Fingertip Injuries: Evaluation and Treatment

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Abstract

The primary goal of treatment of an injury to the fingertip is a painless fingertip with durable and sensate skin. Knowledge of fingertip anatomy and the available techniques of treatment is essential. For injuries with soft-tissue loss and no exposed bone, healing by secondary intention or skin grafting is the method of choice. When bone is exposed and sufficient nail matrix remains to provide a stable and adherent nail plate, coverage with a local advancement flap should be considered. If the angle of amputation does not permit local flap coverage, a regional flap (cross-finger or thenar) may be indicated. If the amputation is more proximal or if the patient is not a candidate for a regional flap because of advanced age, osteoarthritis, or other systemic condition, shortening with primary closure is preferred. Composite reattachment of the amputated tip may be successful in young children. The outcome of nail-bed injuries is most dependent on the severity of injury to the germinal matrix.

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Fingertip injuries, defined as those distal to the insertion of the flexor and extensor tendons, are the most common injuries of the hand. Although maintenance of length, preservation of the nail, and appearance are important, the primary goal of treatment is a painless fingertip with durable and sensate skin. Considerable hand dysfunction results when a painful fingertip causes the patient to exclude the digit from use. Treatment must be individualized on the basis of many patient-related factors and specific wound characteristics. Methods of treatment include healing by secondary intention, skin grafting, shortening of the bone and primary closure, and coverage with a local or regional flap. Composite reattachment should be considered for fingertip amputations in young children. Although microsurgical replantation is not indicated in most cases, it may be justified for some injuries of the thumb, including those in children.

Anatomy of the Fingertip

Knowledge of fingertip anatomy[1] is essential for optimal treatment of injuries. The skin covering the pulp of the finger is very durable and has a thick epidermis with deep papillary ridges. The thick skin beneath the distal free edge of the nail plate is called the hyponychium. The pulp consists of fibrofatty tissue that is stabilized by fibrous septa extending from the dermis to the periosteum of the distal phalanx.

The nail complex, or perionychium, includes the nail plate, the nail bed, and the surrounding skin on the dorsum of the fingertip (paronychium) (Fig. 1). The nail bed is adherent to the very thin periosteum over the distal two thirds or so of the distal phalanx and consists of the sterile and germinal matrices. The germinal matrix is located proximally and forms the ventral floor of the nail fold. Its distal margin is defined by the white semicircular area near the base of the nail, known as the lunula. The germinal matrix produces 90% of the thickness of the nail plate; however, the nail plate is not adherent to the germinal matrix. The sterile matrix, the portion of the nail bed distal to the lunula, is adherent to the nail plate and contributes little to its thickness. The dorsal skin over the nail fold is called the nail wall. The distal margin of the nail wall, which adheres to the nail plate, is called the eponychium. The matrix tissue that forms the dorsal roof of the nail fold provides shine to the nail plate.

General Principles of Evaluation and Treatment

Evaluation of a patient with a fingertip injury begins with taking a history of the mechanism of injury and im-

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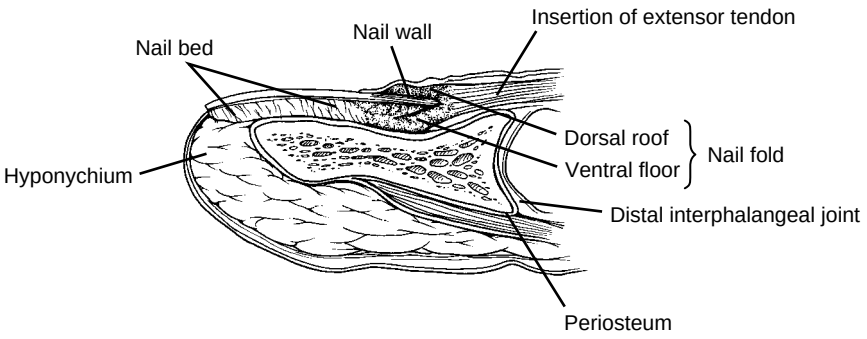

Fig. 1 The anatomy of the nail bed in sagittal section.

portant patient-related factors, such as age, gender, handedness, occupation, avocation, and history of previous hand problems and systemic diseases. A complete hand examination includes assessment of the skin, vascularity, neurologic function, and flexor and extensor tendon function. The injury site is inspected with specific attention to the characteristics of the wound. Radiographs of the finger are obtained to assess the extent of bone injury. Intravenous antibiotics are given to patients with a fracture, and appropriate tetanus prophylaxis is provided.

