

A comparison between reversed cross-finger flap and Quaba flap in reconstruction of proximal dorsal digital defects

Mohamed S.A. Elhoda^a, Tarek F. Keshk^a, Ahmed S. El Gamal^b,
Ahmed A. Taalab^a

Departments of ^aPlastic Surgery, ^bGeneral Surgery, Faculty of Medicine, Menoufia University, Menoufia, Egypt

Correspondence to Mohamed Salah Mohamed Abo Elhoda, MBCh, District 13, Nearby Three, 3rd Building, Sadat City, Menoufia, 32958, Egypt. Tel: 01066830110; e-mail: moha09_doc@icloud.com

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Background

The aim of the study is to compare between reversed cross-finger flap and Quaba flap in reconstruction of proximal dorsal digital defects. The hand is an important part of the body with unique characteristics that plays an indispensable role in human life. Soft-tissue defects and deformities of the hand are caused by trauma, burn, infection, and tumor. These defects if not managed properly can cause a temporary or permanent disability in the hand.

Patients and methods

This cohort prospective study was conducted at Menoufia University Hospitals from January 2018 to January 2020, with a follow-up of 6 months. The population of the study was 43 patients with proximal dorsal digital defects. We divided the cases into two groups: the first underwent reversed cross-finger flap and the second underwent Quaba flap. Follow-up was done over 6 months regarding donor and recipient site functional and esthetic outcomes.

Results

This study was done on 43 patients: 22 (51%) patients underwent Quaba flap and 21 (49%) patients reversed cross-finger flap. Thirty-seven (86%) patients in our study had posttraumatic defects and six (14%) patients had postburn deformity on dorsum of fingers. There was a statistically significant difference in incidence of complications between the two groups, in favor of Quaba flap.

Conclusions

Both reversed cross-finger flap and Quaba flap are reliable for treating small to moderate site defects and deformities on the dorsum of the fingers up to distal interphalangeal joint (DIP). However, Quaba flap has limited donor site impairments, such as contour defect and movement restrictions, in contrast to reversed cross-finger with better functional and esthetic outcome.

Keywords:

dorsal digital defects, Quaba, reversed cross-finger

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Introduction

The hand is an intricate part of the body that plays an essential role in social functioning, expression, productivity, and interactions with environment. Soft tissue envelope of the hand is a complex structure that covers the underlying structures with specialized functional and sensory components. The thick glabrous skin of the palm withstands shearing forces encountered during daily activities and provides discriminatory sensory function that transfers touch, pain, and temperature, whereas the dorsal skin is pliable and mobile that permits a wide range of motion of the hand such as fingers pinch and grip. Soft-tissue defects of the hand following trauma or tumor resection are frequently encountered in hand surgery and may result in a temporary or permanent disability if not managed appropriately [1].

The dorsum of the finger is covered by a thin skin envelope with little subcutaneous tissue, and

underneath lie the extensor tendons and bony structures. Therefore, it is crucial to achieve coverage after dorsal digital injury to protect these structures. Appropriate therapy should use local tissue whenever possible, preserve the esthetic appearance, provide stable skin coverage, minimize donor-site deformities, and preserve motor function of the finger. Therefore, the local flap from the adjacent tissue is used to reconstruct a dorsal digital defect [2].

Surgeons use reconstructions algorithms such as the reconstructive ladder, reconstructive elevator, and reconstructive matrix to determine the most appropriate type of soft-tissue reconstruction [3].

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The reversed cross-finger flap is a modified cross-finger flap with the merits of the heterodigital island flap. This approach also converts the direction of the flap elevation to a right angle, in contrast to the classical cross-finger flap method. The reversed cross-finger flap includes the digital artery opposite to the pedicle and distal arch as the communicating branch. The advantage of this is that the vascular pedicle is attached to the skin of the flap and does not require any special protection [4].

The digital artery is located in the skin pedicle and is not exposed. Therefore, it has a firm soft tissue and holds it stable. The skin connection helps to maintain the flap's distal viability, while decreasing the pedicle movement and preventing venous congestion [5].

