

## Split-Thickness Skin Graft Reconstruction Following Post-Traumatic Hand Infection: Case Report and Literature Review

Irad Antonio Zuñiga-Salazar\*<sup>1</sup>, Felipe Alarcón-Estrada<sup>2</sup>, Alejandro Herbert Oliva-Arvizu<sup>3</sup>, Brenda Aracely Saenz-Medina<sup>4</sup>, Diego Cabeza-Gracia<sup>5</sup>, Miriam Melina Vargas-Mejía<sup>6</sup>, Jocelyn Galindo-Najera<sup>7</sup>, Marlen González-Santana<sup>8</sup>, Mauricio Alonso Espinosa-Romero<sup>9</sup>, Elisa Taynisha Leal-Cabrera<sup>10</sup>

<sup>1</sup>General Surgery Resident, Hospital General Regional No. 251, IMSS.

<sup>2</sup>Universidad Anáhuac México Campus Norte.

<sup>3</sup>General Surgery Resident, Hospital General Regional No. 1 IMSS, Querétaro.

<sup>4</sup>Universidad Autónoma de Chihuahua.

<sup>5</sup>Universidad Nacional Autónoma de México.

<sup>6</sup>General Surgeon, Hospital General Regional No. 196, IMSS.

<sup>7</sup>General Surgery Resident, Hospital General Regional No. 251, IMSS.

<sup>8</sup>Universidad Nacional Autónoma de México.

<sup>9</sup>Universidad Nacional Autónoma de México.

<sup>10</sup>General Surgery Resident, Hospital General Regional No. 251, IMSS.

### ABSTRACT

**Background:** Hand trauma resulting from occupational machinery accidents represents complex high-energy injuries frequently associated with contamination, tissue necrosis, and soft-tissue infection, which can hinder early cutaneous coverage and compromise functional outcomes. Appropriate management requires effective control of the septic focus, adequate preparation of the recipient bed, and timely reconstruction using reliable coverage techniques.

**Case Report:** We report the case of a 34-year-old left-hand-dominant male who sustained a traumatic avulsion injury to the left hand during occupational activity. Initial management consisted of primary wound closure; however, the patient subsequently developed a soft-tissue infection with formation of a dorsal abscess, which required surgical drainage and broad-spectrum antibiotic therapy adjusted according to clinical progression. Following serial surgical debridements, a dorsal cutaneous defect measuring 14 × 7 cm with viable granulation tissue was obtained. Definitive coverage was achieved using a split-thickness skin graft (0.30 mm) harvested with an electric dermatome. At five days postoperatively, adequate graft integration was documented, with no evidence of necrosis or persistent infection, allowing the initiation of early functional rehabilitation.

**Discussion:** Post-traumatic infections of the hand require prompt surgical drainage and targeted antibiotic therapy, as pharmacologic treatment alone is insufficient in the presence of purulent collections. Adequate preparation of the recipient bed represents the most important determinant of successful graft take. In extensive dorsal defects, split-thickness skin grafts offer higher rates of integration due to their lower metabolic demand and greater tolerance to irregularities of the wound bed. Graft incorporation occurs through the sequential phases of plasmatic imbibition, inosculation, and maturation. Early clinical evaluation is therefore essential to identify potential complications and prevent functional impairment.

**Conclusion:** Sequential control of infection followed by coverage with a split-thickness skin graft represents an effective and safe strategy for the management of extensive dorsal hand defects resulting from occupational trauma. This approach provides stable cutaneous coverage

### ARTICLE DETAILS

**Published On:**  
**30 March 2026**

# Split-Thickness Skin Graft Reconstruction Following Post-Traumatic Hand Infection: Case Report and Literature Review

and facilitates early functional rehabilitation.

**KEYWORDS:** Split-thickness skin graft; Hand infection; Occupational hand trauma; Soft-tissue reconstruction; Dorsal hand defect.

**Available on:**

<https://ijmscrs.com>

## INTRODUCTION

Hand trauma represents a frequent cause of consultation in emergency departments and reconstructive surgery units, particularly among the working-age population, in whom industrial machinery accidents constitute one of the highest-energy and most complex injury mechanisms. These injuries often involve not only cutaneous loss but also associated damage to tendons, osteoarticular structures, nerves, and the microvasculature, leading to significant functional impairment due to the highly specialized biomechanical role of the hand in grasping, sensation, and fine motor control. In this context, even seemingly limited skin defects may result in permanent disability if not managed appropriately and in a timely manner.