Once the patient and wound have been completely assessed, a treatment plan is formulated. If more than one option is available, the advantages and disadvantages of each should be discussed with the patient, and the simplest method that accomplishes the desired result should be selected.

Many fingertip injuries can be managed in a well-equipped emergency department, but complex regional flaps are more appropriately treated in a formal operating room. A digital block placed at the level of the metacarpal head is a convenient method of obtaining analgesia. A wrist block can be used when more than one digit is injured. The entire hand and forearm are prepared and draped in sterile fashion. A bloodless field is essential to allow inspection and repair of the wound. A Penrose drain clamped around the base of the finger is convenient, but other devices, such as a pneumatic digital sleeve, a wrist tourniquet, or a blood pressure cuff placed around the forearm, can also be used. The wound should be closely inspected after it has been thoroughly irrigated and debrided of all nonviable and contaminated soft tissue. It is critical to remember that in the severely crushed fingertip, the full extent of the injury may not be evident until the wound has been meticulously debrided, which then necessitates modification of the original treatment plan.

The specific wound characteristics determine which method of treatment is optimal for a given patient. It is important to know whether there is loss of skin or pulp tissue and the amount of such loss, as well as whether there is exposed bone, a distal phalangeal fracture, or injury to the nail bed or perionychial tissue. In the case of amputation, it is important to establish the level and angle of injury. For wounds with no soft-tissue loss, simple closure is all that is needed. Viable skin flaps are loosely sutured, and a splint is applied if a fracture is present.

The treatment of specific types of injuries and the use of various surgical options are discussed in the following sections.

Soft-Tissue Loss Without Exposed Bone

Appropriate treatment for loss of skin or pulp tissue without exposed bone is either to perform a skin graft or to allow the wound to heal by secondary intention. Controversy exists as to which is method is better. Most agree that smaller wounds (those no larger than 1 cm^2) should be treated nonoperatively by the open method; however, the size of the defect relative to the size of the finger must be taken into consideration.

The primary advantage of the open technique is its simplicity. Several authors have reported superior results, high patient satisfaction, and few complications with this method.[2,3] Complete healing usually takes 3 to 5 weeks and occurs by wound contraction and epithelialization. About 7 to 10 days after the injury, the patient is instructed to begin soaking the finger in a warm water–peroxide solution once a day and to apply a light bandage and fingertip protector. Range-of-motion exercises are encouraged. When the wound is completely epithelialized, a home program of desensitization is initiated.

Larger wounds treated nonoperatively heal with a thin layer of epithelium that is not very durable, and application of a skin graft should be considered. Skin grafts applied to the palmar surface of the fingertip should be full thickness because they contract less, are more durable and less tender, and achieve better sensibility than split grafts. The hypothenar area is the preferred donor site, as it is convenient and the skin is durable and an excellent color match, similar in quality to the skin of the pulp.[4]

The skin graft is taken from the hairless area of the ulnar border of the hand. The width of the graft

can be as much as 2 cm. The donor site is closed primarily. The graft is sutured over the defect, with a few sutures left long so that a moist cotton ball can be secured over the graft to help maintain coaptation with the underlying tissue. The cotton ball is removed after about 7 days, and range-of-motion exercises are initiated. Skin grafts should not be used indiscriminately, as they can be associated with significant morbidity, such as tenderness, hypesthesia, decreased sensibility, infection, failure, and donor-site complaints.

Soft-Tissue Loss With Exposed Bone

When bone is exposed, satisfactory soft-tissue coverage must be obtained. There is almost never sufficient local tissue available to close primarily, and attempts to do so may result in skin necrosis, a painful fingertip, and prolonged morbidity. Nonmicrovascular reattachment of the fingertip as a composite graft is not recommended in adults. It has been reported to be successful in a few patients,[5] but it frequently results in failure. Treatment by the open method after the bone has been shortened below the level of the skin may result in a satisfactory outcome; however, it is associated with an unacceptable incidence of nail-plate deformities. Coverage by local or regional flaps or shortening of the bone with primary closure is usually necessary for these types of wounds. The choice of procedure is determined primarily on the basis of the level and angle of the amputation and the age and sex of the patient.

