

Fingertip Repair and Reconstruction

Overview

- Staged flexor tendon reconstruction from fingertip to palm produced 69% good to excellent results [1].
- Homodigital reverse pedicle island flaps for soft tissue reconstruction of the finger and thumb result in minimal donor site morbidity [2].
- Homodigital reverse pedicle island flaps for soft tissue reconstruction of the finger and thumb preserve the length of the digit [2].
- Grip strength was appreciably greater in patients with replanted thumbs and multiple digits compared to those with replanted single digits [3].
- Lateral V-Y advancement flaps permit 10 to 14 mm of flap advancement on each side of the finger [4].
- A 20-year experience with distal finger replantation showed a success rate of 87% [5].
- Replantation of an amputated digit distal to the proximal interphalangeal joint in selected cases can be a worthwhile procedure [6].
- Patients were satisfied with the cosmetic appearance in all of the replanted fingers that survived [7].
- Dorsal adipofascial pedicle flaps are reliable and easy to harvest for dorsal or dorsolateral cutaneous defects of long fingers not exceeding 25 mm in diameter [8].
- Seventeen thumbs of seventeen patients were repaired with a palmar-hinged flap method, with an average follow-up of over 3 years [9].
- Dorsal V-Y advancement flaps are recommended for the more frequent smaller full-thickness dorsal defects of digits [11].
- There is no true answer, either in the literature or from the study group, regarding the complications of finger flaps [12].
- The aesthetic mini wrap-around technique for thumb reconstruction involves complete loss of the nail at the donor site [14].
- The aesthetic mini wrap-around technique for thumb reconstruction involves loss of the nail-to-nail pinch if the interphalangeal joint of the thumb cannot be salvaged [14].

- Resurfacing of the donor defect with a free lateral forearm flap is especially indicated for closure of moderate to big skin defects at the great-toe level during wrap-around procedures for thumb reconstruction [21].
- The thenar flap is a useful technique for severe fingertip injuries when local flaps cannot provide enough soft tissue and replantation is not possible [22].
- The radial artery island flap has proved to be a robust versatile flap ideally suited for reconstruction of the partially damaged thumb [24].
- Lengthening of amputation stumps of the distal phalanges using the modified Ilizarov method can lengthen amputated fingers without the need for bone graft [25].
- Free toe pulp transfer in thumb reconstruction is appealing for cosmetic and functional reasons [26].
- Free toe pulp transfer in thumb reconstruction is a technically demanding and prolonged procedure with unpredictable survival of the transferred neurovascular flaps [26].
- Replantation has advantages over reposition-flap repair in terms of less finger shortening [27].
- Replantation has advantages over reposition-flap repair in terms of longitudinal nail curvature [27].
- Replantation has advantages over reposition-flap repair in terms of absence of PIP flexion contracture [27].
- Replantation has advantages over reposition-flap repair in terms of shorter time off work [27].
- Patients treated with simple suturing of the nail bed showed improved outcomes compared to those treated with nail bed grafts [33].
- Patients who underwent reconstruction of the entire nail bed showed improved outcomes compared to those treated with nail bed grafts [33].
- Palmar grafts provide durable coverage for the indications described and should be considered the procedure of choice for late resurfacing of failed grafts from remote sites [35].
- Function, such as range of motion of the reconstructed digits and union of fractures covered by the flaps, is not superior from one type of flap versus the other when comparing de-epithelialized cross-finger flaps and adipofascial turnover flaps [37].
- Complications and patient dissatisfaction were different in the two patient groups when comparing de-epithelialized cross-finger flaps and adipofascial turnover flaps [37].
- Homodigital pedicle island flaps give satisfying aesthetic and functional results for specific indications in finger-pulp amputation [58].
- Homodigital pedicle island flaps allow considerable advancement for specific indications in finger-pulp amputation [58].

Anatomy & Pathophysiology

OSSEOUS ARCHITECTURE

- The skeleton of the hand consists of 27 bones, of which 19 are long bones [48].

- The hand skeleton is divided into five rays, each forming a polyarticulated chain comprising metacarpals and phalanges [48].
- The thumb ray (first ray) is the shortest, consisting of a metacarpal and two phalanges [48].
- The other four digital rays are formed by four skeletal segments: a metacarpal and three phalanges [48].
- The thumb metacarpal makes an angle of about 45 degrees with the second metacarpal in the sagittal plane [48].
- The epiphyseal plates are located at the proximal ends of the phalanges and the first metacarpal [48].
- The epiphyseal plates are located at the distal ends of the other metacarpals [48].
- The hand presents a longitudinal and transverse concavity, giving it the shape of a cup with a palmar concavity when the thumb is placed next to the index finger [48].
- The transverse axis of the palm forms an acute angle of approximately 75 degrees with the longitudinal axis [48].