Crush and avulsion mechanisms produce progressive tissue destruction that frequently exceeds the initially visible injury. The transmitted energy leads to capillary thrombosis, interstitial edema, increased tissue pressure, and secondary necrosis, all of which favor bacterial colonization and the development of soft-tissue infections. Unlike other anatomical regions, the hand contains closed fascial compartments and tendon sheaths that facilitate deep spread of infection and compromise local perfusion. This anatomical characteristic explains the rapid progression toward abscess formation, tissue necrosis, and further soft-tissue loss when treatment is inadequate. For this reason, early primary closure of contaminated or high-energy wounds may lead to infectious complications and reconstructive failure.

The modern management of these injuries is based on a sequential approach. Initially, the primary objective is control of the infectious focus through timely surgical drainage, debridement of necrotic tissue, and targeted antibiotic therapy. Once the septic phase has been adequately controlled, the next step is to obtain a biologically suitable recipient bed for definitive cutaneous coverage. Proper preparation of the wound bed—characterized by well-vascularized granulation tissue, absence of necrosis, adequate hemostasis, and mechanical stability—represents the most important determinant of reconstructive success.

Among the available coverage options, skin grafts constitute a fundamental reconstructive tool in hand surgery, particularly in extensive dorsal defects where preservation of deeper structures allows their use. Because skin grafts lack an intrinsic vascular pedicle, their viability depends entirely on revascularization from the recipient bed; therefore, graft survival is directly related to the quality of

the prepared tissue bed. Split-thickness skin grafts demonstrate higher take rates and greater biological tolerance in previously infected or relatively vascularized wound beds. In contrast, full-thickness grafts provide superior aesthetic characteristics and less secondary contraction but require optimal local conditions to ensure survival.

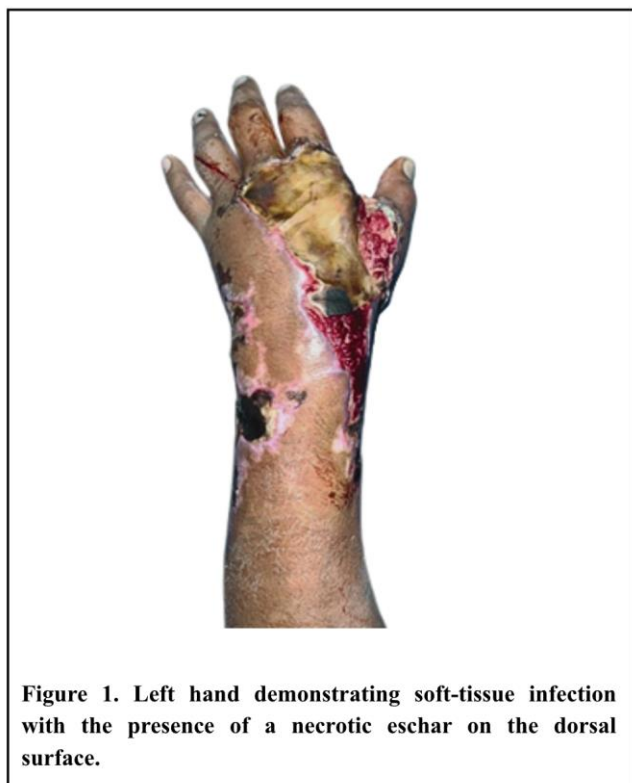
Understanding the biological principles of graft integration—plasmatic imbibition, vascular inosculation, and maturation—allows optimization of functional outcomes and helps minimize complications such as graft necrosis, scar contracture, or joint stiffness. In the hand, where mobility and sensation are essential for function, stable cutaneous coverage and early mobilization are critical to achieving adequate rehabilitation.

This report describes the sequential management of a dorsal cutaneous defect of the hand following an occupational traumatic injury complicated by soft-tissue infection. Emphasis is placed on the importance of effective septic control, appropriate preparation of the recipient bed, and coverage with a split-thickness skin graft as an effective reconstructive strategy to restore cutaneous integrity and promote functional recovery.

