Focus On
Management of fingertip injuries

The fingertips are exposed to all aspects of daily living, recreation and work and it is perhaps no surprise they are the most commonly injured part of the hand.¹ The middle finger, index finger and thumb and are the most frequently injured digits.² Integrity of the fingertip is important for manipulation, tactile sensibility, communication and aesthetics. Successful management of fingertip injuries requires consideration of individual patient requirements, detailed understanding of the anatomy of the fingertip and experience in a range of reconstructive techniques. This short review provides an overview for management of fingertip injuries.

Anatomy

The fingertip is the region distal to the insertions of the flexor and extensor tendons: perionychium (nail complex), glabrous skin, subcutaneous fat containing fibrous septae, distal phalanx, nerves and arteries. The nail complex comprises: germinal matrix, sterile matrix, paronychium, eponychial fold, hyponychium and the nail plate (Fig. 1).

• Germinal matrix – Ventral floor contributes 90% of the volume of the nail. Extends from just distal to extensor insertion to lunula. The matrix then folds dorsally and roof contributes shiny layer to nail.
• Sterile matrix – Portion of nail bed distal to lunula. Integrity is essential for contact adherence of overlying nail plate.
• Hyponychium – Skin distal to sterile matrix.
• Eponychium – Skin lying over proximal nail plate attached to surface of nail.

Fig. 1. Cross section of the fingertip (reproduced with permission of www.boneandspine.com)

• Paronychium – Skin lateral to sterile matrix.
• Lunula – White arc visible through nail plate representing distal extent of germinal matrix.
• Nail plate – Acts as counter force to finger tip pad.

Injury assessment

History
• Age, sex, handedness, occupation
• Mechanism and time of injury
• Co-morbidities and medication
• Smoking
• Treatment to date

Examination
• Nature of wounds and tissues: clean, contaminated, ragged, sharp, crush
• Size of defect and geometry of tissue loss (volar oblique, transverse, dorsal oblique)
• Involvement of nail bed (haematoma, laceration, degree of loss)
• Integrity of flexor and extensor tendons
• Exposed bone
• In case of amputations the level of the amputation and condition of the amputated part

Radiographs
• PA and lateral views
• Amputated part

Principles of treatment

The universal aims of treatment include:
• A durably healed, padded, finger tip
• Preservation of sensation and prevention of neuroma
• Preservation of digit length
• Maintain range of motion and joint function
• Minimise pain and hypersensitivity
• Minimise donor site morbidity
• Nail preservation
• Early return to work
• Satisfactory cosmetic appearance²

Nailbed injuries

These are common and half involve fracture of the distal phalanx. Presentation can include avulsion of the nail, subungual
haematoma, nail bed lacerations and nail bed loss. If the nail remains adherent and a subungual haematoma is present then trephination alone can be undertaken for symptomatic relief. If the nail is avulsed or there is a clear wound then the nail should be removed and the nail bed repaired. If there is missing sterile matrix this can be reconstructed with a split thickness nail bed graft from adjacent undamaged sterile matrix or from a toe.

In children, a distal phalanx fracture involving the physis with an overlying nailbed injury is known as a Seymour fracture. Soft-tissue interposes, blocking reduction of the fracture. This should be managed by exploring the nail bed, irrigation, removal of soft-tissue from the fracture site, careful fracture reduction and repair of the nailbed. It is important intra-operatively to ensure that there is no interposed tissue at the fracture site as this could result in phsyseal growth arrest, deformity and osteomyelitis.

**Fingertip injuries**

The repertoire of reconstructive options for the fingertip is large. Each case should be considered on an individual basis taking into account the mechanism of injury sustained, the involved finger and structures damaged, the surgeons’ expertise and the patients’ comorbidities and preferences. Consent for surgery should include nail deformity, stiff DIP joint, cold intolerance, insensate and painful finger tip which ever management method is used.

- **Simple dressings/Secondary Intention healing**
  
  Secondary intention healing may be an appropriate option for soft-tissue defects of 1.5 cm² without exposed bone. The wound is cleaned and an appropriate dressing applied. Dressings must be changed regularly and the wound can take a number of weeks to heal. This can be inconvenient for the patient and time consuming. As the wound heals sensate skin is drawn into the defect and excellent results can be achieved.

- **Skin grafting**
  
  Split thickness and full thickness skin grafts can be considered for the reconstruction of fingertip defects. However, this has not been shown to provide consistently good results and there are increased rates of cold intolerance and hypersensitivity. Grafting does not expedite a patient’s return to work. A total of 56% of patients considered their results good after split thickness skin grafting compared with 90% managed with healing by secondary intention. Skin grafting should therefore be reserved for wounds that are too large to be left to heal by secondary intention or as a temporising measure.

- **Flap reconstruction**
  
  A flap is a unit of tissue transferred with its blood supply. Flap reconstruction may be considered in order to provide durable coverage and preserve length when deeper structures such as tendons, bones or joints are exposed. There are numerous flap reconstructions described in the literature. We have described some more commonly known techniques.