The dorsal metacarpal artery (DMA) perforator flaps are a vascular island flaps raised on the dorsum of the hand for coverage of dorsal hand and fingers soft-tissue defects proximal to fingertips. It relies on constant distal cutaneous perforator of the DMA that rises at the level of metacarpal neck in the second to fourth intermetacarpal spaces. If the DMA is absent, the perforator arise directly at the same site, from one of the branches of the deep palmar arch [6].

DMA perforator flaps was first described by Quaba and Davidson in 1990, as the DMA flaps and variations on this flap have become popular with plastic surgeons and hand surgeons because they provided a reliable skin paddle that is well matched in quality and color. The location of this perforator allows the Quaba flap to be quite useful in local reconstruction with the ability to cover defects on the dorsum of the hand and fingers proximal to fingertips, as well as web spaces [7].

Patients and methods

This cohort prospective study was conducted at Department of Plastic, Reconstruction Surgery, Menoufia University Hospitals, from January 2018 to January 2020, with a follow-up period of about 6 months. The patient population of the study consisted of 43 patients with proximal dorsal digital defects. We divided them into two groups, the first underwent reversed cross-finger flap and the second underwent Quaba flap. They were aged from 20 to 60 years old.

Inclusion criteria were patients with dorsal digital defects proximal to distal interphalangeal joint (DIP) joint, defect size ranged from 1 to 3 cm in width and 2–6 cm in length, and availability of a healthy donor site.

Exclusion criteria were patients with a major uncontrollable medical illness, chronic heavy smokers, and traumatic injury to the donor site and perforator.

History taking, physical examination, investigations, consent of the evaluated patients, and photographs were obtained.

- (1) History: information on admission was collected concerning name, sex, age, marital status, occupation, special habits of medical importance (e.g. smoking), right or left hand, presence of other chronic illness (e.g. diabetes mellitus), mode of trauma, and time gap between the trauma and attendance to hospital.
- (2) Physical examination: physical examination of the patients was done to evaluate the general condition of the patient, examination of size, extent of the defects, exposed structures, and presence of injury to the donor site. Sterile dressing to the wound was done. Photographs and standard consents were obtained from the patients with special stress on the possibility of sloughing of the flaps and the need for a second operation.
- (3) Investigations: full laboratory investigations were done. Radiological investigations were done in the form of radiograph to detect associated fractures or fracture in metacarpal head, which may cause injury to the pedicle, and Doppler to locate the site of the perforator.

The study was approved by Menoufia University, Faculty of Medicine's ethics committee.

Preoperative preparation and operative steps of reversed cross-finger flap

Most of the injuries were dirty and contaminated with organic matters. Jet irrigation of the wounds with large amounts of saline, and then with povidone-iodine 10% in the irrigating saline. Debridement and meticulous removal of all foreign bodies and dirtiness was done (Figs. 1–3).

- (1) Antibiotic prophylaxis: it was given 1 h preoperatively as 1 g of third-generation cephalosporin direct intravenous route.
- (2) Patient positioning: the patients were placed in a supine position with extended arm on side table.
- (3) Anesthesia: the patients were operated upon under local anesthesia with/without tourniquet.
- (4) Operative procedure:
 - (a) Preoperative marking was done, where flap was designed as a rectangle on the dorsum of

Figure 1



Soft tissue defect in dorsum of proximal phalanx of Lt Index with exposed extensor tendon.

Figure 3



Setting of reversed cross-finger flap in recipient site.

proximal phalanx, limited between metacarpophalangeal joint and proximal interphalangeal joint.

- (b) Disinfection was done by povidone-iodine.
- (c) Skin was incised on proximal and distal limits of flap with lateral incision adjacent to affected finger. Skin is elevated as a full-thickness graft away from site of trauma toward opposite lateral border. Skin was now attached only to the lateral border away from site of trauma leaving subcutaneous tissue exposed. Dissection is

Figure 2



Elevation of reversed cross finger flap with preservation of paratenon of donor site's extensor tendon.

