface of the future eponychial skinfold. **G** Reversed subcutaneous flap covering the defect and original full-thickness skin flap on the donor area. **H** Suturing the original skin flap to the donor site and full-thickness skin grafting on the reversed surface of the flap. **I** Tie-over dressing only on the donor area skin graft. There is no tie-over dressing on the recipient site skin graft. **J, K** Normal extension and flexion are demonstrated at 1-year follow-up. Satisfactory coverage is evident. The full nail graft has some deformity owing to germinal matrix injury at the time of the original accident.

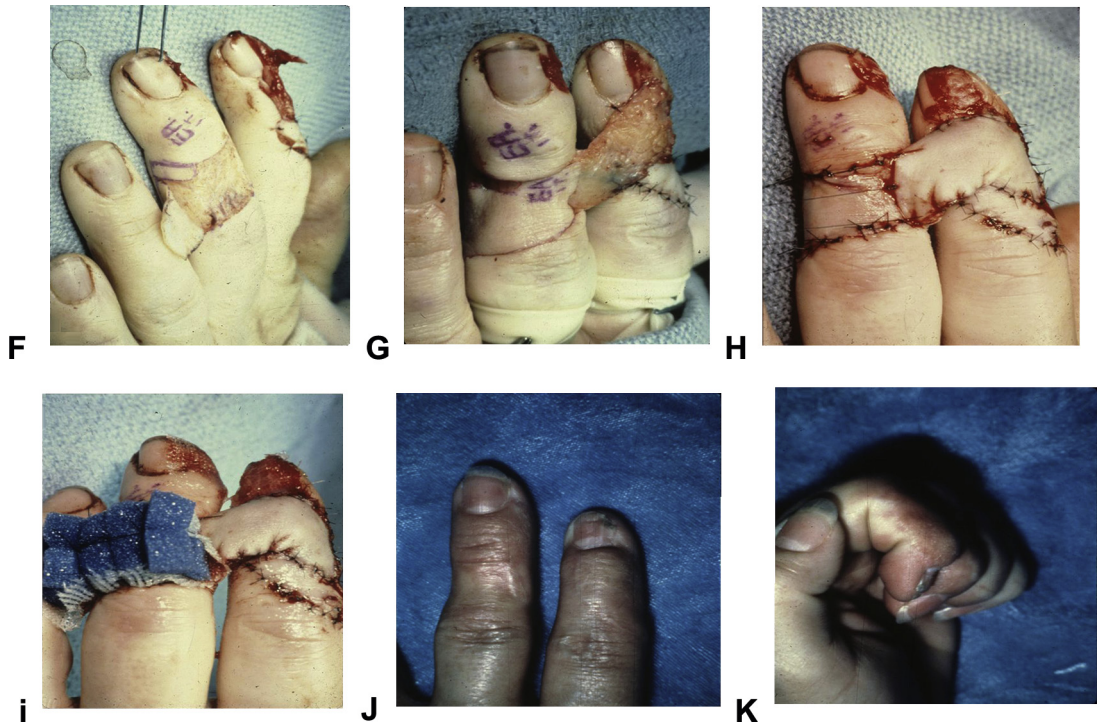

FIGURE 1: (continued).

opposite side of the uninjured finger (Fig. 1A, B). If the patient has an area with loss of eponychial skinfold, a piece of oblique-shaped skin island is left at the distal edge of the subcutaneous flap (Fig. 1A, B).

After reversing the subcutaneous flap with this intact oblique skin island, the skin island will form the inner surface of the eponychium, as demonstrated in Figure 1A to C. This elevated subcutaneous flap with intact skin island is now sutured to the defect. The flap is elevated at the level of the extensor paratenon and dorsal veins and blood supply are preserved in the flap.

The originally elevated, thin, full-thickness skin flap is then sutured back to cover the donor defect and a tie-over dressing is applied (Fig. 1D). After obtaining good hemostasis, the reverse surface of the thin subcutaneous flap on the injured finger is covered with a thin full-thickness skin graft without a tie-over dressing (Fig. 1D–K).

POSTOPERATIVE MANAGEMENT

After the procedure, a soft dressing and orthosis are applied to the surgical site. Extremity elevation in a sling is important. The orthosis, dressing, and sutures are removed in about 2 weeks and the flap is divided between the fingers under local anesthesia.

