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# Dorso Proximal Interphalangeal Island Flap

Osvaldo J. Pereira, MD*
Jorge B. Ely, PhD†
Jaime A. Bertelli, PhD‡
Zulmar A. Vasconcellos, PhD‡
Alfredo S. Granemann, MD‡

**Background:** This study aimed to demonstrate the clinical application of the dorsoproximal interphalangeal island flap as an alternative approach to skin graft or cross-finger flap to repair lesions at the ventral site at the proximal interphalangeal (PIP) finger joint.
**Methods:** Fifteen patients received flaps (11 men and four women, n = 25 flaps). The repair of volar contracture in finger sequelae after burn injuries was the main indication. Five patients underwent two or more flaps during the same surgical session. The mean patient age was 18 years (range, 7–56 years). Most patients presented with palmar finger contractures of the PIP joint. In three patients, six flaps were rotated to the lateral radial and ulnar proximal surfaces of the finger to treat syndactyly.
**Results:** Most flaps survived and provided satisfactory functional and aesthetic improvement of palmar scar contracture in the PIP region. Postoperative donor site follow-up was normal. The color and pliability of the skin are similar to those of the surrounding area. The follow-up period ranged from 6 months to 12 years.
**Conclusions:** Dorsoproximal interphalangeal island flaps are an option for repairing lesions that lack soft tissue and range in size from 10 × 15 to 12 × 18 mm at the volar site and around the PIP joint. The arch of rotation of this flap allows for lateral, ulnar, and radial rotations around the joint. The indication of six flaps in three patients to repair a proximal lack of tissue caused by syndactyly demonstrated its potential use in this anomaly. *(Plast Reconstr Surg Glob Open 2024; 12:e5805; doi: 10.1097/GOX.0000000000005805; Published online 20 May 2024.)*

## INTRODUCTION

The availability of tissue flaps to cover palmar lesions in the proximal interphalangeal (PIP) joint region is limited.[1,2] Thus, it is a particularly challenging area for hand surgeons.[3] Skin grafts and cross-finger flaps are currently used, although these techniques pose significant limitations, including scar contracture recurrence, hyperpigmentation, requirement of a two-stage procedure, and long-term immobilization in cases requiring cross-finger flaps.[4,5]

This study aimed to demonstrate the use of flaps to repair lesions located in the volar region or in the lateral aspect of the PIP joint. The main indication was a scar contracture at the palmar surface situated in that region. Two bilateral branches originating from the proper digital artery supplied the flap.

## PATIENTS AND METHODS

We indicate 25 flaps in 15 patients (11 men and four women). The age of the patients ranged from 10 to 56 years. The mean age of the patients was 24 years. Five patients required two or more flaps during the same surgical session. We found that the flaps mainly repair palmar scar contractures caused by burn injuries at the palmar side of the PIP joint. We used two or more flaps simultaneously in five patients. In two patients, we used two flaps to repair lesions in the radial and ulnar regions of the lateral phalanx. The study also included three patients presenting with syndactyly who required six flaps. The flaps were rotated proximally at the ulnar and radial sides of the third and fourth proximal phalanges, respectively.

*From *Hospital Florianópolis—Plástica Doctor Clinic, Universidade Federal de Santa Catarina, Florianópolis, Brazil; †Universidade Federal de Santa Catarina, Florianópolis, Brazil; and ‡Universidade Federal de Santa Catarina, Florianópolis, Brazil.*

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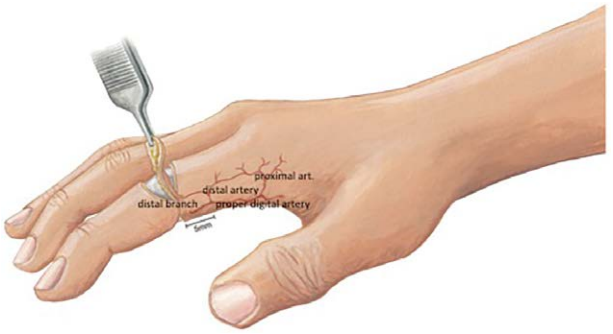


**Fig. 1.** A pictorial depiction showing the dorsoproximal interphalangeal island flap lifted over the PIP joint. The distal pedicle supplies the flaps. It stems from the proper digital artery, ranging from 5 mm proximal to the interphalangeal articular line to half the phalanx length. A partial incision opens the dermal bridge.

