

Redesigned V-Y Flap for the Reconstruction of Fassler Type D Fingertip Injuries: A Case Report and Literature Review

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ABSTRACT

Background: Fassler Type D fingertip injuries represent a significant reconstructive challenge as they involve bone exposure and compromise of the nail complex. The redesigned V-Y flap offers a simple, safe, and functional alternative for small to moderate defects, providing low morbidity and preserving length, sensitivity, and aesthetics.

Objective: To present a clinical case reconstructed using a redesigned V-Y flap and a nail splint, highlighting the technique, clinical outcomes, and contemporary applicability.

Methods: We described the case of a 35-year-old male with a Fassler D-Type fingertip injury to the fourth finger. The defect measured 10 mm x 0.8 mm with distal phalanx bone exposure. An advancing V-Y flap was performed, modifying the incision with an oblique cut being preferred, and subsequent release of the septa to maximize tension-free displacement. A synthetic nail splint was made with polypropylene and fixed with sutures.

Results: Complete coverage and restoration of tissue continuity were achieved under local anesthesia. Follow-up at 4 weeks demonstrated preservation of digital length and sensory recovery with two-point discrimination, restoring both aesthetics and functionality of the fingertip.

Conclusions: The redesigned V-Y flap is a reliable and reproducible option for distal reconstructions with bone exposure, particularly in resource-limited settings.

KEYWORDS: V-Y flap, Fassler D, digital reconstruction, fingertip, nail splint.

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INTRODUCTION

Fingertip injuries account for 60-70% of emergency consultations for hand trauma. The Fassler classification characterizes the magnitude of the defect; Type D is defined

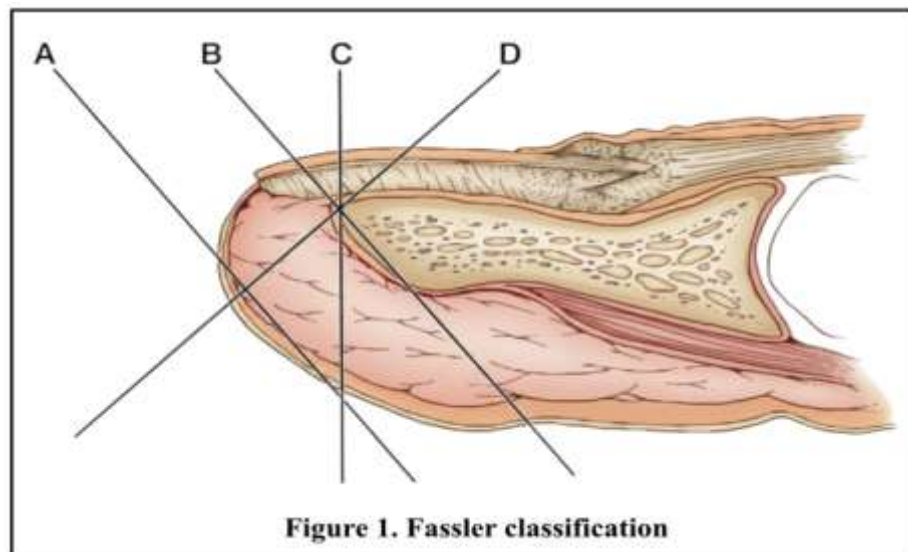
by bone exposure or involvement of the nail complex. A representative diagram is attached. (Figure 1)

The Atasoy V-Y flap, described in 1970, remains the reconstructive standard for defects smaller than 1.5 cm due

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to its robust vascularization, sensory preservation, and minimal donor-site morbidity. However, contemporary modifications, including a more extensive release of the fibrous septa, have been shown to improve the range of motion and reduce tension.

This report presents a clinical case treated with a redesigned V-Y flap, emphasizing useful technical details and comparing results with current literature.



CASE PRESENTATION

A 25-year-old male with no relevant medical or surgical history. His condition began after suffering a sharp trauma to the fingertip of the fourth finger of the left hand. The injury was a dorsal oblique cut caused by a knife while working, not other injuries to the hand were observed.