CASE ILLUSTRATION

The reverse cross finger flap can be used as an elective case (Fig. 2A–E). This patient previously underwent a surgical procedure to correct reduplication of the right thumb at a different facility. After this first surgery the patient developed contracture and ulnar deviation of the IP joint of the right thumb. Correction of the problem was accomplished by releasing the IP joint contracture and reconstructing the ulnar collateral ligament with a piece of extensor tendon, and reconstructing the new extensor tendon of the thumb with the remaining part of the extensor tendon, and covering the skin defect with a reverse cross finger flap from the radial dorsal side of the first web space (Fig. 2A–J).

If a patient has a large defect of the nailbed sterile matrix with exposed distal phalanx with no periosteum, construction of the nailbed can be performed with this described method, as seen in Figure 3A to N.

Large nailbed defects can be reconstructed with a reverse cross finger flap from the dorsum of the adjacent finger. Excellent nail growth was obtained (Fig. 4A–D).

If a patient has large amount of skin loss at the dorsum of the finger with a lacerated exposed extensor tendon, the extensor tendon is repaired first

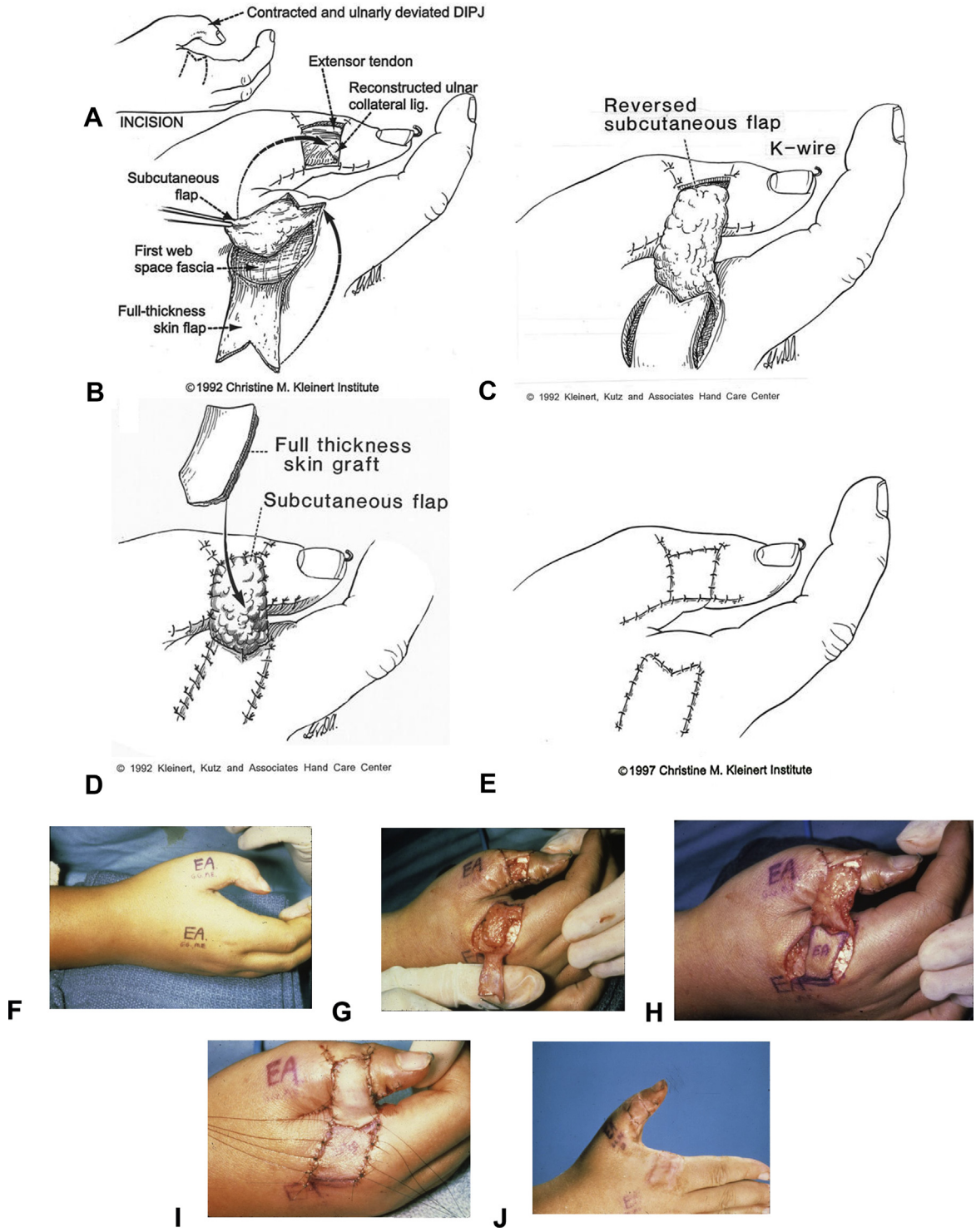

FIGURE 2: A, B Another use of the reverse cross finger flap to cover the skin defect after reconstructing a duplicated right thumb at the ulnar side of the IP joint with an exposed extensor tendon graft and reconstructed ulnar collateral ligament. Design of flap, elevation of thin full-thickness skin flap, and subcutaneous flap in opposite directions at the dorsum of the first web space. DIPJ, distal IP joint. **C, D** Covering the defect with the original skin flap, reversing the subcutaneous flap, suturing the original skip flap to the donor area, and using full-thickness skin grafting to the reversed surface of the flap. **E** Dividing the flap. **F** Preoperative appearance of contracted, ulnarly deviated, thin-looking thumb after previous surgery for duplication. **G** Correction of deformity and extensor tendon graft, and ulnar collateral ligament reconstruction. Coverage of defect with reverse cross finger flap from dorsum of first web space. Full-thickness skin flap and subcutaneous flap are elevated in opposite directions. **H** Skin flap on donor site and subcutaneous flap on defect. **I** Full-thickness skin graft on reversed surface of reverse cross finger flap (no tie-over dressing); the original skin flap covers the donor site and prepare for tie-over dressing. **J** Three weeks after surgery following flap division and set-in.