## TECHNIQUE

An Esmarch band was used as a tourniquet on the forearm after sedation. Donor and recipient sites used 1.5 to 2mL of 0.5% lidocaine without epinephrine. We first carefully incised the scar contracture at the recipient site using a 2.5× magnification glass. The scar fibers were opened using mosquito forceps to preserve the peritendon and fat tissues. We extended the PIP to evaluate the tissue gap. We then pinched the dorsal skin over the PIP joint using Adson forceps to avoid over-resection. The flap was incised using an elliptical design. Meticulous dissection preserved the peritendon and vascular pedicle, emerging from the proper digital artery (0.5 cm) of the PIP articular incisure. The dermal skin bridge can be detached or preserved. A strip of subcutaneous tissue containing the vascular pedicle was released 5 mm parallel to the extensor tendon border to ease the flap rotation to the recipient site. Lastly, the donor site was closed (Fig. 1). [**See Video 1 (online),** which shows the dorsoproximal interphalangeal flap planning and rotation to repair palmar cicatricial burning sequelae at the PIP joint in a 12-year-old patient with a 12 years follow-up.] In the postoperative protocol, the hand splint was positioned in the finger extension for 10 days. Active and passive physiotherapy was initiated after stitching, and local finger massage was started to help smoothen the soft tissue of the donor and receptor sites.

## RESULTS

Twenty-three flaps presented with total integration at the recipient site. The extension movement improved in all patients. The donor sites recovered without any limitation of finger flexion. The quality and texture of the skin were similar to those of surrounding areas. Hyperpigmentation was not observed in island flaps. A 19-year-old man with a rigid scar contracture showed necrosis of the two flaps. He presented with scar contracture after a burn injury. He also had stiff articular joints of the fourth and fifth fingers with excess inelastic skin over the PIP joint and proximal phalanx. Further, in two patients initially treated unsuccessfully elsewhere with skin grafts, we indicated multiple flaps (n = seven flaps) in only one surgical session with an uneventful follow-up. In three patients with syndactyly, we found that six flaps rotated proximally at the lateral aspect of the proximal phalanx; the follow-up period ranged from 6 months to 12 years (Table 1).

### Takeaways

**Question:** Is it possible to repair lesions at the palmar area at and around the proximal interphalangeal (PIP) joint, using the skin flap situated over the dorsal PIP joint?

**Findings:** The flap successfully corrected cicatricial lesions at the ventral side of the PIP joint and showed potential indications to replace lack of tissue at the phalange proximal side in syndactyly, reducing the amount of skin grafting.

**Meaning:** The PIP island flap replaces the skin graft usually indicated to repair the lack of tissue in these areas.

## DISCUSSION

Many flaps can be used to repair the dorsal finger skin.[6] The dorsoproximal interphalangeal (DIP) island flap has a constant vascular pedicle. Bertelli and Pagliei performed a microdissection of eight fresh upper arms and analyzed the vascular pattern in 64 digits. In 58 cases, two branches of the radial and ulnar sides of the proper digital artery reached the dorsal aspect of the proximal phalanx to supply the skin. In six patients, three branches stemmed from the proper digital artery. The average diameter of the proximal branch (PB) was 0.2 mm, with the distal one being 0.4 mm. The vascular arcade overlying the extensor tendon border was linked to these branches[7] (Fig. 2). Based on the anatomical findings, they suggested a flap design using the distal third of the proximal phalanx skin that extends to the PIP joint. In the present study, we designed a flap based on the distal branch (DB) of the DIP joint. This coincided with the natural skin flaccidity of this region (Fig. 3).