MUSCULOTENDINOUS ANATOMY

- Extrinsic muscles have their origin outside of the hand and their insertion on the hand or carpus, whereas intrinsic muscles have both origin and insertion within the hand [47].
- The extrinsic extensors run through six different fibroosseous retinacular compartments at the wrist level [47].
- The extensor pollicis longus inserts on the distal phalanx and provides forceful extension of the thumb interphalangeal joint [47].
- The principal bony insertion of the extrinsic digital extensors is on the dorsal proximal aspect of the middle phalanx [47].
- Distal interphalangeal joint extension is achieved through the conjoined lateral bands, which are composed of tendinous slips from the extrinsic and intrinsic tendons [47].
- The flexor digitorum profundus inserts on the proximal volar aspect of the distal phalanx [47].
- The flexor digitorum superficialis inserts via radial and ulnar slips into the proximal metaphysis of the middle phalanx [81].
- The flexor pollicis longus inserts into the proximal base of the thumb distal phalanx [81].
- The fibroosseous tunnel, or digital flexor sheath, extends distally to the proximal aspect of the distal phalanx [81].
- The A2 and A4 pulleys are the most essential in maintaining the mechanical advantage of the flexor tendons [81].
- Within the flexor tendon sheath, tendon vascularity is supplied via the vincula system: the vinculum longus and brevis [81].
- There are seven interosseous muscles, four dorsal and three volar [74].
- The dorsal interossei are abductors, and the volar interossei are adductors [74].

- The middle finger has two dorsal interossei (abductors) and no volar interossei (adductors) because the central axis of the hand lies within it [74].
- The terminal tendon of the extensor mechanism inserts at the base of the distal phalanx to extend it [74].

VASCULAR AND NEUROVASCULAR ANATOMY

- The “princeps pollicis” artery is the terminal branch of the radial artery and runs along the ulnar side of the first metacarpal bone [78].
- The princeps pollicis divides into two terminal rami, the collateral palmar arteries of the thumb, which run along the digital tunnel symmetrically and are of equal caliber [78].
- An arcade located deep in the flexor tendon joins together the two arteries at the level of the distal metaphysis of the first phalanx [78].
- In anatomical studies, only 15% of dissections of the palmar arteries of the thumb fall into the “typical” classical category [78].
- The digital neurovascular structures are surrounded by a diffuse network of thin transverse oblique fibers [84].
- Fibers dorsal to the neurovascular bundle are collectively called Cleland ligament, and those palmar to the neurovascular bundle are called Grayson ligament [84].
- The thumb is technically more difficult to replant than other digits because of the anatomic arrangement of the neurovascular bundles [49].
- Good sensory return, especially on the ulnar side, is considered essential for the normal function of the thumb [49].

CUTANEOUS ANATOMY AND FUNCTIONAL UNITS

- The dorsal skin possesses a normal pilosebaceous system, unlike the palm [83].
- The dorsal skin has loose connections with deeper planes, allowing free gliding and full flexion at the digital joints [83].
- Flexion of the fingers produces a significant lengthening of the dorsal skin, with an average increase of 3 cm in the middle finger from extension to full flexion [83].
- The dorsal integument of the distal phalanx is characterized by the nail bed with its matrix [73].
- The palmar integument of the digits is subdivided into phalangeal units separated by digital flexion folds [73].
- When a digit is completely flexed, the integument of adjacent phalanges comes into contact in the zones of the flexion creases, establishing areas of cutaneous contact in the form of a diamond [73].
- The sides of the diamond-shaped cutaneous contact zones do not undergo variations in length during flexion and extension movements [73].
- Incisions made along the lines of the diamond-shaped cutaneous contact zones present a minimal chance of retraction [73].

- The dorsal slope of the web spaces has a gradual incline and its supple skin is not adherent to the subjacent region [73].
- The palmar surface of the web spaces is flat and precipitously interrupted, with skin densely adherent to the commissural skeleton [73].
- The necessary skin to cover the thumb distal to the metacarpophalangeal joint is about 9 cm wide and 8 cm long [76].
- The skin covering each finger is 7 cm by 10 cm on both the palmar and dorsal aspects [76].