Figure 4

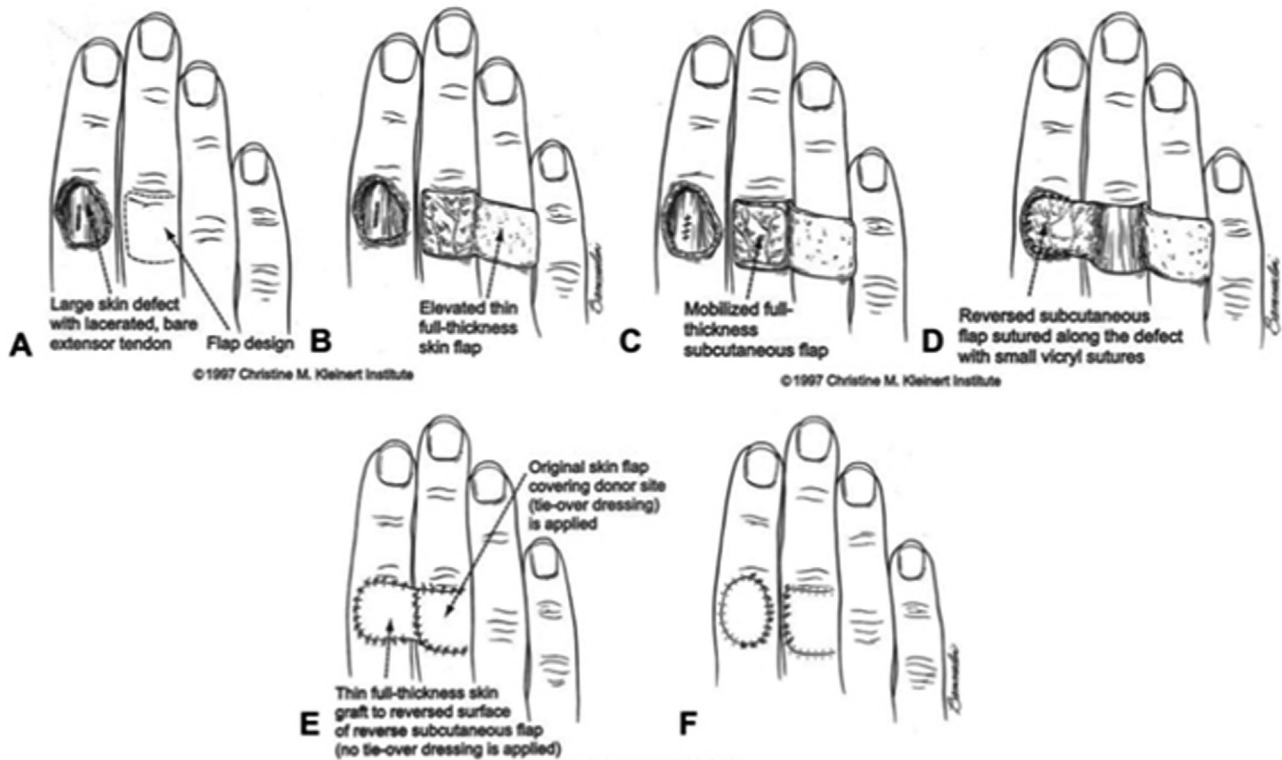


Coverage of flap with full-thickness skin graft and primary closure of donor site.

limited laterally to dorsum of finger without extension to volar surface for preservation of neurovascular bundle.

- (d) Subcutaneous tissue was incised from the far lateral border down to level of paratenon of underlying tendon. Dissection was carried to lateral border adjacent to site of trauma with complete separation of proximal and distal borders (Fig. 2).
- (e) Good hemostasis was maintained by diathermy and compression.
- (f) Subcutaneous tissue flap was turned over like an open book to cover defect. Flap is anchored by vicryl 4/0 sutures (Fig. 3).
- (g) Donor site is covered by skin elevated earlier by vicryl 4/0 sutures after meshing.
- (h) Flap was covered by full/split-thickness graft (Fig. 4).

Figure 5



Reversed cross-finger flap dissection and in setting.

Figure 6



Soft-tissue defect in dorsum of proximal phalanx of left index with exposed extensor tendon.

(i) Dressing with/without splinting was done. Coverage of bare extensor tendon and a large skin defect on the proximal interphalangeal joint (PIP) joint with a reverse cross-finger flap (Figs. 4–6). Marking of flap (b and 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 12–14 days [8].