## CASE PRESENTATION

A 34-year-old left-hand-dominant male with no significant past medical history sustained a traumatic avulsion injury to the left hand following the fall of a mechanical suspension device during occupational activities. He initially presented to the emergency department, where primary closure of the cutaneous flap was performed, and he was discharged with outpatient follow-up.

During the subsequent clinical course, the patient developed an unfavorable evolution characterized by soft-tissue infection (Figure 1). Broad-spectrum antibiotic therapy was initiated using a dual oral regimen consisting of metronidazole 500 mg and cephalexin 500 mg. Subsequently, a purulent collection was identified on the dorsal surface of the left hand, and surgical drainage was performed with evacuation of approximately 50 cc of purulent material. Management was continued with serial wound care using a silver ion-based antiseptic and oral antibiotic therapy for two weeks.



### **I. Surgical Technique**

Due to the persistence of devitalized tissue, surgical debridement was performed, resulting in a dorsal wound defect measuring approximately  $14 \times 7$  cm with irregular margins and the presence of uniformly vascularized granulation tissue. (Figure 2).



Definitive cutaneous coverage was planned using a split-thickness skin graft (0.30 mm) harvested with a Zimmer electric dermatome. (Figure 3). At the postoperative

evaluation on day five, adequate graft integration into the recipient bed was observed, with no evidence of necrosis or ongoing infection. (Figure 4).



### **DISCUSSION**

Hand trauma associated with occupational accidents represents a significant source of morbidity among the economically active population and accounts for a

## Split-Thickness Skin Graft Reconstruction Following Post-Traumatic Hand Infection: Case Report and Literature Review

substantial proportion of consultations in trauma emergency departments and hand surgery units. These injuries predominantly occur in young men and frequently involve the dominant hand, resulting in considerable functional and socioeconomic consequences due to temporary or permanent work disability. Injuries caused by industrial machinery—particularly those involving entrapment, crushing, or avulsion—often produce complex damage characterized not only by cutaneous loss but also by microvascular injury, interstitial edema, capillary thrombosis, and progressive necrosis secondary to subclinical compartment syndrome. Initial contamination is typically high due to the working environment, the energy of the trauma, and the frequent presence of foreign bodies, all of which predispose to early infection and delay definitive reconstruction. Consequently, the initial goal of management is not merely wound closure, but rather preservation of critical structures, restoration of tissue perfusion, reduction of bacterial load, and preparation of a biologically suitable recipient bed for definitive soft-tissue coverage (Crowe et al., 2020; Wu et al., 2018).

**Soft-tissue infections** of the hand following trauma or primary closure under tension represent an expected complication in high-energy injuries. From a microbiological standpoint, *Staphylococcus aureus* remains the most common causative organism, followed by beta-hemolytic streptococci. However, in industrial or heavily contaminated wounds, polymicrobial infections involving gram-negative bacilli and anaerobic bacteria are frequently observed, particularly in the presence of necrosis, hematoma, or purulent collections. The pathophysiology of infection in the hand is influenced by unique anatomical features, including closed fascial compartments, tendon sheaths, and fascial planes that facilitate deep spread of infection and compromise local perfusion. In this setting, systemic antibiotic therapy alone is insufficient, as purulent collections create an acidic microenvironment, increase tissue pressure, and limit antibiotic penetration. Therefore, the presence of an abscess constitutes an absolute indication for surgical drainage. Following evacuation, empiric broad-spectrum antibiotic therapy should be initiated and subsequently tailored according to deep intraoperative culture results, a strategy that reduces recurrence and limits the development of antimicrobial resistance (King, 2023; Song, 2024).

**Surgical control of the infectious focus** requires wide incision, copious irrigation, and meticulous debridement until viable bleeding tissue is obtained. The persistence of fibrin, devitalized tissue, or bacterial biofilm prevents adequate angiogenesis and compromises any subsequent reconstructive procedure. In many cases, serial debridements are required to convert a contaminated wound into a clean wound suitable for reconstruction. Once the infection has been controlled, the priority shifts to

preparation of the wound bed for definitive coverage. The ideal recipient bed should demonstrate uniform granulation tissue, adequate capillary perfusion, absence of critical colonization, strict hemostasis, and mechanical stability, as hematoma formation or shear forces can prevent proper graft adherence. In the hand in particular, skin grafts do not survive when placed over tendons lacking paratenon or over bone without periosteum. Therefore, it may be necessary to promote granulation tissue formation beforehand, use dermal matrices, or consider flap coverage when these structures remain exposed (Milner, 2024).