PATHOPHYSIOLOGY OF INJURY

- Avulsion injuries are associated with a higher incidence of anastomotic failure than clean-cut amputations [30].
- In avulsion injuries, the zone of intimal damage may extend far beyond the actual level of amputation [30].
- The red line sign and the ribbon sign are recognized as indicators of damaged vessels and are suggestive of a poor prognosis for replantation [49].
- The main problem of distal phalangeal replantation, particularly in zone I, is venous drainage because the vessel diameter is too small for microsurgical repair or because no suitable dorsal vein can be found in the amputated part [17].
- Venous flooding after digital replantation will ultimately result in arterial compromise [17].
- Stiffness of the proximal interphalangeal joint can lead to an overall reduction in hand function following replantation [17].
- Conventional methods for fingertip coverage, such as local flaps or skin grafts, often cause long-lasting disability due to painful neuromas, tender scars, and ineffective precision pinch [17].
- Approximately 30–50% of patients with fingertip amputations experience cold intolerance and hypersensitivity [88].
- Local flap procedures for fingertip coverage involve incising and advancing uninjured tissue, which extends the area of scarring and damages the fine branches of the digital nerves [88].
- The experimental thresholds for finger avulsion resistance were defined as 260 Newtons at slow speed (0.01 m/min) and 4 kg in free fall from 0.50 m at rapid speed [92].

Classification

- Allen's classification of fingertip injuries includes Stage II, Stage III, and Stage IV [91].
- In a dual-center study of fingertip reconstruction, 61.9% of cases were classified as Allen Stage II [91].
- In a dual-center study of fingertip reconstruction, 33.1% of cases were classified as Allen Stage III [91].
- In a dual-center study of fingertip reconstruction, 5% of cases were classified as Allen Stage IV [91].
- Merle's classification of amputation levels includes Type 1a, Type 1b, and Type 1c [64].

- In a series of heterodigital neurovascular island flaps for thumb reconstruction, 18 cases were classified as Merle Type 1a [64].
- In a series of heterodigital neurovascular island flaps for thumb reconstruction, 10 cases were classified as Merle Type 1b [64].
- In a series of heterodigital neurovascular island flaps for thumb reconstruction, 2 cases were classified as Merle Type 1c [64].
- The Urbaniak et al. classification of ring avulsion injuries includes Class IV for completely amputated digits [43].
- In a series of ring avulsion injuries, 28 digits were classified as Class IV (completely amputated) [43].
- A new classification of the amputated level for the distal part of the finger was described by Ishikawa et al. [19].

Clinical Presentation

- Fingertip injuries are common and have been the subject of an inordinate amount of study [90].
- The most relevant single presenting indication for fingertip reconstruction is the presence of the amputated part with the possibility of distal replantation [90].
- Another relevant presenting indication is a neighboring “bank” digit that is functionally nonconservable but may be used to yield useful transferable parts [90].
- The decision for wound coverage or healing by secondary intention depends on the patient’s age, associated vascular and nerve damage, nature of work, and leisure activity [90].
- The decision for wound coverage or healing by secondary intention depends on the digit itself and its participation in fine pinch [90].
- The decision for wound coverage or healing by secondary intention depends on the nature of the trauma, including crush, avulsion, and contamination [90].
- The decision for wound coverage or healing by secondary intention depends on the precise nature of loss, including depth, extent, and delay of presentation [90].
- In avulsion amputations, soft-tissue injuries often occur more proximally than do skeletal injuries [49].
- The red line sign is a recognized indicator of damaged vessels and is suggestive of a poor prognosis for replantation [49].
- The ribbon sign is a recognized indicator of damaged vessels and is suggestive of a poor prognosis for replantation [49].
- In avulsion amputations, the traction force places tissues literally torn apart rather than cut [49].
- Avulsions often result in intimal damage both proximally and distally [49].
- The actual extent of intimal damage in avulsion injuries can be difficult to accurately judge by clinical evaluation [49].
- In ring avulsion injuries, isolated digital arterial injury is relatively common [51].

- In a series of ring avulsion injuries, seven of 14 class II injuries demonstrated only arterial compromise [51].
- Four of seven digits with isolated arterial compromise in ring avulsion injuries were misdiagnosed at initial evaluation despite definitive but subtle clinical signs [51].
- Digit amputations in the pediatric population are rare events and often occur secondary to avulsions or crushing injuries [52].
- The mean survival rate following replantation in the pediatric population is approximately 70% [52].
- The survival rate following replantation in the pediatric population is lower than the reported rates in adults when taking into account the injury mechanisms [52].
- Fingertips are particularly conspicuous because they carry the nails [38].
- In cases of crush or avulsion amputation, extensive damage to the arterial wall and other tissues complicate delicate microsurgical revascularization [38].
- Even if blood flow is reestablished in crush or avulsion amputations, arterioles eventually become occluded and necrosis occurs in about one-third of the cases with severe tissue damage in zone 1 [38].
- Less satisfactory results in crush or avulsion amputations included cases of patients with finger atrophy [38].
- The fingertips are particularly conspicuous because they carry the nails [38].