Preoperative preparation and operative steps of Quaba flap

- (1) Antibiotic prophylaxis was given 1 h preoperatively.
- (2) Patient positioning: the patients were placed in a supine position with extended arm on side table.
- (3) Anesthesia: the patients were operated upon under general anesthesia with tourniquet on the arm without exsanguination (Fig. 6).

Operative procedure

- (1) Preoperative marking was done, where the axis of flap was marked in the midline between adjacent metacarpals and Doppler detected the perforator between their heads (1–1.5 cm proximal to the midpoint of metacarpal heads region and corresponds to the pivot point of the flap).
- (2) Disinfection was done by povidone-iodine.
- (3) An incision done on either the ulnar or the radial aspect of the proximal portion of the flap markings.
- (4) The flap was dissected between the subcutaneous tissue of the flap and the paratenon.

Figure 7



Dissection of Quaba flap over paratenon of extensor tendon with identification of Quaba perforator.

- (5) Dissection of the flap was done from proximal to distal until juncture tendinum was reached.
- (6) Dissection of the most distal portion of the flap was done, and subcutaneous tissue and fascia surrounding the perforator were freed up without skeletonization until the flap could be rotated into the defect without any kinking or tension on the perforator (Fig. 7).
- (7) Release of tourniquet was done, and hemostasis was maintained.
- (8) Flap was anchored to the defect using prolene 4/0 sutures.
- (9) The donor site was closed in two layers: subcutaneous layer by vicryl 3/0 and skin by prolene 3/0 (Fig. 8).
- (10) Dressing and splinting were done.

Figures 7–9 shows the arc of rotation and in setting of Quaba flap based on the second intermetacarpal space [7].

Figure 10 shows the DMA (Quaba) perforator distal to juncturae tendinae [9].

Postoperative follow-up

Postoperative follow-up of the flap was done to assess the viability through flap color, warmth, and capillary refill. A volar splint was made to keep the fingers and the wrist in extension. Patients were discharged on the same day and advised to keep the limb elevated. Passive physiotherapy was advised after 1 week, and sutures removed in 2 weeks, and then active physiotherapy was started after 3 weeks. Care of graft in case of reversed cross-finger was taken with antiseptic spray with good hygiene of fingers. Flap separation was done after 2–3 weeks (Figs 11 and 12).

Figure 8



Coverage of soft-tissue defect with Quaba flap with primary closure of donor site.

In case of large soft-tissue defects, Quaba flap is rotated to cover the defect without skin bridge or later separation with better esthetic outcome and without any donor site complications (Figs 13–15).