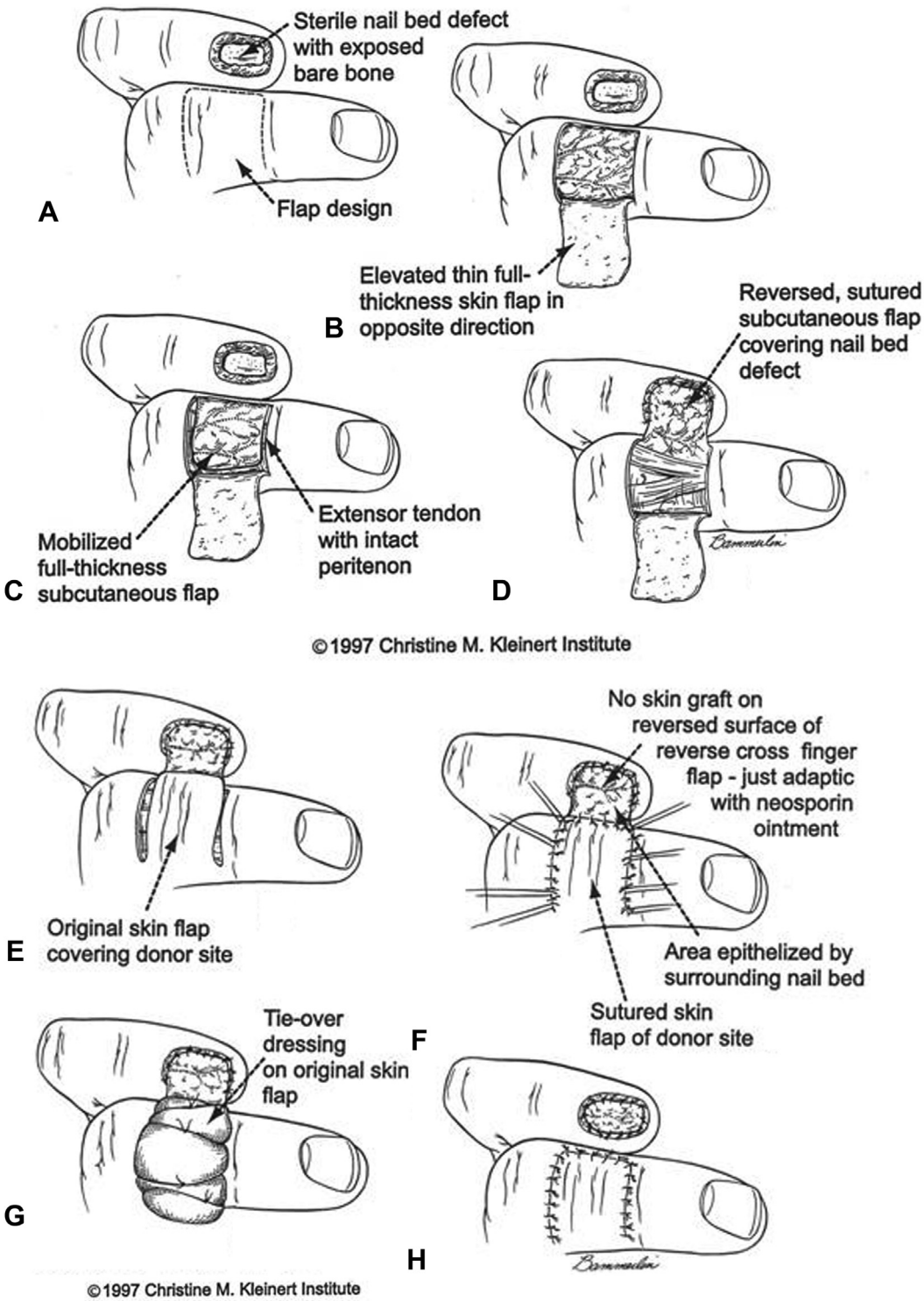

FIGURE 3: **A** Coverage of exposed distal phalanx and reconstruction of large nailbed defect. Design of flap on middle phalanx. **B** Elevation of thin full-thickness skin flap in opposite direction. **C** Elevation of full-thickness subcutaneous tissue off paratenon from donor digit adjacent to recipient finger. **D** Reversing the subcutaneous flap and suturing along the nailbed defect with 6-0 or 7-0 cat gut or absorbable, synthetic, braided suture. **E–G** Coverage of donor defect with the original skin flap; suturing and preparing for the tie-over dressing. There is no skin grafting to the reverse surface of the flap. **H** Division of flap in 10 to 14 days.

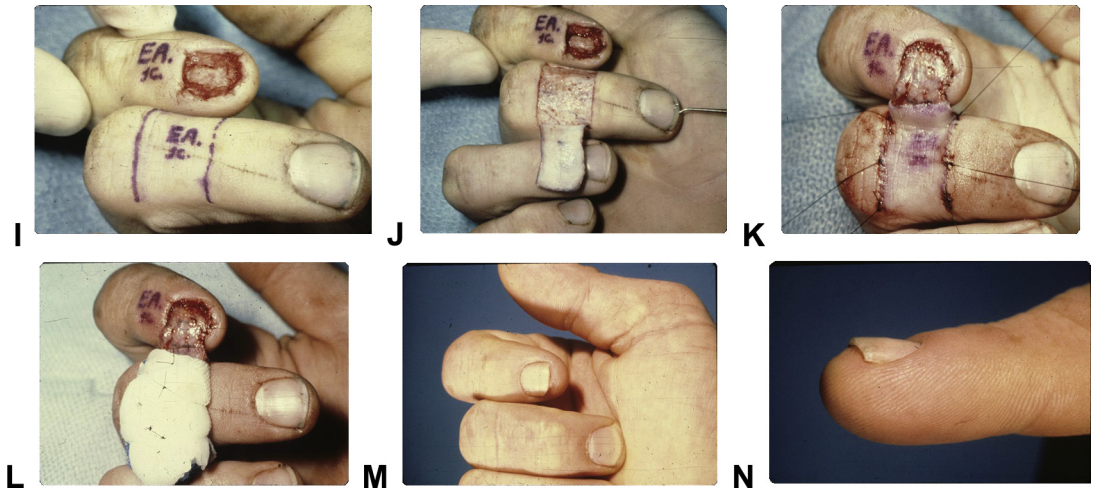

FIGURE 3: (continued). **I** Coverage of exposed distal phalanx and reconstruction of nailbed defect. There is a large defect on the index finger nailbed. Flap design. **J** Elevation of full-thickness skin flap and full-thickness subcutaneous flap based in opposite directions. **K** Flap sutured on defect; the original skin graft covers the donor site. **L** Tie-over dressing on original skin graft. There is no skin graft on the reverse cross finger flap. It should be left to be epithelialized by the surrounding nailbed for better adherence of the growing nail. **M, N** At 1-year follow-up, there is excellent nail growth with good adherence to the nailbed. (Figures 3I and 3L were reprinted with permission from: Atasoy E. Reversed cross finger subcutaneous tissue flap. In: Strauch B, Vasconez LO, Grabb WC, Hall-Findlay EJ. *Grabb's Encyclopedia of Flaps, Volume 2*. 1st ed. Boston, MA: Little, Brown and Company; 1990:932-935.[4])