The vascular arcade links the PB and the DB, determining the flap territory. The diameter of DB (0.4 mm) is double that of the PB, (0.2 mm), based on the above mentioned study. Therefore, we designed a flap over the DB because it supplies the skin over the PIP joint. The rotation axis arises 0.5 cm proximal to the interarticular line. Flaps ranging from 10- to 12-mm wide and 15-18 mm long allowed primary closure of the donor site. After opening the scar contracture, the dorsal skin sufficiently covered the resultant gap in the palmar tissue. After incision at the recipient site, the scar border was preserved to avoid excessive tissue demand for lesion repair. The skin covering the donor site at the level of the PIP joint expands progressively with age, particularly in children and teenagers. These patients are therefore the appropriate population for testing this method. The excess skin over the PIP joint in these groups was softer than that present in adults. The corneal skin layer is thin compared with that of laborers and adults because they hardly use their hands as craftsmen. Nevertheless, it is also possible to demonstrate this

**Table 1. Dorsoproximal Interphalangeal Island Flap: Indications according to Finger Sites, Pathology, Flap Size, and Follow-up**

| Patient | Age | Sex | Site | Diagnosis: Indication | Flap Size (mm) | Follow-up |
|---|---|---|---|---|---|---|
| 1. MA | 26 | M | Third | Scar contracture | 12×20 | Uneventful |
| | | | Fourth | Scar contracture | 11×17 | Uneventful |
| | | | Fifth | Scar contracture | 10×14 | Uneventful |
| 2. ES | 43 | F | Fifth | Scar contracture | 0.9×14 | Uneventful |
| 3. RS | 28 | M | Third | Scar contracture | 12×16 | Uneventful |
| | | | Fourth | Scar contracture | 10×15 | Uneventful |
| 4. AS | 12 | M | Second | Scar contracture | 12×18 | Uneventful |
| 5. LR | 14 | F | Second | Scar contracture | 12×19 | Uneventful |
| 6. JS | 32 | M | Second | Scar contracture | 11×18 | Uneventful |
| | | | Third | Scar contracture | 12×20 | Uneventful |
| | | | Fourth | Scar contracture | 10×17 | Uneventful |
| | | | Fifth | Scar contracture | 10×15 | Uneventful |
| 7. JC | 56 | M | Second | Ulnar scar lesion | 10×18 | Uneventful |
| 8. CS | 19 | M | Fourth | Rigid contracture | 0.9×16 | Necrosis |
| | | | Fifth | Rigid contracture | 0.8×13 | Necrosis |
| 9. MA | 10 | F | Second | Scar contracture | 10×19 | Uneventful |
| 10. LK | 12 | F | Third | Syndactyly | 11×19 | Uneventful |
| | | | Fourth | Syndactyly | 12×18 | Uneventful |
| 11. | 07 | — | Third | Syndactyly | 10×17 | Uneventful |
| | | | Fourth | Syndactyly | 10×16 | Uneventful |
| 12. | 10 | — | Third | Syndactyly | 11×18 | Uneventful |
| | | | Fourth | Syndactyly | 10×18 | Uneventful |
| 13. VC | 18 | M | Third | Scar contracture | 12×19 | Uneventful |
| 14. JM | 15 | M | Second | Scar contracture | 10×18 | Uneventful |
| 15. RS | 26 | M | Third | Scar contracture | 12×20 | Uneventful |

M, Male; F, Female.