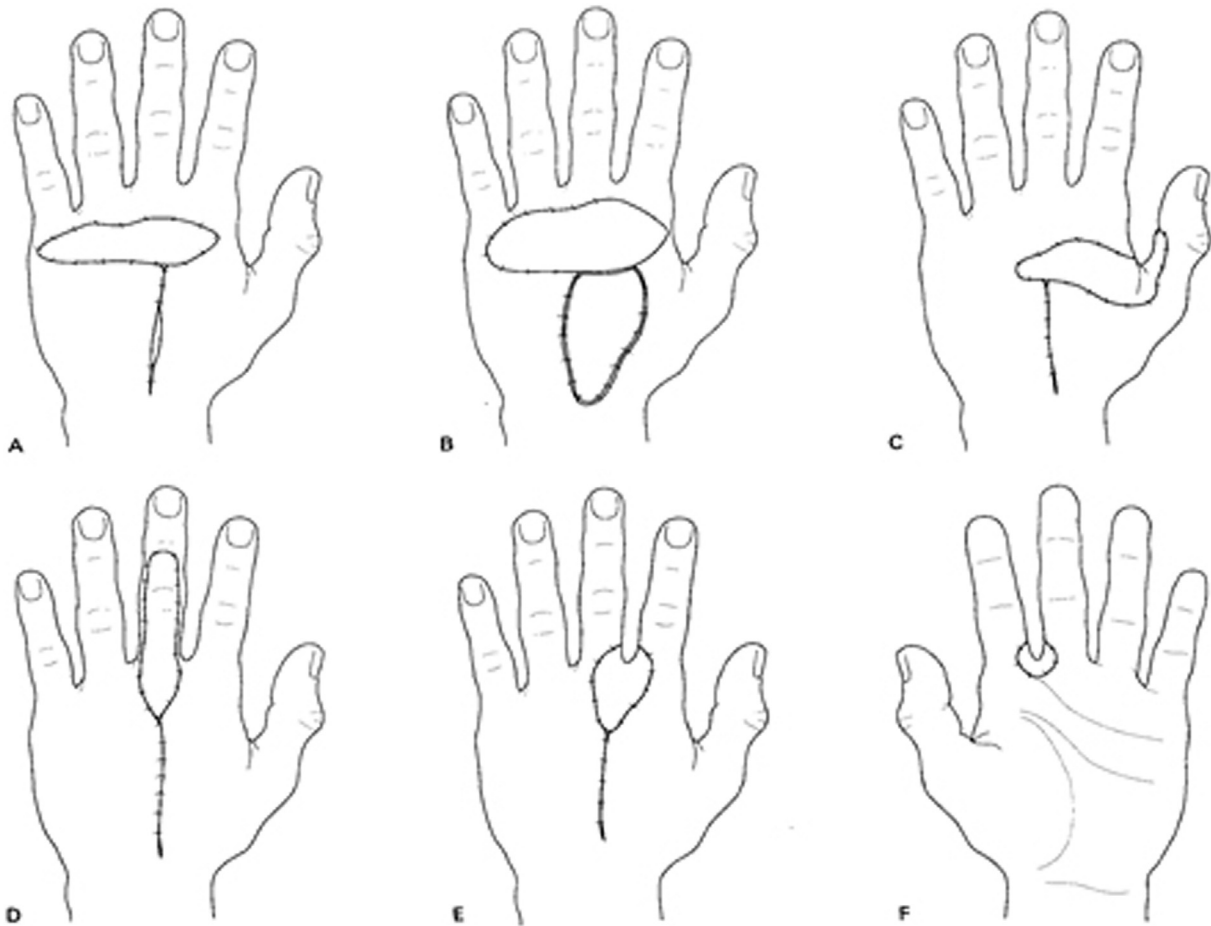
Statistical analysis

The collected data were organized, tabulated, and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 21; SPSS Inc., Chicago Ill, USA). Data were described using mean and SD and frequencies according to the type of the data (quantitative or categorical respectively). χ^2 and Fisher exact tests were used for comparison of qualitative variables. We used one-way analysis of variance test to compare between means of categorical and numerical data. Significance level (P value) was adopted, that is P value less than 0.05 for interpretation of results of tests of significance.

Results

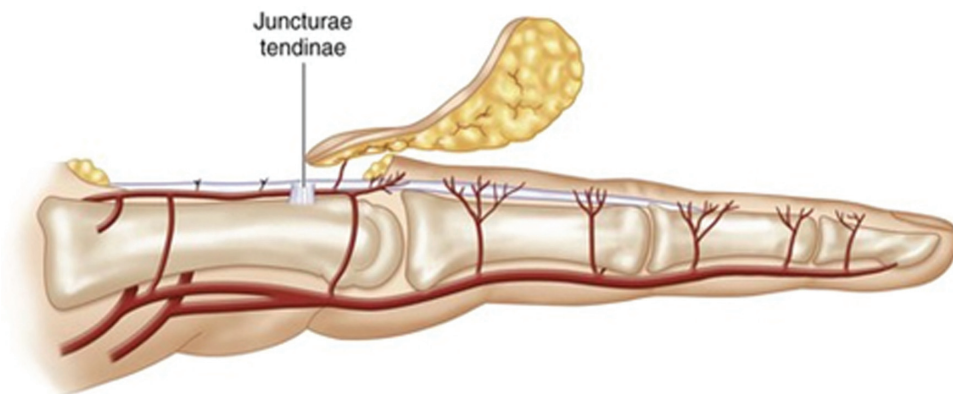
This was a prospective study done on 43 patients with proximal dorsal digital defects and deformities, attending Menoufia University Hospital during the period from January 2018 to January 2020. They

Figure 9



Arc of rotation of Quaba flap based on the second intermetacarpal space.