Revision Amputation

Shortening and primary closure of fingertip amputations is indicated in adults of any age when not enough sterile matrix remains (less than 5 mm) to produce an adherent, stable nail.[6] Patients who are of advanced age or who have a systemic condition and in whom, therefore, a regional flap is contraindicated should undergo a revision amputation when open treatment, skin grafting, or local flap coverage is not possible.

The remaining nail matrix must be ablated to prevent formation of irritating nail remnants. To gain access to the most proximal portion of the germinal matrix, the nail wall is reflected proximally by making incisions on each side of it, extending from the eponychium. If the flexor and extensor tendon insertions cannot be preserved in the revision, the distal interphalangeal joint should be disarticulated, as there is no advantage in preserving a small stump of distal phalanx.

Distal traction is applied to the profundus and extensor tendons, which are then transected and allowed to retract. The prominent volar condyles of the head of the middle phalanx are removed with a rongeur, and the palmar plate and collateral ligaments are excised to improve the contour. To prevent the occurrence of a painful neuroma, it is essential that the digital nerves be identified, mobilized for a short distance, placed under slight tension, and transected about 1 cm from the wound edge. The palmar skin is brought over the end of the bone and sutured to the dorsal skin. If the angle of the amputation is oblique in the sagittal plane, the side with the long skin flap is used to cover the bone. Excess skin (e.g., dog-ears) usually needs to be trimmed to obtain satisfactory contour and appearance.

Local Flaps

A local flap is one in which the transferred tissue is confined to the injured digit, with at least one side of the flap adjacent to the defect. The advantages are that they can be used in patients of any age, they preserve length, the donor defect does not require a skin graft, and the transposed tissue is similar in quality, texture, and color to that of the recipient site. An early range-of-motion program can be started. Use of these flaps requires judgment and expertise and should not be attempted by the inexperienced. Figure 2 shows the various angles of amputation.

V-Y Flap

For transverse or dorsal oblique (more tissue loss dorsally than volarly) amputations, the triangular volar, or V-Y, flap (Fig. 3) is an ideal method of treatment.[7] It can be used for all digits, including the thumb. The critical factor that

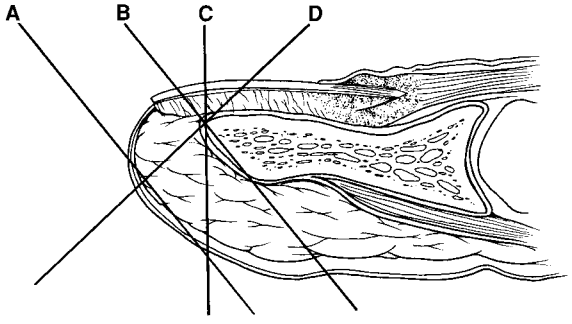

Fig. 2 Angles and levels of amputation. **A,** Volar oblique with no exposed bone. **B,** Volar oblique with exposed bone. **C,** Transverse with exposed bone. **D,** Dorsal oblique with exposed bone.