Investigations

- Clinical evaluation of the injured or dysfunctional hand and wrist requires combining patient history with a careful physical examination to pinpoint or narrow the scope of possible pathologic processes [46].
- Diagnostic tests such as imaging and serum laboratory studies are useful in determining pathology but can be expensive, time consuming, and often nonspecific [46].
- A careful physical examination is essential to direct care and future testing if indicated [46].
- An 8-MHz Doppler tone assessment may be used to identify superficially displaced neurovascular bundles when Dupuytren cords lie beneath soft fleshy prominences [87].
- False-negatives are possible with 8-MHz Doppler tone assessment for identifying neurovascular bundles [87].
- MRI is probably most useful in identifying additional pathology such as flexor tendon bowstringing in the context of Dupuytren's disease [87].
- MRI may be helpful in providing a quantitative noninvasive measure of cellularity of affected areas, which is an index of biologic activity [87].

Treatment

REPLANTATION

- Function seems to be almost always acceptable provided that there has been primary repair of all structures, especially the digital nerves [13].
- Replantation has several advantages over reposition-flap repair in terms of less finger shortening, longitudinal nail curvature, absence of PIP flexion contracture and shorter time off work [27].
- The overall survival rate of the fingertip replantations was 76%; that of the topical and systemic anticoagulation group was 64% [34].
- In cases of clean-cut and blunt-cut amputations, replantation in zone 1 has a 95.2% success rate [38].
- In cases of crush or avulsion amputation in zone 1, necrosis occurs in about one-third of the cases with severe tissue damage [38].
- Good results in terms of regained sensibility were experienced in about 60% of crush or avulsion injuries in zone 1 [38].
- Arteries in zone 1 are 0.2–0.4 mm in diameter and can be anastomosed microsurgically using 11/0 monofilament suture material [38].
- The excision of damaged vessels must include a substantial length of apparently healthy-looking vessel to minimise the risk of anastomotic complications [30].
- Replantation after amputations distal to the lunula will show near normal nail regeneration if there is minimal postoperative circulatory disturbance [70].
- Grip strength was appreciably greater in patients with replanted thumbs and multiple digits, and less so in those with replanted single digits [3].

LOCAL FLAPS

- The Moberg volar advancement flap is a safe as well as effective adjunct in the treatment of finger tip injuries [10].
- A double V-Y flap is a simple and reproducible technique that can be used in any of the fingers [20].
- Homodigital reverse pedicle island flaps have minimal donor site morbidity and preserve the length of the digit [2].
- Homodigital neurovascular island flaps successfully restored sensibility to the tip of the thumb and preserved its sensory orientation [15].
- Homodigital pedicle island flaps give satisfying aesthetic and functional results, allowing considerable advancement for specific indications in finger-pulp amputation [58].
- Varying the homodigital triangular neurovascular island flap design and dissection technique according to the type of amputation provides good results in terms of fingertip contour and padding, range of motion and sensibility [62].

- A homodigital switch flap to restore sensation to the ulnar border of the thumb tip has minimal donor site morbidity [57].
- The innervation of a homodigital switch flap is from the same digit and remains uninterrupted [57].
- Dorsal transposition flaps for reconstruction of lateral or medial oblique amputations of the thumb with exposure of bone obviate the need for cross-digit flaps and avoid the risk of digital stiffness [63].
- A palmar-hinged flap for reconstruction of traumatic thumb defects was used in seventeen thumbs of seventeen patients with an average follow-up of over 3 years [9].
- Dorsal adipofascial pedicle flaps are reliable and easy to harvest, intended for dorsal or dorsolateral cutaneous defects of long fingers not exceeding 25 mm in diameter [8].
- De-epithelialized cross-finger flaps and adipofascial turnover flaps do not differ in function, such as range of motion of the reconstructed digits and union of fractures covered by the flaps [37].
- Complications and patient dissatisfaction were different between de-epithelialized cross-finger flaps and adipofascial turnover flaps [37].