Figure 10



DMA perforator distal to juncturae tendinae. DMA, dorsal metacarpal artery.

were managed by reversed cross-finger flap or Quaba flap and followed up for 6 months over more than 2 years.

The study included 43 patients (30 males and 13 females) ranged in age from 20 to 60 years old who had soft-tissue defect in dorsum

of the hand proximal to PIP and had been reconstructed by reversed cross-finger flap or Quaba flap (Table 1).

Thirty-seven patients in our study had posttraumatic defects and six patients had postburn deformity on dorsum of fingers (Table 2).

Figure 11



Intraoperative excision of the flap bridge after 1 month of surgery.

Figure 12



Late follow-up of Quaba flap with no movement restriction.

Thirty-seven patients of had no comorbidities or risk factors, whereas three patients were smokers, one patient had controlled diabetes mellitus, and two patients had controlled hypertension (Table 3).

Table 4 shows the flaps' data. The flap size ranged from 2 to 4 cm in length and 1–3 cm in width in reversed cross-finger flap and from 4 to 8 cm in length and 1–3.5 cm in width in Quaba flap. The donor site was closed primarily in all cases of Quaba flap and reversed cross-finger flap.

The duration of hospital stay was 1 day. There was no postoperative wound infection or dog-ear formation in the donor site and no postoperative hemorrhage or local abscess recorded.

Reversed cross-finger flap was done in 21 patients; two cases experienced total flap necrosis, and distal flap necrosis occurred in one case.

Figure 13



Soft-tissue defect in middle phalanx and Quaba flap marking.

Figure 14



Immediate postoperative results after setting of flap and closure of donor site primarily.

Quaba flap was done in 22 patients, with distal flap necrosis occurred only in one case.

Postoperative complications' data are shown in Table 5, and follow-up data are shown in Table 6.

Discussion

The hand is an intricate part of the body that plays an essential role in social functioning, expression, productivity, and interactions with our environment. Skin/soft-tissue envelope of the hand is a complex structure that not only covers the underlying structures but also has specialized functional and sensory components [1].

Many modalities are used for covering and reconstruction of soft-tissue defects including skin

Figure 15



Late postoperative results after wound healing with no contour defect or limited movement.

Table 1 Distribution of the studied cases according to demographic data (N=43)

	n (%)
Sex	
Male	30 (70.0)
Female	13 (30.0)
Age (years)	
<30	26 (60.0)
≥30	17 (40.0)
Minimum–maximum	20.0–60.0
Mean±SD	40±15.0
Median	30.0

grafting [10]; local random flaps, for example, rotation flap, z plasty, and five flap; local pedicled flap from the hand, for example, reversed cross-finger flap; or regional pedicled flaps from the forearm, abdominal wall, and groin flaps [11].

Skin grafting is an easy technique, but it is only limited to small defects without exposed bone or tendons. Applying full-thickness graft to the injured finger is done successfully when there are small gaps in the tendon [10].

Reversed cross-finger flap is an option for covering these defects. Reversed cross-finger flap is a modified cross-finger flap with the merits of the heterodigital island flap. This approach also converts the direction of the flap elevation to a right angle, in contrast to the classical cross-finger flap. Reversed cross-finger flap includes the digital artery opposite to the pedicle and distal arch as the communicating branch. However, the sensory nerve is harvested from the terminal dorsal branch of the proper digital nerve. The

Table 2 Distribution of the studied cases according to etiology (N=43)

Etiology	n (%)
Posttraumatic	37 (86.0)
Postburn	6 (14.0)

Table 3 Incidence of comorbidities and /or risk factors in our studied cases (N=43)

Comorbidities	n (%)
No	37 (86.0)
Yes	6 (14.0)
Diabetes mellitus	1 (2.0)
Smoking	3 (7.0)
Hypertension	2 (5.0)

advantage of this is that the vascular pedicle is attached to the skin of the flap and does not require any special protection. In case of reversed cross-finger flap, the digital artery is located in the skin pedicle and is not exposed. Therefore, it has a firm soft tissue and holds it stable. The skin connection helps to maintain the flap's distal viability, while decreasing the pedicle movement and preventing venous congestion [4].