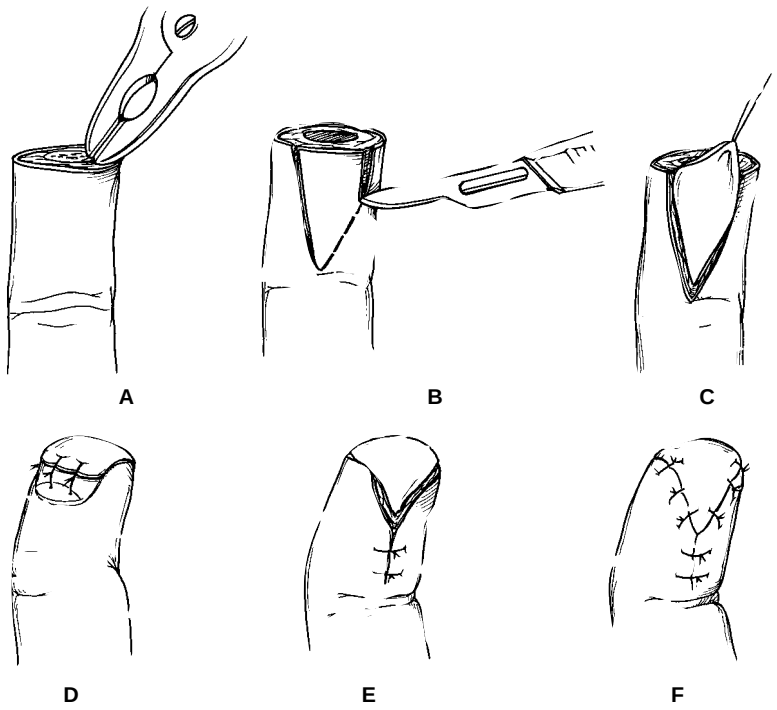

Fig. 3 Triangular volar advancement flap. **A,** Bone is trimmed even with skin and distal edge of nail bed. **B,** Flap is designed with base at distal margin of wound and apex in midline of distal interphalangeal crease. **C,** Flap is mobilized. **D,** Flap is advanced distally over end of bone and sutured to distal margin of nail bed. **E** and **F,** Volar skin is sutured.

must be assessed is whether enough palmar tissue is available for distal advancement. The distal edge of the flap can be advanced only about 1 cm. Not appropriate for treatment with this flap are amputations that are too proximal and those with more tissue loss volarly than dorsally (volar oblique), as there is not enough tissue for advancement.

The flap is designed with the distal edge of the wound as the base of a triangular flap. The apex is a point in the midline of the distal interphalangeal crease. The nail bed and bone should be trimmed even with each other. The skin and subcutaneous tissue are then incised, with great care being taken not to damage the neurovascular bundles.

To adequately mobilize the flap, all the fibrous septa that anchor the pulp tissue to the distal phalanx must be divided. From the distal aspect of the wound, a No. 15 knife blade is swept tangentially along the volar aspect of the bone to divide the septal attachments to the periosteum. The mobilized tissue is then advanced over the end of the bone and sutured to the distal edge of the nail bed with 5-0 nylon sutures. The tourniquet can be removed at this point to check the vascularity of the flap. If capillary refill is poor, it is usually because there has been inadequate mobilization and the vessels are stretched.

Once it has been ascertained that the flap has been properly mobilized and there is good capillary refill, the remaining edges of the flap can be sutured. The skin edges of the flap need not be sutured too tightly, as this may compromise blood flow. Any subcutaneous tissue protruding between the skin edges will heal by secondary intention. Patients usually have normal or nearly normal sensibility of the fingertip and superb restoration of contour and padding.

Kutler Flap

This flap is most appropriate for distal transverse amputations. Kutler[8] described the use of dual triangular flaps advanced from the sides of the fingertip. Triangular flaps are designed on each side of the tip, with the bases being the distal edge of the wound and the apices more proximal. After incision of the skin and subcutaneous tissue, the flaps are advanced, without undermining, over the end of the bone and sutured to each other. The disadvantage of this technique is that the flaps are small and may be difficult to advance, with the result that closure cannot be obtained without tension.

Regional Flaps

The two most commonly used regional flaps, the cross-finger flap and the thenar flap, can be used for similar defects involving the fingertips. They are employed to preserve length and obtain coverage of amputations with a volar oblique angle and amputations too proximal to allow performance of a local flap, as well as to replace substantial loss of pulp tissue. In patients with more than one fingertip injury, multiple cross-finger flaps or a combination of cross-finger and thenar flaps may be appropriate.[9]

The main disadvantage of these flaps is that their use involves a two-stage procedure requiring division of the flap. Because prolonged immobilization may result in stiffness, some consider patient age greater than about 40 to be a relative contraindication to their use. However, Melone et al[10] used the thenar flap in patients over the age of 50 with no resultant stiffness in digits with trauma isolated to the fingertip.

These flaps are contraindicated in patients with osteophytes or arthritis in the involved digits and in patients with systemic conditions, such as rheumatoid arthritis, diabetes, and vasospastic disorders.[9]

The cross-finger flap leaves a dorsal donor-site scar that may be unappealing, especially to female patients. In dark-skinned persons, transfer of the darker dorsal skin to the lighter fingertip pad may be objectionable. The thenar-flap donor site is less conspicuous and may be better accepted by female and dark-skinned patients.

Postoperatively, the hand is supported in a bulky dressing and splint for comfort. Uninjured digits can be left free to exercise. Flap division is performed with the use of local anesthesia about 12 to 14 days after the initial procedure. Delaying division of the flap much beyond 14 days increases the risk of joint stiffness. Suturing of the cut edge of the flap at the recipient site at the time of division is not recommended, as tension from sutures may cause marginal necrosis. Local wound care of the small open areas and an aggressive range-of-motion program are instituted immediately on division of the flap.