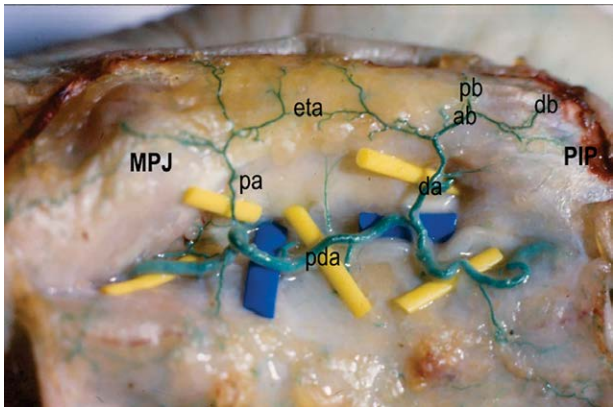


**Fig. 2.** Microdissection of the finger showing the proper digital artery (pda), proximal artery (pa), distal artery (da), extensor tendon arcade (eta), descendent branch (db), proximal branch (pb), ascendant branch (ab), metacarpal interphalangeal joint (MPJ), and PIP joint. The DIP island flap is supplied mainly by the distal artery's descendent branch (db), which has an average diameter of 0.4 mm.

in the older population. Based on our data, we successfully performed this technique in five adults.

Both the ulnar and radial pedicles supply the flap owing to the wide range of anastomoses. The arch of rotation allows repair on both sides of the proximal and middle phalanges and the flexion palmar area of the PIP joint. This approach has advantages over the cross-finger flap, which requires a second session to transect it. Additionally, the DIP flap results in less hyperpigmentation and tissue contraction than observed with skin grafts. Novice residents can quickly learn this method. [**See Video 2 (online),** which shows a 12-year follow-up showing excellent integration of the flap, extension function improvement, and preservation of the donor site.) We performed two or more DIP flaps in the same surgical session in five patients within 1 hour of surgery (Fig. 4).

Unlike other significant flaps designed to repair the dorsal skin based on proper digital artery blood supply,[8,9] the DIP island flap preserves it. This method is selected when the lesion requires only a small amount of tissue. There are previously described techniques that require flaps more than 10–12 mm wide and 15–18 mm long. However, these approaches cut the dorsal branches.[10,11] Unlike the PIP island flaps, which require a skin graft to cover the donor bed, the donor site of the PIP island flap is primarily closed. This is another advantage of the island flap compared with the approaches used to treat complex lesions.[12,13] Donor-site closure acts as a temporary splint and extends the fingers. Thus, it contributes to flap adaptation at the recipient site. Furthermore, using tissue from the same digit to treat small lesions is another advantage of this method over the cross-finger flap, which may lead to complications at the donor site.[14]

We indicated six island flaps in three patients presenting syndactyly. The flap rotation proximally replaced the lack of tissue on the ulnar and radial of the third and fourth fingers. In this anomaly, the flaps minimize the need for a skin graft, which is typically used after finger


**Fig. 3.** Preoperative view of a 26-year-old man presenting finger palmar retraction at the PIP region after burn injury. A, He had been unsuccessfully treated elsewhere with a skin graft. B, Planning the DIP flap over the PIP Joint. C, Six-month postoperative view with total integration of the DIP island flap at the recipient site of the third, fourth, and fifth fingers.