A **skin graft** is defined as tissue transferred without its own vascular pedicle, whose viability depends entirely on revascularization from the recipient bed. Skin grafts are classified as either split-thickness or full-thickness depending on the amount of dermis transferred. A split-thickness skin graft includes the epidermis and superficial dermis; it has lower metabolic demand, higher take rates, and the ability to cover large surface areas, making it particularly useful in extensive defects or in wound beds with relative vascularity. However, it is associated with greater secondary contraction and less favorable aesthetic outcomes. In contrast, a full-thickness skin graft includes the entire dermis and provides superior texture, pigmentation, and less scar contraction, but it requires a highly vascularized wound bed and carries a greater risk of necrosis when local conditions are suboptimal. In extensive dorsal defects following infection, an intermediate split-thickness skin graft represents the safest reconstructive option, balancing biological viability with functional outcomes (Braza, 2025; Ramsey, 2025; Milner, 2024).

**Graft integration** occurs through three physiological phases. The initial phase of plasmatic imbibition (first 24–48 hours) allows diffusion-based nutrition and adhesion through fibrin deposition; any hematoma or purulent collection during this period may result in early graft failure. This is followed by the phase of inosculation and revascularization (approximately from day 2 to day 21), during which capillaries from the recipient bed establish direct connections with those of the graft, enabling effective blood circulation. Finally, the maturation phase develops and may extend over several months, characterized by reorganization of collagen fibers, gradual reduction of edema, changes in pigmentation, and progressive scar contraction. These changes are particularly relevant in the hand because of their potential impact on functional outcomes (Milner, 2024; Braza, 2025).

Clinical evaluation of the graft should be performed in a serial manner. **The fifth postoperative day** represents a critical time point for assessment, when a viable graft typically demonstrates a uniform pink coloration, appropriate temperature, firm adherence to the recipient bed, and absence of fluctuance. Persistent pallor suggests arterial ischemia, violaceous discoloration indicates venous

## Split-Thickness Skin Graft Reconstruction Following Post-Traumatic Hand Infection: Case Report and Literature Review

congestion, and purulent discharge is indicative of active infection. Adequate graft integration at this stage allows the initiation of early protected mobilization, which is essential to prevent joint stiffness, tendon adhesions, and functional impairment—complications that are particularly disabling in the hand (Milner, 2024).

Overall, the favorable evolution observed in this case aligns with **contemporary reconstructive principles**: effective infection control through surgical drainage and targeted antibiotic therapy, establishment of a well-vascularized wound bed through serial debridements, and definitive coverage using a split-thickness skin graft. This strategy provides stable cutaneous coverage, restores the protective function of the skin, and facilitates early rehabilitation, achieving high graft take rates in extensive dorsal hand defects (King, 2023; Milner, 2024; Song, 2024).

### CONCLUSIONS

Hand injuries resulting from high-energy occupational accidents represent complex lesions characterized by progressive tissue damage, significant bacterial contamination, and microvascular compromise. For this reason, primary closure of contaminated wounds or wounds under tension should be avoided when appropriate biological conditions are not present. Timely control of the septic focus through wide surgical drainage, copious irrigation, serial debridements, and targeted antibiotic therapy constitutes the fundamental step to halt progressive necrosis, reduce bacterial load, and convert a contaminated wound into a biologically viable wound bed. Preparation of the recipient area—defined by the presence of uniform granulation tissue, adequate capillary perfusion, strict hemostasis, and absence of critical colonization—is the most important determinant of reconstructive success, as the viability of any coverage method depends directly on the vascular quality of the wound bed.