REGIONAL AND FREE FLAPS

- The thenar flap is a useful technique for use with severe fingertip injuries when local flaps cannot provide enough soft tissue and replantation is not possible [22].
- Free palmar skin grafts provide durable coverage and should be considered the procedure of choice for late resurfacing of failed grafts from remote sites [35].
- A reverse osseofasciocutaneous radial forearm flap with a butterfly design is a useful modification for thumb reconstruction [28].
- Free toe pulp transfer in thumb reconstruction is appealing for cosmetic and functional reasons, but it is a technically demanding and prolonged procedure with unpredictable survival of the transferred neurovascular flaps [26].
- Toe-to-thumb transfer can reconstruct sensate pulp, nail, and motion, but the reconstructed thumb is smaller than normal [39].
- In thumb reconstruction with a wraparound free flap distal to the MCP joint, complete opposition was possible in all cases [59].
- In thumb reconstruction with a wraparound free flap at or proximal to the MCP joint, complete opposition was achieved only when the graft was fixated at 30° flexion and 45° internal rotation [59].
- A free lateral forearm flap is especially indicated for closure of moderate to big skin defects at the great-toe level during wrap-around procedures for thumb reconstruction [21].
- A functional latissimus dorsi island pedicle musculocutaneous flap restored active finger flexion or extension in all transfers [32].
- The aesthetic mini wrap-around technique for thumb reconstruction has the disadvantage of complete loss of the nail at the donor site and loss of the nail-to-nail pinch if the interphalangeal joint of the thumb cannot be salvaged [14].

BONE AND NAIL BED

- The 'Te' technique addresses both bone and soft tissue problems faced in fingertips destabilized from underlying bony resorption [36].

COMPOSITE AND OTHER TECHNIQUES

- In patients with four-finger amputations, the second toe and great toe wrap-around composite flap provided satisfactory finger replacement when thumb function was normal [16].
- Ray transposition for central digital loss improved prehension and esthetics of the hand in all patients [23].
- The pulp plasty composite graft provides a relatively normal contour and satisfactory pad to the fingertip for complete syndactyly fingertip separations [45].
- In an older patient with a severely injured hand and a damaged expendable digit, the osteocutaneous digital fillet flap offers promise as an alternative in the management of composite tissue losses in the hand [55].
- Microsurgical repair of digital nerves gives satisfactory results, since a normal or good two-point discrimination can be obtained in one-half of cases while sensation improves in the others [29].

Complications

REPLANTATION AND VASCULAR OUTCOMES

- In cases of crush or avulsion amputation in zone 1, arterioles eventually become occluded and necrosis occurs in about one-third of the cases with severe tissue damage [38].
- The overall survival rate of fingertip replantations treated with topical and systemic anticoagulation was 76%, while the survival rate for the specific topical and systemic anticoagulation group was 64% [34].
- The risk of thrombosis is significantly increased when an injured vessel is microanastomosed [30].
- The zone of intimal damage in avulsion injuries may extend far beyond the actual level of amputation [30].
- Conventional methods for wound coverage, such as local or distal flaps, full thickness skin grafts, or delayed wound healing, often cause long lasting disability due to painful neuromas, tender scars, and ineffective precision pinch [17].
- Among replantations with vascular success, approximately 30% achieved complete functional success at one year without revision surgery [71].
- When veins are used for arterial reconstruction, a mismatch of calibre between the graft and the distal and proximal arteries is not uncommon [30].
- Joining vessels of differing calibre is difficult and often results in an anastomosis which is haemodynamically unsafe [30].

FLAP AND SOFT TISSUE COMPLICATIONS

- Flap necrosis and hook nail deformity due to suture line tension are relatively common complications in V-Y advancement flap for fingertip reconstruction [42].

- In a series of 28 patients treated with a modified V advancement flap, complications included 4 cases of hypertrophic scar and keloid, 2 cases of complex regional pain syndrome, 6 cases of delayed union, and 1 case of refracture [42].
- No cases of infection associated with osteosynthesis material were observed in the series of 28 patients treated with a modified V advancement flap [42].
- Fractures in the nondominant hand, intra-articular fractures, and delay in surgical treatment are associated with poorer functional outcomes in fingertip reconstruction [42].
- Four flaps needed debulking and contracted flap margins were released in three cases during dorsal middle phalangeal finger flap procedures [66].
- Z-plasties were carried out in one finger and two thumb webs to correct scar contractures along the passage line of the flap pedicles [66].
- The single flap necrosis in a series of 41 heterodigital neurovascular island flaps occurred in one of the early cases [64].
- The disadvantages of the aesthetic mini wrap-around technique for thumb reconstruction include complete loss of the nail at the donor site and loss of the nail-to-nail pinch if the interphalangeal joint of the thumb cannot be salvaged [14].