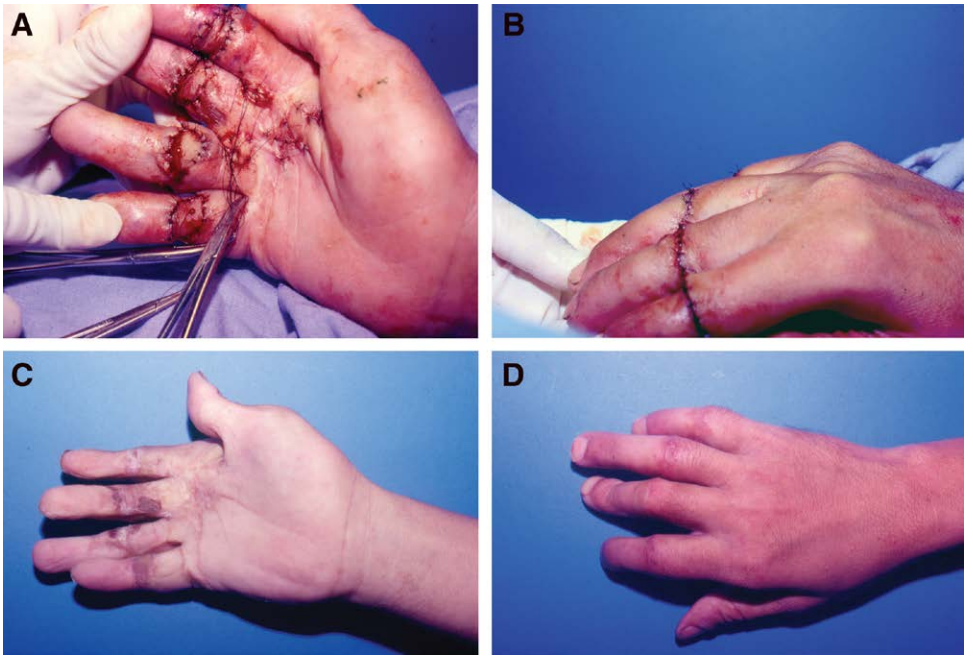


**Fig. 4.** Intraoperative view of a 24-year-old patient presenting palmar scar contracture of the second, third, fourth, and fifth fingers. The patient also had been treated elsewhere with a skin graft. A, A DIP island flap was successfully used for the four fingers concomitantly. A transoperative view shows the bleeding of the flap at the fifth finger after pinching with a needle. B, The four finger donor sites were primarily closed. C, Six-month follow-up of four island flaps with normal healing. D, The donor function extension preserved.

individualization. Retrograde flap excursion was easy. All flaps survived using this approach (Fig. 5). This is a pioneering study because it provides new possibilities for the surgical correction of this congenital entity and minimizes skin graft demand. However, further investigation is required to support this strategy (Fig. 6).

The main complication was present in one 19-year-old man who lost two DIP island flaps. He presented with palmar scar contracture of the fourth and fifth fingers secondary to a burn injury. The donor site had tough skin overlying the joints. We corrected this case with functional arthrodesis of the fingers.

The DIP flap was performed under a hospital-day regime. Active and passive physiotherapy was initiated after the second week. Patients could return to work soon after surgery, reducing the social costs. Finally, this procedure reduces stiffness and rigidity commonly associated with techniques that require long-term immobilization.[15]

Koshima et al[16] described digital artery perforator flaps supplied by arterioles and venules arising from the digital artery. The authors indicated using flaps for resurfacing the fingertips. They suggested the use of a small amount of adipose tissue to preserve the venular system. However, this method is not recommended for volar PIP scar contracture, which is the preferred indication for DIP flaps.

Lim et al[17] used a homodigital neurovascular island flap to reconstruct significant pulp defects in the fingertips. This area contains the sensory skin that restricts donor morbidity. They also did not report any indications for using this flap to repair the palmar region of the finger at the PIP joint.

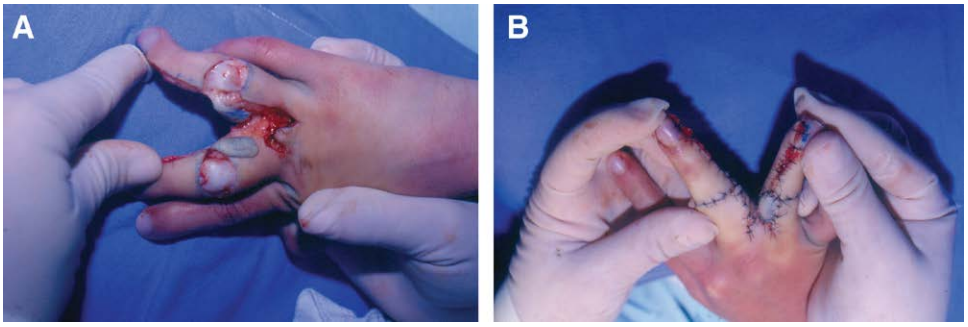


**Fig. 5.** A, Transoperative view of a 10-year-old patient after dissection of the DIP flap, rotated cranially to repair the skin gap after finger separation. B, The DIP flaps in their receptor bed, reducing the demand for a skin graft. The donor site is primarily closed.