  An Atasoy – Kleinert is a volar V-Y advancement flap (Fig. 2). Useful for dorsal oblique or transverse defects. This is a triangular flap with the apex of the triangle and the DIPJ crease, with the base of the triangle the same width as the nailplate. Excess tension should be avoided to prevent the development of a hook nail deformity. Expected advancement is 1 cm and requires the release of the fibrous septae from the distal phalanx.

  **Fig. 2.** Atasoy volar V-Y advancement flap ©Donald Sammut 2016

Homodigital Island flap (Fig. 3) is when a suitably sized island of skin with associated neurovascular bundle is designed on the same finger as the injury to cover the defect. Examples include the Venkataswami flap and the Evans step advancement. The island is dissected and advanced proximally until adequate advancement to cover the defect can be achieved. The donor site can often be closed directly as there is often more laxity at the base of the finger. Alternatively the donor site can be grafted.

  **Fig. 3.** Homodigital neurovascular island flap ©Donald Sammut 2016

A cross finger flap (Fig. 4) imports a flap of tissue from an adjacent finger (heterodigital flap) and is mainly used for defects on the volar surface of the digit. The flap is elevated over the dorsal aspect of the middle phalanx ensuring a layer or paratenon is left behind. The donor site is then resurfaced with a full thickness skin graft. The pedicle of the flap remains attached to the adjacent finger and is turned over and sutured to cover the defect. Both fingers are immobilized and the flap can be safely divided after 2 weeks. A reverse cross finger flap utilizes volar skin from over a middle phalanx to cover a dorsal defect.
MANAGEMENT OF FINGERTIP INJURIES

Terminalisation
Terminalisation may be appropriate for selected patients when there is significant disruption to the distal phalanx and soft tissue loss. Ablating the nailbed, shortening the bone and using the remaining soft tissue to cover the defect involves a shorter, simpler operation with fewer complications than other reconstructive options, and recovery time is quicker. However, this approach sacrifices digital length. If terminalisation of a digit is undertaken operative technique is important:

- Identify the appropriate level for amputation (FDP insertion preserved if possible. If amputating proximal to DIPJ, then preserve FDS insertion)
- If less than 50% of nail bed remaining necessary to ablate rather than trying to preserve. This should be done thoroughly, ensuring all germinal matrix is removed to avoid troublesome spicules of nail remnant developing.
- Identify nerves, trim back and ensure away from skin closure to minimize neuroma formation.
- Fashion skin flaps to achieve tension free closure

Replantation
Fingertip replantation is technically challenging, requiring microsurgical expertise. At least 4 mm of skin proximal to the nail fold is required for potential suitable vessels for anastomosis. Replantation in a single digit distal to the FDS insertion can give superior outcomes compared with replantation more proximally in the finger. Patients should be counseled about the risk of replant failure and subsequent revision surgical procedure, longer surgical time and the recovery.

Composite graft
Replacement of the amputated fingertip as a composite graft has been shown to be successful in the paediatric population, particularly in under 3 year olds when the repair takes place within 5 hours. It can be attempted in older patients, however the failure rate is higher. This approach may be trialed in adults in some circumstances. Patients and parents should be warned about the possibility of failure, the risk of infection, the need for a delayed reconstructive procedure or a period of dressings.

Thumb tip injuries work
Considering its contribution to hand function, preservation of function and sensation is particularly important for the thumb. The techniques described above can all be used for thumb tip reconstruction. There are two additional reconstructive techniques that are of particular use in the thumb: the Moberg flap and the first dorsal metacarpal artery flap (FDMA).

A Moberg flap (Fig. 5) is a volar advancement flap based on both of the neurovascular bundles, it can be used to resurface as much as 1.5 cm² and supplied sensate skin to resurface the pulp of the thumb. By incorporating a “V” into the design of the flap, the proximal defect can be closed in a “V-Y” fashion and the need to flex the thumb interphalangeal joint to achieve closure is avoided.

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First Dorsal Metacarpal Artery Flap (Fig. 6) is most often used to resurface ulnar volar thumb defects. The flap is based on the first dorsal metacarpal artery and usually includes sensory innervation from a branch of the radial nerve. The flap is harvested from the dorsal surface of the proximal phalanx of the index finger and can resurface defects up to 4 cm.13

Fig. 5. Moberg Flap ©Donald Sammut2016

Fig. 6. First dorsal Metacarpal Artery Flap ©Donald Sammut2016
Conclusions
The primary aim for any hand injury is to maximise an individual patient’s functional and aesthetic outcome. It is important that as surgeons we are aware of the multitude of possible surgical options for soft tissue reconstruction. We should utilise only those techniques in which we are competent. A comprehensive discussion with the patient at the outset is essential. This enables selection of the most appropriate surgical option for that patient and their injury, sets realistic expectations and empowers the patient to play a positive role in their recovery.

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References