I. Physical Examination: The patient was conscious, alert and oriented. With preserved cardiorespiratory

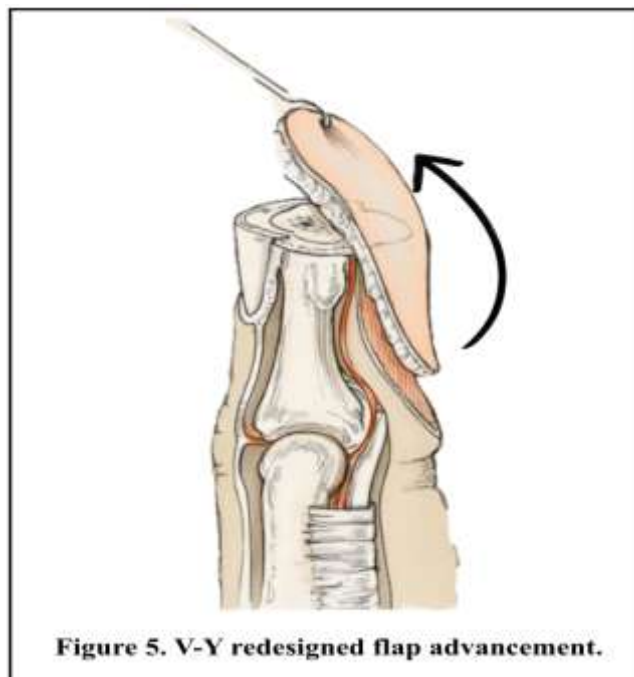
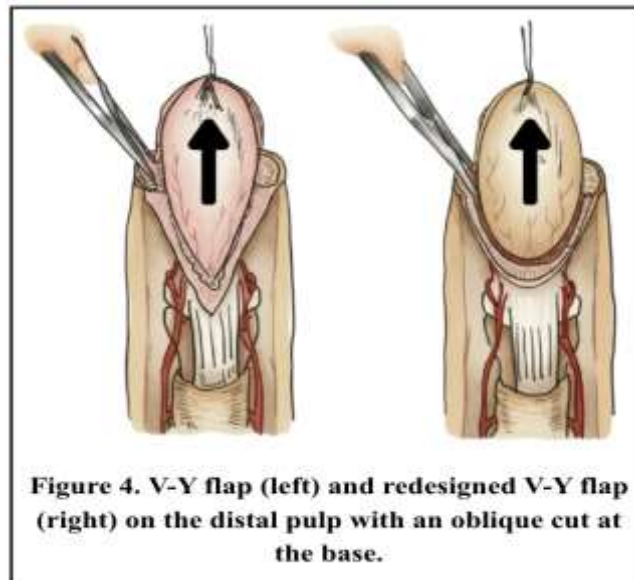
functions. A wound was observed on the fingertip of the fourth left finger with 15% residual nail plate avulsion and a 10 mm x 0.8 mm exposure of the distal phalanx with regular edges and minimal bleeding. Radial, brachial, and ulnar peripheral pulses were present; capillary refill was 2 seconds in fingertips. Sensory functions in the median, radial, and ulnar nerve distributions were intact, with no other abnormalities on examinations. (Figures 2 and 3)



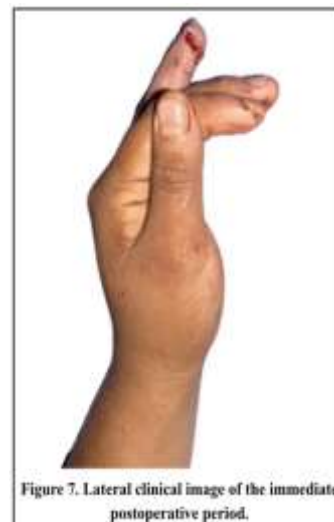
II. SURGICAL TECHNIQUE

Under a safe surgery protocol, digital infiltration of the radial and ulnar pedicles of the fourth left finger was performed using 6 CC 2% simple lidocaine. After asepsis and antisepsia with povidone-iodine up to the upper third of the forearm, the residual nail plate was removed with a #15

scalpel and a V-Y flap was designed on the distal pulp with an oblique cut at the base. (Figure 4). The septa were released to allow adequate advancement. (Figure 5) The flap was attached to the nail matrix using 3-0 nylon suture with simple stitches. After the subungual hematoma perforation, a synthetic nail splint (polypropylene) was made, fixed with a proximal "U" stitch, and a cross stitch using 3-0 nylon.