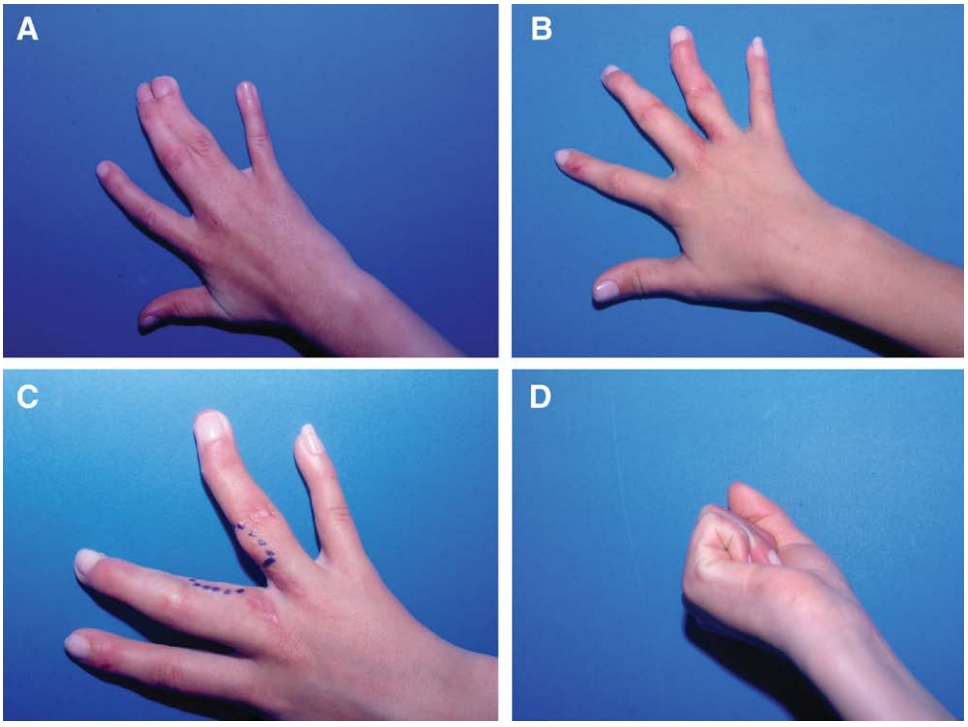


**Fig. 6.** Postoperative view of the same patient shown in Figure 5. A, Before separation of the syndactyly fingers. B, Six-month follow-up showing good integration of the flaps. C, Preservation of skin quality and texture. D, Preservation of the hand function.

In summary, the preferential indication of the DIP island flap is preferred in pediatric and teenage patients. These patients presented with appropriate skin flaccidity in the donor region. The primary recipient site was a palmar lesion at the PIP joint. The arch of rotation of the flap makes it suitable for replacing the tissue on the proximal and middle phalanx sides. This advantage of the island flap is a potential indication for cases of syndactyly.

## CONCLUSIONS

The DIP island flap is an option for repairing soft tissue defects ranging from 10 to 15 mm to 12–18 mm on the palmar side of the PIP joint. The arch of rotation of this flap allows for lateral, ulnar, and radial transposition around the homolateral joint. The successful use of six flaps in three patients to repair proximal tissue defects in syndactyly signals its potential indication for this congenital anomaly.

***Osvaldo J. Pereira, MD***
Antônio Edu Vieira 1414, 88040-001, Pantanal
Florianópolis, Santa Catarina
Brazil
E-mail: osvaldojpf@gmail.com
Twitter: @plasticadoctor
Instagram: @drosvaldojpereirafilho

## DISCLOSURES

*The authors have no financial interest to declare in relation to the content of this article.*

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