DONOR SITE MORBIDITY

- Donor site morbidity for the homodigital reverse pedicle island flap is minimal [2].
- The donor site morbidity for the homodigital switch flap to restore sensation to the ulnar border of the thumb tip is minimal [57].
- The donor site morbidity for secondary restoration of fingertip sensation with Littler's heterodigital neurovascular island flap after ring avulsion injury is tolerable [101].
- Donor site morbidity for conventional nerve grafts in the setting of digital nerve loss is not zero [103].

NAIL BED AND SENSORY COMPLICATIONS

- Failures in nail bed repair and reconstruction by reverse dermal grafts were attributed to errors in indication, specifically underestimated matrix involvement, and postoperative infectious complications [102].
- Seven of 10 secondary reconstruction procedures for nail bed defects ultimately had poor results [69].
- In cases of crush or avulsion amputation in zone 1, good results in terms of regained sensibility were experienced in about 60% of injuries [38].
- Less satisfactory results in zone 1 replantations included cases of patients with finger atrophy [38].

Recovery

REPLANTATION OUTCOMES AND COMPLICATIONS

- A 20-year experience with distal finger replantation demonstrated a success rate of 87% [5].
- The overall survival rate of fingertip replantations was 76%, while the survival rate for the topical and systemic anticoagulation group was 64% [34].
- The benefit of replantation of a single amputated digit remains controversial [17].
- Stiffness of the proximal interphalangeal joint can lead to an overall reduction in hand function [17].
- Digital replantation distal to the insertion of the flexor digitorum superficialis avoids the complication of proximal interphalangeal joint stiffness [17].
- Conventional methods for wound coverage, such as local or distal flaps or full thickness skin grafts, often cause long lasting disability due to painful neuromas, tender scars and ineffective precision pinch [17].
- Venous flooding after digital replantation will ultimately result in arterial compromise and can only be prevented by drainage of venous blood [17].

SOFT TISSUE RECONSTRUCTION AND FLAPS

- Fingertip to palm staged flexor tendon reconstruction produced 69% good to excellent results [1].
- Donor site morbidity is minimal, and the length of the digit is preserved in homodigital reverse pedicle island flaps [2].
- Seventeen thumbs of seventeen patients were repaired with a palmar-hinged flap, with an average follow-up of over 3 years [9].
- Functional latissimus dorsi island pedicle musculocutaneous flap transfers restored active finger flexion or extension in all cases [32].
- Seven of 10 secondary reconstruction procedures using reverse dermal grafts ultimately had poor results [69].
- A bilobed racquet flap or extended seagull flap used for thumb reconstruction exhibited no necrosis or venous congestion in a reported case [50].
- At the latest follow up at four months, two-point discrimination at the injured thumb was 10 mm in a patient treated with a bilobed racquet flap [50].

FUNCTIONAL AND SENSORY RECOVERY

- The technique of digital nerve advancement successfully restored sensibility to the tip of the thumb and preserved its sensory orientation [15].
- Functional testing showed that strength and dexterity of the toe transfer hands were comparable to the opposite normal hands [67].

Key Evidence

- [L4] Fingertip to palm staged flexor tendon reconstruction produced 69% good to excellent results. [1] ([10.1053/jhsu.2002.34319](#))
- [L4] Donor site morbidity is minimal, and the length of the digit is preserved. [2] ([10.1016/0266-7681\(94\)90149-x](#))
- [L3] Grip strength was appreciably greater in patients with replanted thumbs and multiple digits, and less so in those with replanted single digits. [3] ([10.1016/s0363-5023\(82\)80085-3](#))
- [L4] This technique permits 10 to 14 mm of flap advancement on each side of the finger. [4] ([10.1016/s0363-5023\(83\)80153-1](#))
- [L4] Our 20-year experience with distal finger replantation showed a success rate of 87%. [5] ([10.1097/bth.0b013e31820504c9](#))
- [L4] Replantation of an amputated digit distal to the proximal interphalangeal joint in selected cases can be a worthwhile procedure. [6] ([10.1016/s0363-5023\(82\)80081-6](#))
- [L4] The patients were satisfied with the cosmetic appearance in all of the replanted fingers that survived. [7] ([10.1016/s0363-5023\(85\)80107-6](#))
- [L4] These flaps are reliable and easy to harvest, intended for dorsal or dorsolateral cutaneous defects of long fingers not exceeding 25 mm in diameter. [8] ([10.1016/j.main.2006.04.001](#))
- [L4] Seventeen thumbs of seventeen patients were repaired with this method, with an average follow-up of over 3 years. [9] ([10.1016/s0363-5023\(87\)80016-3](#))
- [L4] Our results suggest this to be a safe as well as effective adjunct in the treatment of finger tip injuries. [10] ([10.1016/s0363-5023\(80\)80179-1](#))
- [L4] The authors recommend this simple and quick technique for the more frequent smaller full-thickness dorsal defects of digits. [11] ([10.1016/0266-7681\(94\)90058-2](#))
- [L4] There is no true answer, either in the literature or from the study group, regarding the complications of finger flaps. [12] ([10.1016/s1297-3203\(01\)00029-4](#))
- [L4] Function seems to be almost always acceptable provided that there has been primary repair of all structures, especially the digital nerves. [13] ([10.1016/0266-7681\(84\)90028-7](#))
- [L4] The disadvantages are complete loss of the nail at the donor site and loss of the nail-to-nail pinch if the interphalangeal joint of the thumb cannot be salvaged. [14] ([10.1097/01.bth.0000151862.54660.96](#))
- [L5] The technique of digital nerve advancement successfully restored sensibility to the tip of the thumb and preserved its sensory orientation. [15] ([10.1016/s0363-5023\(84\)80239-7](#))
- [L4] In patients with four-finger amputations, the second toe and great toe wrap-around composite flap provided satisfactory finger replacement when thumb function was normal. [16] ([10.1016/s0363-5023\(82\)80145-7](#))
- [L4] [17] ([10.1016/s0266-7681\(98\)80005-3](#))
- [L4] [19] ([10.1016/j.jhsb.2005.04.014](#))