**The selection of cutaneous coverage** should follow the principles of the **reconstructive elevator**, a concept that has replaced the traditional reconstructive ladder and allows individualized selection of the most appropriate technique based on factors such as defect depth, exposure of critical structures, prior contamination, functional requirements, and the patient's overall condition. In well-vascularized superficial defects, healing by secondary intention or skin grafting may be appropriate. However, when vital structures are exposed—such as tendons lacking paratenon, bone without periosteum, or joints—advancement along the reconstructive elevator toward local, regional, or free flaps providing vascularized tissue becomes necessary. (Figure 5)

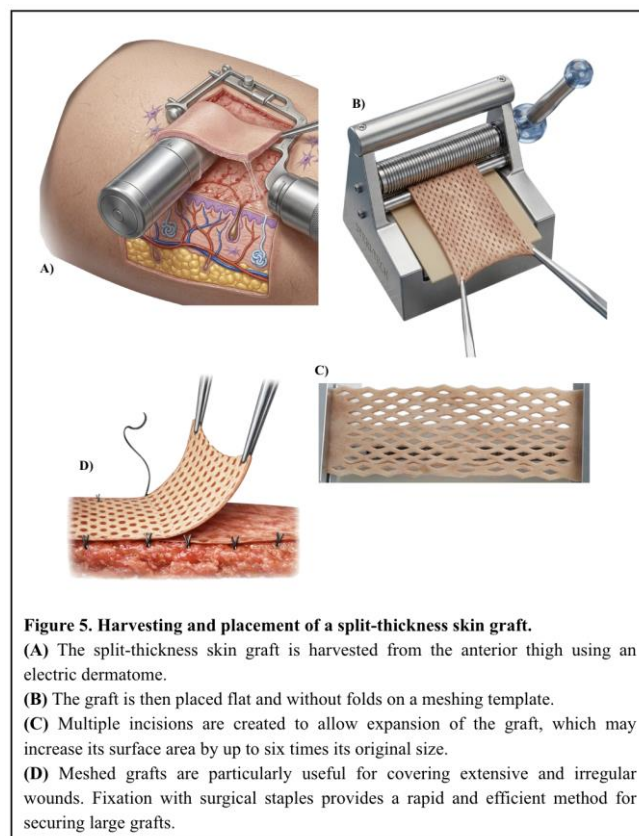


**Figure 5. Harvesting and placement of a split-thickness skin graft.**

- (A) The split-thickness skin graft is harvested from the anterior thigh using an electric dermatome.  
(B) The graft is then placed flat and without folds on a meshing template.  
(C) Multiple incisions are created to allow expansion of the graft, which may increase its surface area by up to six times its original size.  
(D) Meshed grafts are particularly useful for covering extensive and irregular wounds. Fixation with surgical staples provides a rapid and efficient method for securing large grafts.

On the dorsum of the hand, where coverage must remain thin, flexible, and allow adequate tendon gliding, a **split-thickness skin graft** represents a particularly effective reconstructive option when the wound bed has been properly prepared. This technique offers high graft take rates, lower metabolic demand, and the ability to cover large surface areas without increasing tissue bulk or restricting mobility. (Figure 6)

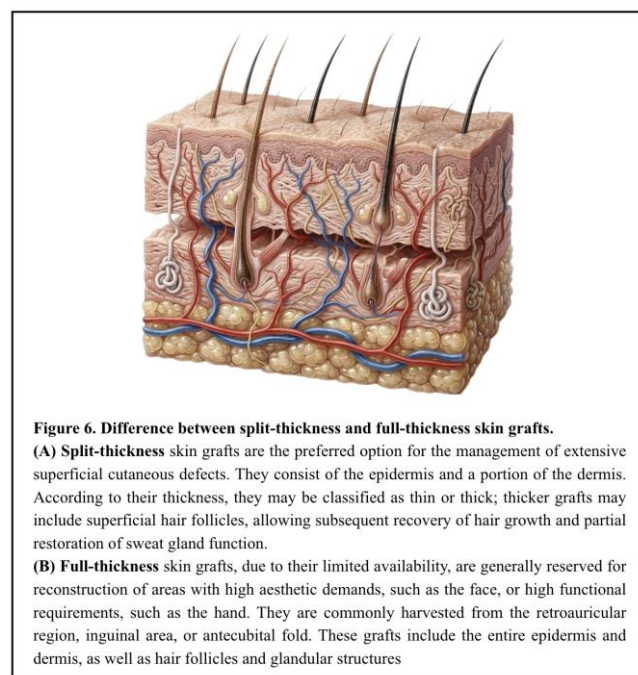


**Figure 6. Difference between split-thickness and full-thickness skin grafts.**

- (A) **Split-thickness** skin grafts are the preferred option for the management of extensive superficial cutaneous defects. They consist of the epidermis and a portion of the dermis. According to their thickness, they may be classified as thin or thick; thicker grafts may include superficial hair follicles, allowing subsequent recovery of hair growth and partial restoration of sweat gland function.  
(B) **Full-thickness** skin grafts, due to their limited availability, are generally reserved for reconstruction of areas with high aesthetic demands, such as the face, or high functional requirements, such as the hand. They are commonly harvested from the retroauricular region, inguinal area, or antecubital fold. These grafts include the entire epidermis and dermis, as well as hair follicles and glandular structures