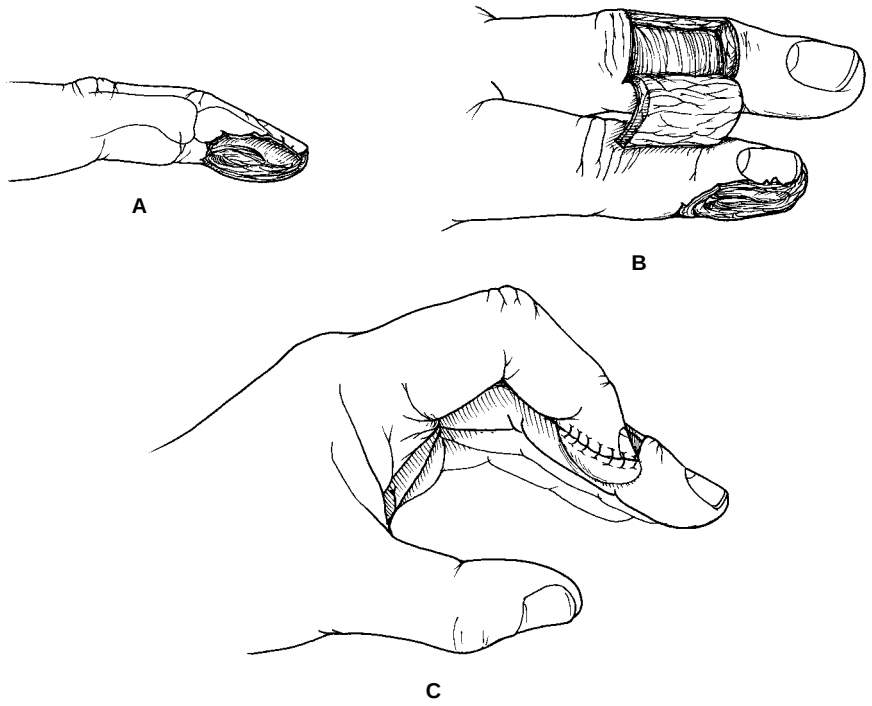

Fig. 4 **A,** Volar oblique amputation with exposed bone. **B,** A cross-finger flap is elevated from the dorsal aspect of the donor digit. **C,** Flap is sutured to defect.

Cross-Finger Flap

The standard cross-finger flap is outlined as a rectangle over the middle phalanx of the donor digit, with the hinge side adjacent to the injured finger[9] (Fig. 4). The longitudinal axis of the hinge runs along the midaxial line. The skin is incised on three sides, and the incision is carried through the subcutaneous tissue. As the flap is raised, it is imperative that the paratenon of the extensor tendon be preserved. The flap is reflected on its hinge, and the injured fingertip is placed on the subcutaneous surface of the flap and sutured. A full-thickness skin graft from the groin or elsewhere is applied to the donor defect.

Variations in the design of the cross-finger flap can be made depending on the location and size of the defect. The flap can be based proximally, distally, or laterally. A proximally based cross-finger flap can also be raised over the dorsum of the thumb for coverage of defects on the radial side of the tip of the index finger.

Kleinert et al[11] reported satisfactory recovery of sensibility (two-point discrimination of 8 mm or better) in 70% of 56 patients in whom cross-finger flaps were used. The average two-point discrimination reported by Nishikawa and Smith[12] was about 10 mm, and many of their patients had impaired tactile gnosia. Despite the abnormalities in sensibility, most patients in both studies were very satisfied with the outcome. Cohen and Cronin[13] modified the standard cross-finger flap to improve sensibility. The dorsal sensory nerve of the donor digit that supplies sensibility to the skin over the middle phalanx is transected proximally and sutured to the proper digital nerve of the injured digit.

Thenar Flap

The thenar flap can be used for any fingertip, but sometimes the small finger can be difficult to position comfortably. Stiffness of the proximal interphalangeal joint and tenderness of the donor site have been concerns with this flap; however, Melone et al[10] reported few complications in 150 patients.

The most important technical consideration is the location of the flap on the thenar eminence. It should be designed high on the thenar eminence, with the radial border parallel and adjacent to the metacarpophalangeal joint crease. Placing it too close to the midpalm has been associated with debilitating donor-site tenderness. The base of the flap is located proxi-

mally. Flap width and length are determined on the basis of the size of the defect. The flap can be as wide as 2 cm and should be 1.5 times as wide as the defect so as to restore the normal rounded contour to the tip.