Hemostasis was verified, and a sterile dressing was applied. The procedure was completed without incident. (Figures 6 and 7)



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DISCUSSION

The reconstructive management of fingertip injuries must be individualized according to the size of the defect, bone exposure, involvement of the nail matrix, and the functional needs of the patient. In Fassler D injuries, conservative treatment is rarely sufficient, as exposure of the distal phalanx prevents spontaneous epithelialization and carries a risk of osteomyelitis and loss of functional length.

The V-Y flap remains one of the most reproducible techniques for small to moderate defects. It is based on the elasticity and vascularization of the fingertip tissue, derived from the terminal branches of the digital arteries themselves. This configuration allows for a 5 to 10 mm advancement, preserving the sensory innervation of the digital neurovascular bundles.

The redesigned variant applied in this case emphasizes the careful release of the lateral fibrous septa to avoid tension at the base of the flap, optimizing mobility and reducing the risk of marginal necrosis or contracture. Compared to other procedures such as the finger cross flap, Kutler flap, Moberg flap, or dermo-adipose grafts the V-Y flap offers several advantages:

1. Simple and reproducible technique, performable under local anesthesia.
2. Preserves fine tactile sensitivity and pinch function.

3. Minimal morbidity at the donor site.
4. Favorable aesthetic result by maintaining finger length and pulp impression.

The synthetic nail splint plays also an important role in protecting the matrix and preventing adhesions between the bed and the proximal fold, promoting normal nail growth. Recent studies (*Wolfe et al., 2022; Neligan, 2023*) highlight that the use of acrylic or thermoplastic splints reduces the risk of postoperative onychodystrophy in more than 80% of cases.

The most common complications reported with the V-Y flap include marginal necrosis (<5%), residual hypersensitivity (2%), distal joint stiffness (1%), and peak deformity if performed with excessive tension (1%). In the present case, no such complications were observed, reinforcing the importance of a proportional design (base-to-height ratio of 1:1) and sufficient tissue mobilization prior to advancement.

Postoperative follow-up should focus on preventing contracture, with early distal flexion- extension exercises (at 10-14 days) and protection with a splint for three weeks. At four weeks, most patients regain full function, with sensitivity in the range of 4 to 6 mm according to the two-point discrimination test. (Figure 8)

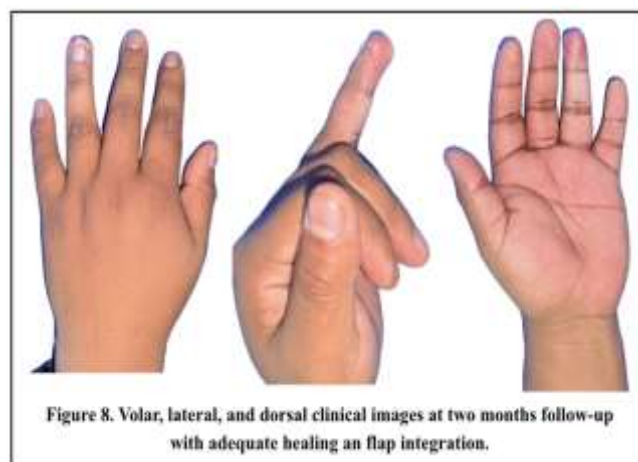


Figure 8. Volar, lateral, and dorsal clinical images at two months follow-up with adequate healing and flap integration.

The success of this type of reconstruction is based on three fundamental principles:

- Appropriate selection of the patient and the type of defect.
- Anatomical respect for digital vascularization.
- Early functional rehabilitation.

The case presented illustrates how the redesigned V-Y flap can offer an ideal balance between technical simplicity, low risk, and excellent functional results, making it a valid alternative in scenarios where resources are limited, and the goal is to preserve digital anatomy and function without resorting to more complex regional flaps or microsurgery.

CONCLUSIONS

The redesigned V-Y flap has established itself as a highly effective local reconstructive technique for the treatment of complex Fassler D-type fingertip injuries, characterized by bone exposure and partial loss of the nail complex. In this context, its application allows for comprehensive anatomical and functional restoration by achieving stable coverage of the defect, preservation of digital length, and early recovery of sensitivity, which are fundamental elements for fine hand function and patient satisfaction (*Atasoy et al., 1970; Fassler, 1996; Wolfe et al., 2022*). From a biomechanical and vascular point of view, this flap preserves the axial vascularization and sensory innervation of the fingertip, resulting in viable, stable tissue with adequate long-term integration. Modification of the

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classic V-Y design, through complete release of the lateral fibrous septa, allows for broader, more homogeneous, and controlled tissue advancement, significantly decreasing tension at the base of the flap and reducing the risk of marginal necrosis, scar contractures, or residual deformities (Hsu et al., 2020; Kang et al., 2017; Chen et al., 2019).