Graft integration depends on the sequential processes of **initial plasmatic imbibition, vascular inosculation, and subsequent scar maturation**, biological mechanisms that

## Split-Thickness Skin Graft Reconstruction Following Post-Traumatic Hand Infection: Case Report and Literature Review

develop properly only in the absence of hematoma formation, infection, or mechanical shear. For this reason, early clinical evaluation is essential to detect signs of arterial ischemia, venous congestion, or infection, allowing timely interventions that may prevent partial or complete graft loss. Once graft integration has been confirmed, **early protected mobilization** becomes essential to prevent tendon adhesions, joint stiffness, and scar contractures complications that are particularly disabling in the hand. (Figure 7)

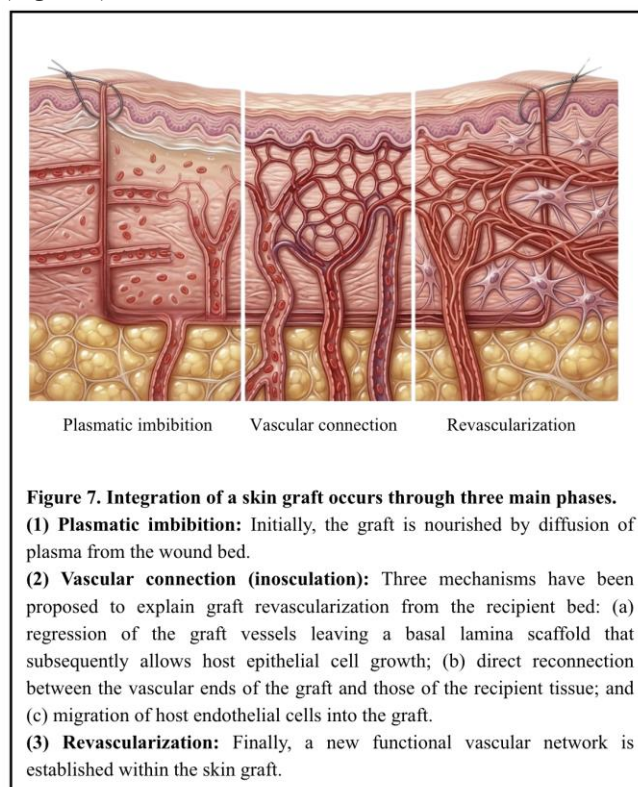


**Figure 7. Integration of a skin graft occurs through three main phases.**

**(1) Plasmatic imbibition:** Initially, the graft is nourished by diffusion of plasma from the wound bed.

**(2) Vascular connection (inosculation):** Three mechanisms have been proposed to explain graft revascularization from the recipient bed: (a) regression of the graft vessels leaving a basal lamina scaffold that subsequently allows host epithelial cell growth; (b) direct reconnection between the vascular ends of the graft and those of the recipient tissue; and (c) migration of host endothelial cells into the graft.

**(3) Revascularization:** Finally, a new functional vascular network is established within the skin graft.

Overall, **sequential management based on infection control, appropriate wound bed preparation, and rational selection of coverage according to the reconstructive elevator** allows restoration of cutaneous integrity, protection of underlying structures, and optimization of functional recovery. The use of a **split-thickness skin graft** in extensive dorsal defects following infection provides stable coverage with favorable functional outcomes and lower morbidity, while also contributing to reduced work disability time and improved overall patient prognosis.

### AUTHOR CONTRIBUTIONS

**Irada Antonio Zuñiga-Salazar:** conceptualization, project administration, supervision, writing – original draft, writing – review and editing. **Felipe Alarcón-Estrada:** formal analysis, resources, software, writing – review and editing. **Mauricio Alonso Espinosa-Romero:** investigation, methodology, resources. **Brenda Aracely Saenz-Medina:** investigation, resources. **Marlen González-Santana:** investigation, resources. **Elisa Taynisha Leal-Cabrera:** investigation, resources. **Diego Cabeza-**

**Gracia:** investigation, methodology, resources. **Jocelyn Galindo-Najera:** investigation, resources. **Alejandro Herbert Oliva-Arvizu:** investigation, resources. **Miriam Melina Vargas-Mejía:** investigation, resources.