- [L4] It is a simple and reproducible technique that can be used in any of the fingers. [20] ([10.1097/bth.000000000000132](#))
- [L4] This technique is especially indicated for closure of moderate to big skin defects at the great-toe level, whenever a larger than usual amount of skin is required, during wrap-around procedures for thumb reconstruction. [21] ([10.1016/s0363-5023\(97\)80090-1](#))
- [L4] The thenar flap is a useful technique for use with severe fingertip injuries when local flaps cannot provide enough soft tissue and replantation is not possible. [22] ([10.1016/j.jhsb.2003.10.006](#))
- [L4] Prehension and esthetics of the hand were improved in all patients. [23] ([10.1016/s0363-5023\(79\)80159-8](#))
- [L4] The radial artery island flap has proved to be a robust versatile flap ideally suited for reconstruction of the partially damaged thumb. [24] ([10.1016/0266-7681\(86\)90008-2](#))
- [L4] The procedure can lengthen amputated fingers without the need for bone graft. [25] ([10.1053/jhsu.2003.50054](#))
- [L4] Free toe pulp transfer in thumb reconstruction is appealing for cosmetic and functional reasons, but it is a technically demanding and prolonged procedure with unpredictable survival of the transferred neurovascular flaps. [26] ([10.1016/0266-7681\(91\)90169-o](#))
- [L4] Replantation has several advantages over reposition-flap repair in terms of less finger shortening, longitudinal nail curvature, absence of PIP flexion contracture and shorter time off work. [27] ([10.1016/s0266-7681\(97\)80401-9](#))
- [L4] The butterfly design is a useful modification of the skin paddle of the reverse osseofasciocutaneous radial forearm flap for thumb reconstruction. [28] ([10.1016/j.jhsa.2005.08.006](#))
- [L4] Microsurgical repair of digital nerves gives satisfactory results, since a normal or good two-point discrimination can be obtained in one-half of cases while sensation improves in the others. [29] ([10.1016/0266-7681\(91\)90111-z](#))
- [L4] [30] ([10.1016/0266-7681\(91\)90009-d](#))
- [L4] All transfers restored active finger flexion or extension. [32] ([10.1016/s0363-5023\(85\)80207-0](#))
- [L4] In our series, patients treated with simple suturing of the nail bed—both those with and without associated finger fractures—and patients who underwent reconstruction of the entire nail bed showed improved outcomes compared to those treated with nail bed grafts. [33] ([10.1016/j.hansur.2018.10.052](#))
- [L4] The overall survival rate of the fingertip replantations was 76%; that of the topical and systemic anticoagulation group was 64%. [34] ([10.1053/jhsu.2000.6920](#))
- [L4] Palmar grafts provide durable coverage for the indications described and should be considered the procedure of choice for late resurfacing of failed grafts from remote sites. [35] ([10.1016/s0363-5023\(81\)80133-5](#))
- [L5] The method addresses both bone and soft tissue problems faced in fingertips destabilized from underlying bony resorption. [36] ([10.1142/s0218810417500472](#))