The incorporation of a synthetic nail splint is an important technical addition, as it temporarily protects the matrix and nail bed during the critical healing phase. This strategy helps prevent adhesions, bed irregularities, and late nail complications, such as onychodystrophy or hook deformity. It also helps preserve the physiological curvature of the proximal nail fold, optimizing the final aesthetic result and the harmony of the nail complex (Zook et al., 1984; Ogawa & Hyakusoku, 2019).

The case analyzed demonstrates that the redesigned V-Y flap, when properly planned and executed, is a highly effective alternative, as it does not require microsurgical instruments, can be performed under local anesthesia, and has a reproducible learning curve. These characteristics make it a particularly valuable option in second level hospitals and peripheral care units, without compromising functional or aesthetic results (Kvernmo & Haugstvedt, 2015; Patel et al., 2016).

Early rehabilitation plays a decisive role in the overall success of the procedure. Early implementation of flexion-extension exercises, active assisted mobilization, and supervised manual therapy is essential to prevent joint stiffness, control edema, and promote functional reintegration of the injured finger, allowing the patient to resume precision and fine pinching activities in the early postoperative stages (Sebastin & Chung, 2011; Adani et al., 2018).

From a comprehensive reconstructive perspective, the success of the redesigned V-Y flap is based on three fundamental pillars:

1. Appropriate selection of the patient and the type of defect,

2. Strict respect for digital neurovascular anatomy during dissection and flap advancement

1. Postoperative strategy aimed at early functional mobilization and control of the healing process (Neligan, 2023; Wolfe et al., 2022).

The evidence available in the literature supports that local flaps, and in particular the V-Y flap, remain the gold standard for digital tip defects smaller than 1.5 cm with bone exposure, due to their consistently reported low complication rate of less than 5%, rapid sensory recovery, and predictable and lasting aesthetic results (Hattori et al., 2014; Sebastin & Chung, 2011; Adani et al., 2018).

In conclusion, the redesigned V-Y flap not only represents an immediate reconstructive solution, but also a comprehensive functional preservation strategy that restores the shape, function, and sensitivity of the fingertip. Its correct execution reaffirms the fundamental principles of modern reconstructive surgery: restoring tissues while respecting their biology, optimizing functional results, and offering the patient satisfactory anatomical and aesthetic reintegration. (Table 1)

AUTHOR CONTRIBUTIONS

Gabriel Alcalá-Soto: conceptualization, project administration, supervision, writing – original draft, writing – review and editing. **Luis Enrique Hernández-Alcalá:** formal analysis, resources, software, writing – review and editing. **Denisse Sánchez-Padilla:** investigation, methodology, resources. **Rodrigo Alonso Mata-Pérez:** investigation, resources. **Yuliet Guadalupe Sánchez-Javier:** investigation, resources. **Rafael Mendez-Reynosa:** investigation, resources. **Leslie Denisse Castillo-Campos:** investigation, methodology, resources. **Irad Antonio Zuñiga-Salazar:** investigation, resources. **Aranza Maleny Esquivel-Ramos:** investigation, resources. **Rocío Kinnereth Mateos-Rodríguez:** investigation, resources.

Technique	Ideal defect size	Sensivity	Aesthetics	Donor morbidity	Limitations
V-Y (Atasoy)	<1.5 cm	High	Excellent	Minimal	Limited advancement
Modified V-Y (this case)	<1.8 cm	High	Excellent	Minimal	Depends on septal release
Kutler (bilateral V-Y)	1–2 cm	Moderate	Good	Minimal	Risk of bifid tip
Moberg (volar)	Pulgar	High	Good	Minimal	Not useful on other fingers
Cross-finger flap	>2 cm	Medium	Moderate	High	Two surgical stages
Dermal-adipose graft	Variable	Medium	Regular	Low	Contracture/numbness

Table 1. Flap techniques comparison

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DECLARATION OF CONFLICT OF INTEREST

The author declares that he has no conflict of interest related to this article.

FUNDING DECLARATION

The study did not receive external financial support.

CONSENT

The patient provided written informed consent for the publication of this case report and any related images.

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