### 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.

### REFERENCES

- I. Braza, M. E., & Fahrenkopf, M. P. (2025). Split-thickness skin grafts. *StatPearls Publishing*. <https://www.ncbi.nlm.nih.gov/books/NBK551561/>
- II. Crowe, C. S., Massenburg, B. B., Morrison, S. D., Chang, J., & Abady, G. G. (2020). Global trends of hand and wrist trauma: A systematic analysis of fracture and digit amputation using the Global Burden of Disease 2017 study. *Injury Prevention*, 26(Suppl 2), i115–i124. <https://doi.org/10.1136/injuryprev-2019-043495>
- III. Dailiana, Z. H., Rigopoulos, N., Varitimidis, S., & Malizos, K. N. (2018). Purulent flexor tenosynovitis: Factors influencing the functional outcome. *Journal of Hand Surgery (European Volume)*, 43(5), 509–514. <https://doi.org/10.1177/1753193417740875>
- IV. Fufa, D. T., Calfee, R. P., Wall, L. B., & Zeng, W. (2013). Acute hand infections. *Journal of Hand Surgery*, 38(12), 2458–2468. <https://doi.org/10.1016/j.jhsa.2013.09.028>
- V. King, V. M., & Tosti, R. (2023). Infection management for the hand surgeon. *Hand Clinics*, 39(2), 147–159. <https://doi.org/10.1016/j.hcl.2023.01.004>
- VI. Milner, S. M., & Choudhry, M. A. (2024). Skin grafting of the dorsum of the hand. *ePlasty*, 24, e15.
- VII. Ramsey, M. L., & Dove, C. R. (2025). Full-thickness skin grafts. *StatPearls Publishing*. <https://www.ncbi.nlm.nih.gov/books/NBK532875/>
- VIII. Shores, J. T., Higgins, J. P., & Lee, W. P. A. (2011). Tendon and soft tissue coverage of the hand. *Plastic and Reconstructive Surgery*, 127(3), 136e–151e. <https://doi.org/10.1097/PRS.0b013e318205f3e0>
- IX. Song, E. C., & Tosti, R. (2024). Diagnosis and management of hand infections. *Journal of Hand*

## Split-Thickness Skin Graft Reconstruction Following Post-Traumatic Hand Infection: Case Report and Literature Review

- Surgery*, 49(4), 345–357.  
<https://doi.org/10.1016/j.jhsa.2023.10.012>
- X. Thompson, P. W., & Herndon, D. N. (2017). Principles of burn reconstruction and skin grafting. *Plastic and Reconstructive Surgery*, 139(3), 688e–698e.  
<https://doi.org/10.1097/PRS.0000000000003110>
- XI. Weinzwieg, N., & Gonzalez, M. (2012). Surgical infections of the hand and upper extremity: A comprehensive review. *Plastic and Reconstructive Surgery*, 129(4), 795e–806e.  
<https://doi.org/10.1097/PRS.0b013e3182442355>
- XII. Wu, Z., Zhang, X., & Zhang, Y. (2018). The epidemiology of acute occupational hand injuries treated in emergency departments. *Ulus Travma Acil Cerrahi Dergisi*, 24(3), 256–262.  
<https://doi.org/10.5505/tjtes.2017.59020>
- XIII. Zubowicz, V. N., & Gravier, M. (2014). Management of soft tissue defects of the hand. *Hand Clinics*, 30(2), 193–205.  
<https://doi.org/10.1016/j.hcl.2013.12.006>
- XIV. Khan, W., Agarwal, M., & Funk, L. (2016). Skin grafting in hand reconstruction: A review of indications and outcomes. *Journal of Hand Surgery (European Volume)*, 41(6), 628–636.  
<https://doi.org/10.1177/1753193415620121>
- XV. Peterson, B. C., Mangiapani, D. S., & Kakar, S. (2019). Modern management of hand infections. *Hand Clinics*, 35(1), 1–12.  
<https://doi.org/10.1016/j.hcl.2018.08.001>