The design of the flap made exactly following the limits of functional phalanx unit. For easy dissection, we prefer to infiltrate the flap using physiological serum. The procedure begins by making proximal, distal, and midlateral incisions on the side of the defect. Proximal, distal, and lateral incisions in the subcutis were carried out, and the flap was raised, including all tissue between the dermis and the paratenon. The flap was then turned laterally on its attached base to reach the

Table 4 Flaps' data

Flaps' data	Characteristics	
	Reversed cross-finger flap	Quaba flap
Flap type		
Flap size		
Range of length (cm)	2–4	4–8
Range of width (cm)	1–3	1–3.5
Duration of flap elevation range (min)	10–15	25–35
Donor site closure [n (%)]		
Primary closure	21 (100)	22 (100)
Skin graft	0	0

Table 5 Postoperative complications

Postoperative complications	Characteristics [n (%)]	
	Reversed cross-finger flap	Quaba flap
Donor site		
Wound infection	1 (5)	0
Wound dehiscence	0	0
Dog ear	0	0
Recipient site		
Total flap necrosis	2 (9.5)	0
Distal flap necrosis	1 (5)	1 (4.5)
Hemorrhage	0	0
Local abscess	0	0
Bulkiness of the flap	0	0

Table 6 Follow-up Data

Follow-up data	Characteristics [n (%)]	
	Reversed cross-finger flap	Quaba flap
Donor site: functional outcome		
Movement restriction	5 (24)	0
Sensory disturbance	8 (38)	0
Cold intolerance	2 (9.5)	0
Donor site: esthetic outcome		
Hypertrophic scarring	1 (5)	1 (4.5)
Keloid formation	0	0
Hyperpigmentation	3 (14)	0
Hypopigmentation	1 (4.5)	0
Contour defect	16 (76)	0
Recipient site: functional outcome		
Movement restriction	0	0
Recipient site: esthetic outcome		
Color mismatch	10 (47)	0
Contour defect	0	0
Flap bulkiness	0	0

opposite side of the defect. After the flap is fixed to the defect, the skin over the donor site is repositioned over the paratenon, and a split-thickness skin graft is applied to the raw surface of the reversed flap. The flap division can be made from the seventh to the 12th day because of the excellent revascularization of the flap. The reversed cross-finger subcutaneous flap has appeared as an excellent alternative for achieving early coverage of cutaneous wounds at the dorsal aspect of proximal and middle phalanges of the long fingers. It is

an easy flap and represents our first choice to cover those defects [12].

Other option for covering these defects are DMA flap and Quaba flap. Blood supply to the dorsum of the hand and its role in the overall blood supply of the hand skin had received little attention until the report of Maryama and Quaba in the 1990s on interesting flaps based on the DMAs. In fact, the first to describe flaps supplied by the dorsal metacarpal system of vessels were Foucher and Braun, namely, the first DMA flap [13].

Flaps based on the DMAs may be of either direct or reverse flow, but for the purposes mentioned before in our cases, the reverse flow type seems more related to reconstructions in the distal parts of the hand. The skin island of the Maruyama pattern flap was designed over intermetacarpal space and is elevated in continuity with the underlying DMA, which is divided at its proximal end beneath the extensor tendon. Small branches passing between the finger extensor tendons to reach the overlying skin are preserved. Dissection of the vascular pedicle was continued distally to the web space, taking care to preserve the connections between the DMA and the branches of the palmar digital arteries [7].

Quaba has shown that it is not necessary to elevate the DMA with island flaps from the dorsum of the hand if

they are based distally on the branches to the skin given off by the second, third, and fourth DMAs in the area ~1 cm proximal to the metacarpal heads [7]. The skin island is orientated longitudinally to incorporate the longitudinal vascular network formed by anastomoses between successive branches of individual DMAs. Venous drainage is ensured by the preservation of a substantial cuff of tissue around the arterial pedicle and some subcutaneous veins be preserved at the (anatomically) distal end of the flap. Flow in these veins is reversed from normal [14].

Our prospective study done on 43 cases that had dorsal digital defects or deformities proximal to DIP. Thirty-seven cases were caused by trauma, 30 patients were males, and this is consistent with what mentioned by Petkoyal in 1984, who stated that the highest incidence of trauma to the hand and digits was in the males below the age of 30 years.