The skin is elevated with its underlying subcutaneous tissue, with care being taken not to damage the radial digital nerve of the thumb. Before the flap is sutured to the defect, a full-thickness skin graft is applied to the donor area from the non-hair-bearing area of the groin, the palmar aspect of the wrist, or the hypothenar area. If the donor area is not too wide, it is sometimes possible to perform a primary closure. The finger is positioned with the metacarpophalangeal and distal interphalangeal joints flexed as much as possible to decrease the amount of flexion required at the proximal interphalangeal joint, and the flap is then sutured to the defect. A well-molded dressing and splint are applied, permitting range of motion of the uninjured fingers.

Injury of the Thumb

The principles of management of injuries of the thumb tip are similar to those for other digits. However, the importance of preservation of length and restoration of sensibility is magnified. Although function of the thumb is usually satisfactory when the thumb has been shortened to the level of the interphalangeal joint, the availability of local and regional flaps allows preservation of length in most cases.

Moberg Advancement Flap

For soft-tissue defects that cannot be restored with a V-Y flap and for those measuring no more than about 2 cm in length, the Moberg advancement flap[14,15] (Fig. 5) is the procedure of choice because it preserves length and tactile gnosia. Midaxial incisions are made on both sides of the thumb, extending from the injury site to the metacarpophalangeal crease. The entire volar skin flap, containing both neurovascular bundles, is dissected from the flexor tendon sheath from distal to proximal. The flap is advanced over the bone. Flexion of the interphalangeal joint may be necessary for the flap to reach the tip; however, a flexion contracture of the interphalangeal joint may develop if it is positioned with too much flexion. The flap can be mobilized a greater distance, thus requiring less interphalangeal joint flexion, if a transverse incision is made between the two longitudinal incisions near the metacarpophalangeal crease and the proximal defect is covered with a full-thickness skin graft.

Cross-Finger Flap From Index Finger

For loss of more than two thirds of the pulp tissue, a cross-finger flap from the dorsal aspect of the index finger usually provides satisfactory padding of the thumb and adequate sensibility. The hinge of the flap is placed on the radial side of the proximal phalangeal segment of the index finger. Innervation of the cross-finger flap from the index finger can be augmented by transposing branches of the dorsal sensory branch of the radial nerve at the time of attachment of the flap.[16] In addition to transposing those branches, Hastings[17] performed a neurorrhaphy of the dorsal sensory branch of the radial digital nerve of the index finger to the lacerated ulnar digital nerve of the thumb. Thumb defects can also be covered by dorsal or palmar cross-finger flaps from digits other than the index finger.[18,19]

First Dorsal Metacarpal Artery–Island Pedicle Flap

This is an excellent flap that is performed in one stage and can include branches of the dorsal sensory branch of the radial nerve.[20,21] It is based on the first dorsal metacarpal

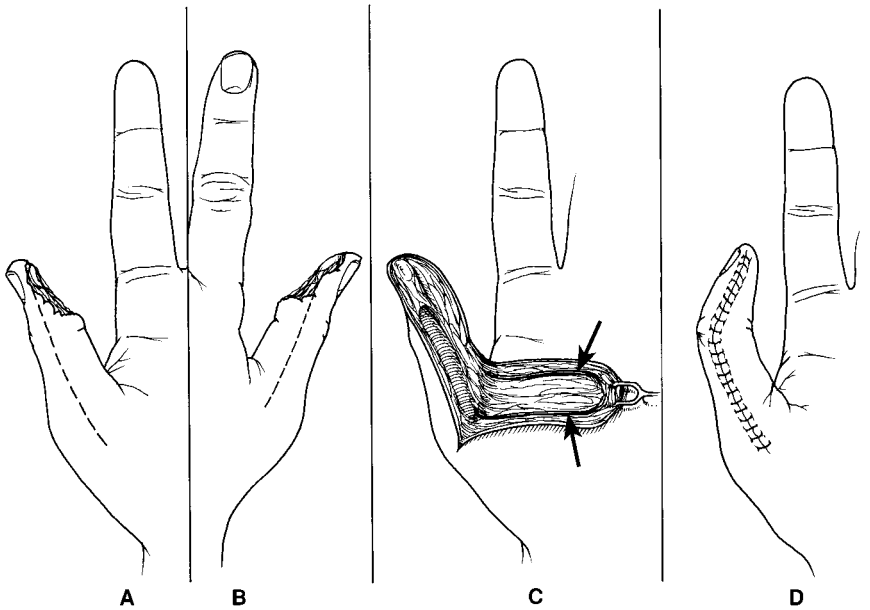

Fig. 5 Moberg advancement pedicle flap for thump-tip injury. Midaxial incisions are outlined radially **(A)** and ulnarly **(B)**. **C,** A flap containing both neurovascular bundles is raised. **D,** Flap is advanced and sutured. Note interphalangeal joint flexion.

