

## CASE REPORTS

# Versatility of the Cross-Finger Flap for Reconstruction of the Thumb

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## Abstract

The thumb is responsible for 40% of the hand function. Therefore, when resurfacing of the thumb is required, cross-finger flap may prove very useful. In this paper, we reported three cases where cross-finger flaps were used successfully in order to cover soft tissue defects of the thumb's distal phalanx. No major complications were encountered. All patients were satisfied with the cosmetic aspect of the reconstruction procedure (9 on VAS). All the fingers were fully functional, with a mean TAM score of 266° for the donor fingers and a mean DASH score of 2.16 after 1 year from injury. Using this technique, we obtain good quality soft and bulky tissue to restore the original form of the thumb in order to prevent function loss by reducing length and primary suture of the finger. Therefore, we consider this method very effective in covering vital structures with almost no morbidity related to the donor site. Alongside other previous papers describing this technique, we concluded that the cross-finger flap is a versatile reconstruction procedure.

**Keywords:** cross-finger flap, thumb reconstruction, fingertip amputation, dorsal flap, soft tissue defect

## Rezumat

Policele este responsabil de 40% din funcția mâinii. Așadar, în situația în care este necesară refacerea suprafeței digitale a acestuia, lamboul de tip cross-finger poate fi extrem de util. În această lucrare, vă prezentăm trei cazuri în care aceste tipuri de lambouri au fost utilizate pentru a acoperi cu succes defecte de părți moi ale falangei distale a policelui. Nu au fost înregistrate complicații majore. Pacienții au fost satisfăcuți de rezultatul estetic al acestui tip de procedură (9 pe scala VAS). Degetele și-au recăpătat funcționalitatea complet, cu o medie a scorului TAM de 266° și a scorului DASH de 2.16 după un an de la evenimentul inițial. Utilizând această tehnică, am obținut un țesut de acoperire suplu, de calitate și de volum adecvat pentru a restabili forma inițială a policelui fără a pierde din lungime și a recurge la sutura primară. Așadar, considerăm această metodă în acoperirea structurilor vitale extrem de eficientă, asociată cu o morbiditate aproape inexistentă la nivelul zonei donoare. Așa cum a fost demonstrat și în alte lucrări din literatura de specialitate, prin cazurile prezentate în această lucrare confirmăm versatilitatea lamboului de tip cross-finger.

**Cuvinte cheie:** lambou tip cross-finger, reconstrucția policelui, amputație digitală apicală, lambou dorsal tip steag, defect de părți moi

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## INTRODUCTION

It is well known that the thumb is responsible for 40% of the hand function. Therefore, preserving its length and mobility represents the main objective of the plastic surgeon while choosing the most appropriate reconstruction technique<sup>1</sup>. When resurfacing of the fingers is needed after hand injuries, cross-finger flaps have proved themselves very useful<sup>2</sup>. Since its premier many years ago<sup>3</sup>, this type of flap remains an elegant method in order to cover exposed bones or tendons of the finger, in order to ensure length preservation and function recovery. There are other techniques available, such as V-Y advancement flap, Moberg's volar flap, Littler's flap, distal pedicle flaps, bone shortening followed by primary suture, skin grafts, healing by secondary intention, which are usually used for fingertip reconstruction or distal phalanx<sup>4</sup>. Finger injuries are associated with morbidity and loss of function. Therefore, a stable and durable replacement for the lack of soft tissue covering is decisive for a functional finger<sup>1</sup>. In order to provide quality tissue, a cross-finger flap may be designed and performed, due to its efficiency and reliability in terms of resuming patient's daily activities, as previous studies have revealed<sup>1,3</sup>. In this paper, we reported three cases where cross-finger flaps were used successfully in order to cover soft tissue defects of the thumb's distal phalanx.

## MATERIALS AND METHODS

A two-stage reconstruction procedure was performed in two males and one female with transverse and oblique fingertip amputations of the thumb in order to regain its functionality (Figure 1, 2). During the first stage, a cross-finger flap was designed on an adjacent finger and harvested from the dorsal part of the middle phalanx in one case and the proximal and middle phalanx in the other two cases (Figure 3). The flap was harvested above the paratenon and sutured to the injured thumb, while a dorsal hinge was preserved to ensure the blood supply of the flap. The secondary defect on the dorsal part of the donor finger was covered using a full-thickness skin graft harvested from the medial side of the ipsilateral arm (Figure 4). A tie-over dressing was used to cover the skin graft, while a bulky dressing and a volar splint covered and protected the thumb from accidental injuries. Regular dressing was performed and protective splinting was maintained for three weeks. After 21 days the second stage of the reconstruction procedure was performed in order to divide the cross-finger flap. Splinting was maintained for another three days, followed by active and passive

movements of the fingers. The suture material was removed after 12 days. Physiotherapy and scar care was prescribed after the splint was removed. The following aspects were evaluated: occurrence of complications, Disability of Hand Arm and Shoulder score (DASH), Total Active Motion score (TAM), cold discomfort and patient satisfaction (0 to 10 on a Visual Analogue Scale - VAS).