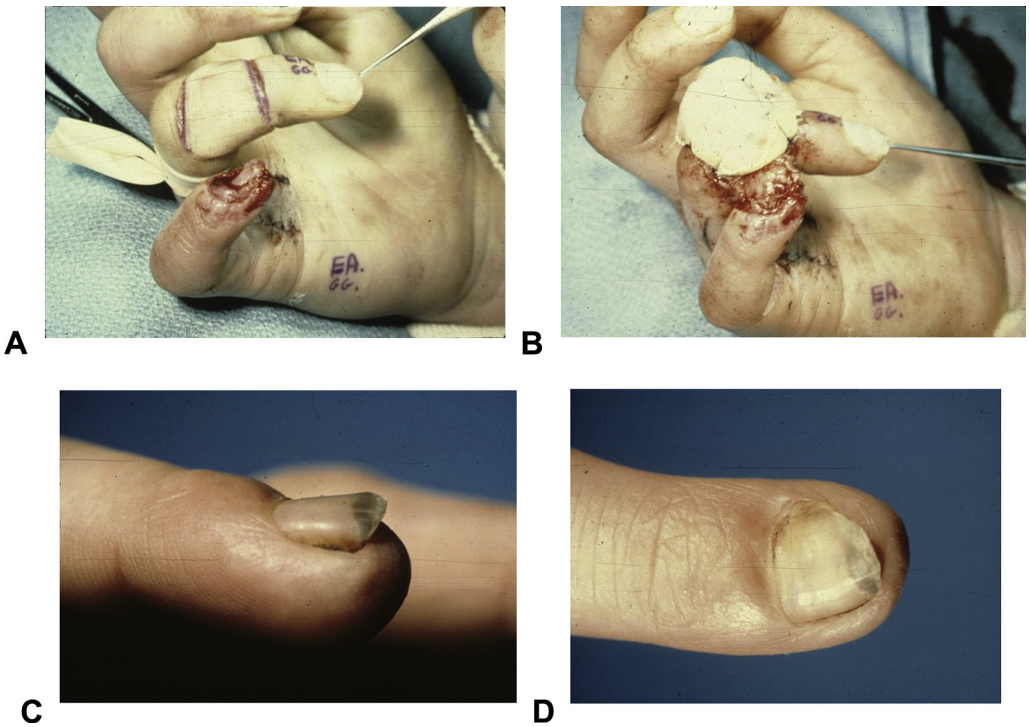

FIGURE 4: **A** Coverage and reconstruction of nailbed in another case of large nailbed defect with exposed phalanx of the little finger. Incision marking on the ring finger. **B** Reversed flap sutured to cover the defect and tie-over dressing on the donor site skin graft. There is no skin graft on the reversed flap. **C, D** Satisfactory nail growth (18 months after surgery).