artery, which is a branch of the radial artery. The skin over the dorsum of the proximal phalanx of the index finger is elevated in a manner similar to that for a standard cross-finger flap but with incisions on all four sides. An incision is extended proximally over the dorsum of the first web space, and a pedicle containing the first dorsal metacarpal artery, the subcutaneous veins, and branches of the dorsal sensory branch of the radial nerve is isolated. The skin island with the attached pedicle is transferred to the thumb defect and sutured in place. The donor area is covered with a full-thickness skin graft from the groin.

Neurovascular-Island Pedicle Flap

The neurovascular-island flap, first described by Littler,[22] requires the transfer of tissue from the ulnar side of the ring or middle finger across the palm to the thumb on its neurovascular pedicle. It is used to restore sensibility and padding to the ulnar side of the thumb pulp if other methods have proved unsatisfactory. Because of the possibility of mutilation of the donor digit and availability of superior flaps, the use of this flap is very limited and should not be the surgeon's first choice for regional coverage of acute thumb-tip injuries.

Fingertip Injuries in Children

Most crush- and avulsion-type fingertip amputations in children can be managed by the open method. Especially in children less than 2 years of age, a relatively normal-appearing fingertip can be formed, even when bone is exposed.[23] Nonmicrosurgical reattachment of the cleanly amputated fingertip as a composite graft by suturing the skin and nail bed can also be successful.

When no bone is exposed, I prefer to treat fingertip injuries by the open method. For amputations through the sterile-matrix region in which the distal segment is not available or is badly crushed, protruding bone is trimmed even with or just below the level of the soft tissue, and healing by secondary intention is allowed. The bone should not be trimmed to a level more proximal than the distal margin of the nail matrix, as a hook-nail deformity may result. If the amputation is through the germinal matrix and no distal segment is available, the nail matrix is ablated, the bone is shortened, and the wound is closed primarily or left to heal by secondary intention.

If there is a clean, sharp amputation through any portion of the nail and the distal segment is available, the tip can be simply reattached as a composite graft. The upper age limit for successful composite reattachment has not yet been established.

Nail-Bed Injuries

Injuries of the nail bed are varied and include subungual hematomas, simple and complex lacerations, and avulsions of matrix tissue. It is important that the nail bed be repaired with great attention to detail in order to restore function and prevent annoying or unsightly deformities.[24] Loupe magnification is recommended, and the use of microinstruments allows easier handling of the tissue and small needle.

Subungual Hematomas

Decompression of a subungual hematoma should be performed to relieve pain if it involves no more than 50% of the area of the nail.[24] A hole should be placed in the nail plate over the hematoma with either a heated paper clip or an 18-gauge needle. For larger subungual hematomas, the nail plate should be removed to repair the nail bed.

Lacerations

Lacerations are repaired after removal of the entire nail plate or at least enough to allow placement of sutures. The nail plate is carefully separated from the nail matrix with a Freer elevator. The wound is then irrigated and debrided, taking care that all matrix tissue is retained.

Fractures of the distal phalangeal shaft can usually be stabilized by simply suturing the skin of the lateral nail folds and the nail bed. If the fracture is unstable, it may displace, which will result in tenting of the nail bed. Unstable fractures should be pinned with a Kirschner wire, avoiding the distal interphalangeal joint if possible. Lacerations of the skin and lateral nail folds should be repaired with 5-0 nylon suture to stabilize the soft tissue. The nail bed is meticulously approximated with absorbable 6-0 chromic or plain gut suture. Flaps of tissue that are too small to accept sutures should be replaced in their normal position. If the laceration extends into the germinal matrix, the nail wall should be reflected proximally by making an incision on each side of it, extending from the eponychium.

After repair, the nail plate should be placed back into the nail fold to prevent scar formation between the ventral floor and the dorsal roof. If the nail plate is not available, a piece of nonadherent gauze cut in the shape of the nail is a good substitute. It can be left in place indefinitely, as it will be pushed out as the new nail regrows.