## RESULTS

During the postoperative follow-up, in one case a limited area of epidermolysis at the tip of the flap was observed (Figure 5) which was treated using antiplatelet and vasodilator therapy for five days. No other complications such as infection, wound dehiscence, donor site morbidity, necrosis of the flap, severe joint stiffness or extension lag were encountered (Figure 6, 7, 8, 9). There were no signs of cold sensitivity, neuroma or neuropathic pain in none of the three cases. All patients were satisfied with the cosmetic aspect of the reconstruction procedure (9 on VAS) (Figure 10). All the fingers were fully functional, with a mean TAM score of 266 for the



**Figure 1.** Intraoperative aspect of the soft tissue defect located on the radial aspect of the thumb.



**Figure 2.** Intraoperative aspect of the exposed bone due to partial amputation of the distal phalanx of the thumb.



**Figure 4.** Intraoperative final aspect of the cross-finger flap performed to cover the circumferential defect of the thumb.



**Figure 3.** Intraoperative aspect of the flap harvested from the dorsal aspect of the proximal and middle phalanx of the index.



**Figure 5.** Limited area of epidermolysis after 10 days from surgery.



**Figure 6.** Clinical aspect of the cross-finger flap before dividing the pedicle.



**Figure 7.** Intraoperative aspect of the flap before dividing the pedicle.



**Figure 8.** Clinical aspect of the thumb and donor finger after 1 month from surgery.



**Figure 9.** Clinical aspect of the thumb before removing the stitches after 12 days.



**Figure 10.** Clinical aspect of the thumb after one year.

donor fingers (Figure 11, 12) and a mean DASH score of 2.16 after 1 year.

## DISCUSSIONS

In this cases, the use of cross-finger flap enabled the patients to regain function and resume work after 5 weeks from injuries, with good aesthetic results. The first paper which described the cross-finger flap as a “trans-digital flap” was published in 1950 by Gurdin M. and Pangman J.W.<sup>3</sup>, followed by a series of papers referring to the cross-finger flap as a versatile reconstruction procedure published by Hoskins DH, Gaul SJ, Joshi BB, Atasoy E, Robins TH, Mutaf M, Gupta A and others<sup>1</sup>. This flap can be designed in many ways in order to cover the needs of the surgeon to perform the



**Figure 11.** Clinical aspect of the donor site after one year.



**Figure 12.** Full recovery of the function with a TAM score of 268°.

reconstruction procedure. Therefore, most commonly, it can be harvested as a classic cross-finger flap (from the dorsal aspect of the finger to the lateral side of the finger, above the paratenon), reverse cross-finger flap which is usually used to reconstruct areas that are not suited for skin grafting such as bones, denuded tendons, eponychial skinfold or nail bed, as a dorsal flag flap which (with a pedicle based on the dorsal digital arteries), or as a distally based cross finger flap<sup>1,5</sup>. In some cases, multiple cross-finger flaps may be performed to cover soft tissue defects of multiple digits<sup>6</sup>. In our case, we designed the cross-finger as a dorsal flag flap in order to cover circumferential defects of the thumb and defects located on the radial side of the distal phalanx. Therefore, a large pedicle was needed to obtain the appropriate length of the dorsal flap. In one case, due to the site of the defect, the flap was harvested from the dorsal aspect of the third finger, in order to accommodate the crossed fingers in a comfortable manner (Figure 4). In some cases, the dorsal digital nerve may be isolated and transposed in order to preserve the sensitivity of the flap<sup>7,8</sup>, but in our case, due to the mechanism of trauma in accordance with the patient's wishes, we did not performed this type of procedure. Even if a cross-finger flap can be performed whenever an adjacent finger to the defect is intact, there are

some clinical conditions such as Raynaud's disease, diabetes mellitus, Dupuytren's contracture, advanced age, Buerger's disease, rheumatoid arthritis or vasospastic behaviors (smoking) which may lead to a less fortunate result like flap necrosis<sup>9</sup>. We reported in this paper one case where a limited area of epidermolysis was encountered and related to the smoking history of the patient, which he could not interrupt during treatment period. The mean operative time was one hour in all cases, with no intraoperative complications and followed by a short hospitalization period for the patient. Using this technique, we obtain good quality soft and bulky tissue to restore the original form of the thumb in order to prevent function loss by shortening of the bone and primary suture of the finger.

## CONCLUSIONS

Cross-finger flaps remains one of the best reconstructive technique in order to cover soft tissue defects of the fingers, especially of the thumb. Due to its versatility, it can be adapted to cover a large panel of defects, from volar to dorsal part, from medial to lateral aspect, from proximal to distal phalanx. Therefore, we consider this method very effective in covering vital structures with almost no morbidity related to the donor site.

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