Reversed cross-finger flap was done in 21 patients, whereas Quaba flap was done in 22 patients. In our study, only two reversed cross-finger flaps were completely lost.

Distal flap necrosis occurred in one case, whereas in Quaba flap, no total flap loss occurred with one time distal flap necrosis.

Donor site complications were highly significant in reversed cross-finger flap as donor site's contour defect occurred in sixteen cases ($P \leq 0.001$) and movement restriction occurred in five cases ($P \leq 0.0095$).

Cases

- (1) Case 1: a 35-year-old male patient presented by local trauma to left index finger with soft tissue loss over proximal pharynx with exposed extensor tendon (Figs 1–4).
- (2) Case 2: a 24-year-old male patient with posttraumatic defect over the middle phalanx of the left index finger with exposed joint (Figs 6–8, 11, 12).
- (3) Case 3: a 29-year-old male patient with posttraumatic soft-tissue defect over proximal phalanx of left index finger with exposed tendon (Figs 13–15).

Conclusion

Both reversed cross-finger flap and Quaba flap are reliable alternative for treating small to moderate site defects and deformities on the dorsum of the fingers up to DIP. However, Quaba flap has the upper hand, with better functional and esthetic outcome, with less complications regarding limited donor site impairment, such as contour defect and movement restrictions, in contrast to reversed cross-finger flap, in which these complications were more significant.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

- 1 Hegge T, Henderson M, Amalfi A, Bueno RA, Neumeister MW. Scar contractures of the hand. *Clin Plast Surg* 2011; 4:591–606.
- 2 Jiao H, Ding X, Liu Y, Zhang H, Cao X. Clinical experience of multiple flaps for the reconstruction of dorsal digital defects. *Int J Clin Exp Med* 2015; 8:18058–18065.
- 3 Maciel-Miranda A, Morris SF, Hallock GG. Local flaps, including pedicled perforator flaps: anatomy, technique, and applications. *Plast Reconstr Surg* 2013; 131:896e–911e.
- 4 Kim DH, Seo KB, Lee SH, Lee HJ, Kang HJ. Reverse digital artery cross-finger flap for reconstruction of failed finger replantation. *J Orthop Surg (Hong Kong)* 2019; 27:2309499018816773.
- 5 Chong CW, Lin CH, Lin YT, Hsu CC, Chen SH. Refining the cross-finger flap: considerations of flap inseting, aesthetics and donor site morbidity. *J Plast Reconstr Aesthet Surg* 2018; 71:566–572.
- 6 Sebastin SJ, Mendoza RT, Chong AK. Application of the dorsal metacarpal artery perforator flap for resurfacing soft-tissue defects proximal to the fingertip. *Plast Reconstr Surg* 2011; 128:166–178.
- 7 Quaba AA, Davison PM. The distally-based dorsal hand flap. *Br J Plast Surg* 1990; 43:28–39.
- 8 Atasoy E. Reversed cross-finger subcutaneous flap. *J Hand Surg Am* 2016; 41:122–128.
- 9 Saint M, Germann G, Dorsal metacarpal artery flap. Michael R, Jones G (eds). *Nahai and mathes reconstructive surgery anatomy, technique and clinical application*; Vol2. New York: Taylor and Francis 2012; 1013–1045
- 10 Elliot D, Giesen T. Treatment of unfavorable results of flexor tendon surgery: skin deficiencies. *Indian J Plast Surg* 2013; 46:325–332.
- 11 Chao JD, Huang JM, Wiedrich TA. Local hand flaps. *J Am Soc Surg* 2001; 1:25–44.
- 12 Fejjal N, Belmir R, El Mazouz S, Gharib N, Abbassi A, Belmahi A. Reversed cross finger subcutaneous flap: a rapid way to cover finger defects. *Indian J Plast Surg* 2008; 41:55–57.
- 13 Isaraj S. Use of dorsal metacarpal artery flaps in post burn reconstruction – two cases report. *Macedonian J Med Sci* 2011; 15; 4:180–184.
- 14 Torii S, Namiki Y, Mori R. Reverse flow island flap: clinical report and venous drainage. *Plast Reconstr Surg* 1987; 79:600.