Nail-Matrix Avulsions

When the proximal portion of the nail plate has been avulsed from the nail fold and lies on top of it, there is always an associated nail-bed laceration or avulsion of the germinal matrix from its proximal attachment

and a fracture or epiphyseal separation. Proximal detachments or avulsions of the germinal matrix must be replaced into the nail fold (Fig. 6). Three sutures, one at each corner and one in the middle, are sufficient. Each suture is passed from the outside to the inside of the nail fold, through the proximal edge of the germinal matrix in a horizontal-mattress fashion, and back through the base of the nail fold, exiting dorsally. After all three sutures have been passed, the germinal matrix is cinched into place by pulling proximally on the sutures, which are tied over the dorsum of the nail fold.

Injuries of the nail bed resulting in loss of matrix tissue are the most difficult to treat and are the ones most likely to result in a permanent deformity.[25] The detached nail plate should be inspected for remnants of the nail bed that can be used for repair. If available, the avulsed tissue can be carefully removed from the nail plate with a scalpel and sutured in place as a full-thickness graft directly on the distal phalanx.

Defects in the sterile matrix with no tissue available for repair should be treated with a split-thickness nail-bed graft. The optimal donor site is an undamaged area of the sterile matrix of the injured digit. Other donor options are the nail bed of an unsalvageable discarded digit or the great toe. Split-thickness sterile matrix grafts are obtained by shaving the donor nail bed with a scalpel blade. The graft must be very thin (0.007 to 0.011 inch) to prevent a deformity from occurring at the donor site. The graft is then sutured to the surrounding nail bed.

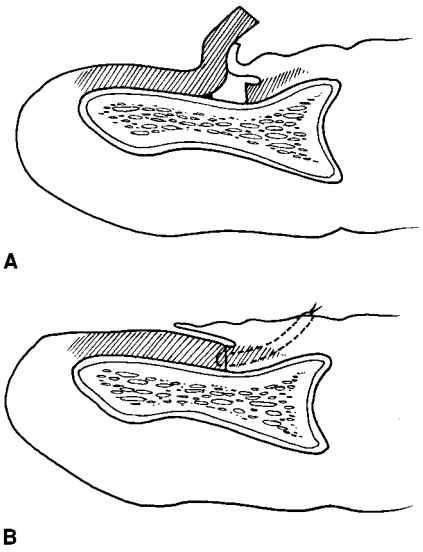

Fig. 6 **A,** Proximal detachment of the germinal matrix. **B,** Replacement into nail fold and repair with horizontal mattress sutures.

An excellent result can be expected in about 90% of cases.[26]

Treatment of avulsion of germinal matrix with no available tissue for replacement depends primarily on the size and width of the defect. Shepard[26] has used split-thickness germinal-matrix grafts from an adjacent area of undamaged germinal matrix, full- or split-thickness grafts from the great toe, and local bipedicle or distally based nail-bed flaps. The results of these methods of nail-bed replacement are unreliable, and nail deformities may occur at the injury and donor sites. If the entire nail bed has been completely or nearly completely avulsed and the distal phalanx remains, the best treatment is the application of a split-thickness skin graft.

Injuries of the Nail Wall

Repair of the dorsal nail wall should be accomplished in two layers, with the use of 5-0 nylon sutures for the outer skin and 6-0 chromic for the matrix of the dorsal roof. In cases of avulsion of the nail wall, reconstruction is best performed with a local rotation flap.[27] If that is not possible, reconstruction of the nail wall can be accomplished with a reverse cross-finger flap.[19,28] Shepard[26] recommends the placement of a split-thickness graft on the undersurface of the flap.

Summary

For the treatment of fingertip injuries, the decision-making process should proceed from the simpler techniques to the more complicated. When no bone is exposed, the open method is ideal for small or moderate-sized wounds, and skin grafting should be considered for larger wounds. Distal transverse and dorsal oblique amputations with bone exposure can be treated with local tissue advancement that preserves length. More proximal and volar oblique amputations can be managed with a regional flap to preserve length if enough sterile matrix remains for a stable nail and if there is no contraindication. Shortening and primary skin closure can be used for amputations not amenable to other methods of treatment. The surgeon should be familiar with the advantages and disadvantages of all the available methods of treatment to ensure high patient satisfaction.

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