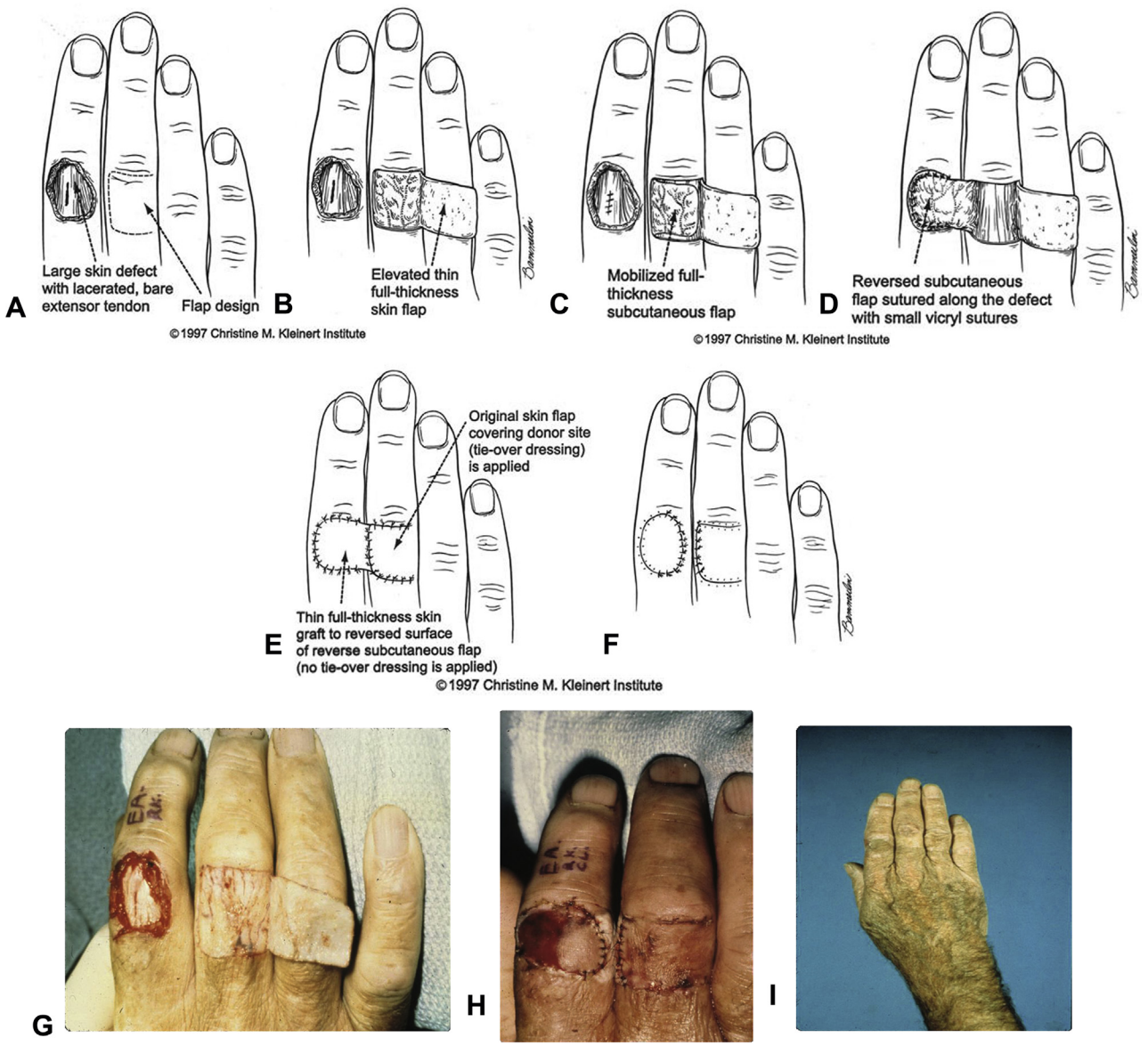

FIGURE 5: **A** Coverage of lacerated bare extensor tendon and a large skin defect on the PIP joint with a reverse cross finger flap. Marking of flap. **B**–**D** Raising of thin full-thickness skin flap and full-thickness subcutaneous flap in opposite directions. Repairing the extensor tendon and suturing the reversed flap along the skin defect. **E** Covering the donor defect with the originally raised skin flap and full-thickness skin grafting to the reversed surface of the subcutaneous flap and tie-over dressing only on the originally raised full-thickness skin flap. **F** Division of flap in 12 to 14 days. **G** Full-thickness skin loss with lacerated denuded extensor tendon of index finger near PIP joint. The thin full-thickness skin flap was raised in the opposite direction, exposing subcutaneous tissue. **H** Elevated full-thickness subcutaneous flap covering the defect and original skin graft covering the donor site. **I** Satisfactory coverage (6 months after surgery). (Figures 5G and 5I were reprinted with permission from: Atasoy E. Reversed cross finger subcutaneous tissue flap. In: Strauch B, Vasconez LO, Grabb WC, Hall-Findlay EJ. *Grabb's Encyclopedia of Flaps, Volume 2*. 1st ed. Boston, MA: Little, Brown and Company; 1990:932-935.[4])

and then a reverse cross finger flap is used to cover the defect, as seen in Figure 5A to I.

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