- [L4] Function (such as range of motion of the reconstructed digits and union of fractures covered by the flaps) is not superior from one type of flap versus the other, however, complications and patient dissatisfaction were different in the 2 patient groups. [37] ([10.1016/j.jhsa.2005.02.004](#))
- [L4] [38] ([10.1016/0266-7681\(93\)90095-w](#))
- [L4] Toe-to-thumb transfer can reconstruct sensate pulp, nail, and motion, but the reconstructed thumb is smaller than normal. [39] ([10.1016/0266-7681\(84\)90032-9](#))
- [L4] [42] ([10.1177/1558944716660555dg](#))
- [L4] [43] ([10.1016/j.jhsa.2004.07.015](#))
- [L4] This technique provides a relatively normal contour and satisfactory pad to the fingertip. [45] ([10.1016/0363-5023\(92\)90105-x](#))
- [L4] [49] ([10.1016/s0363-5023\(87\)80070-9](#))
- [L5] [50] ([10.1142/s2424835518720050](#))
- [Paper] [51] ([10.1016/s0363-5023\(85\)80091-5](#))
- [L5] [52] ([10.1016/j.main.2015.07.003](#))
- [L5] In an older patient with a severely injured hand and a damaged expendable digit, the osteocutaneous digital fillet flap offers promise as an alternative in the management of composite tissue losses in the hand. [55] ([10.1016/s0266-7681\(85\)80024-3](#))
- [L4] The innervation of the flap is from the same digit and remains uninterrupted, which probably plays a large part in this, and the reconstruction has minimal donor site morbidity. [57] ([10.1016/s0266-7681\(03\)00174-8](#))
- [L4] For specific indications in finger-pulp amputation, the homodigital pedicle island flaps give satisfying aesthetic and functional results, allowing considerable advancement. [58] ([10.1016/j.main.2012.10.161](#))
- [L4] In group 1 (distal to MCP), complete opposition was possible in all cases, while in group 2 (at or proximal to MCP), complete opposition was achieved only when the graft was fixated at 30° flexion and 45° internal rotation. [59] ([10.1053/jhsu.2000.6465](#))
- [L4] Varying the flap design and dissection technique according to the type of amputation provides good results in terms of fingertip contour and padding, range of motion and sensibility. [62] ([10.1016/s0266-7681\(95\)80056-5](#))
- [L4] It obviates the need for cross-digit flaps and avoids the risk of digital stiffness. [63] ([10.1016/s0363-5023\(83\)80089-6](#))
- [L4] [64] ([10.1016/0266-7681\(94\)90113-9](#))
- [L3] [66] ([10.1016/s0266-7681\(97\)80403-2](#))
- [L3] Functional testing showed that strength and dexterity of the toe transfer hands were comparable to the opposite normal hands. [67] ([10.1053/jhsu.2000.6913](#))
- [L4] In contrast, seven of 10 secondary reconstruction procedures ultimately had poor results. [69] ([10.1016/s0363-5023\(83\)80134-8](#))

- [L4] Replantation after amputations distal to the lunula will show near normal nail regeneration if there is minimal postoperative circulatory disturbance. [70] ([10.1016/s0363-5023\(96\)80105-5](https://doi.org/10.1016/s0363-5023(96)80105-5))
- [L4] Among replantations with vascular success, approximately 30% achieved complete functional success at one year without revision surgery. [71] ([10.1016/j.main.2005.08.005](https://doi.org/10.1016/j.main.2005.08.005))
- [L4] [90] ([10.1016/0363-5023\(94\)90072-8](https://doi.org/10.1016/0363-5023(94)90072-8))
- [L4] [91] ([10.1016/j.hansur.2019.11.003](https://doi.org/10.1016/j.hansur.2019.11.003))
- [Paper] The experimental thresholds for finger avulsion resistance were defined as 260 Newtons at slow speed (0.01 m/min) and 4 kg in free fall from 0.50 m at rapid speed. [92] ([10.1016/s1297-3203\(00\)73528-1](https://doi.org/10.1016/s1297-3203(00)73528-1))
- [L4] The donor site morbidity is tolerable. [101] ([10.1016/j.main.2014.12.001](https://doi.org/10.1016/j.main.2014.12.001))
- [L4] Failures in this series were attributed to errors in indication (specifically underestimated matrix involvement) and postoperative infectious complications. [102] ([10.1016/s1297-3203\(02\)00136-1](https://doi.org/10.1016/s1297-3203(02)00136-1))
- [L4] However, donor site morbidity is not zero. [103] ([10.1016/j.main.2013.10.016](https://doi.org/10.1016/j.main.2013.10.016))

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