FINGERTIP INJURIES AND AMPUTATIONS

Hand Therapy Training Program 2015

Yanshan Lu

FINGERTIP INJURIES

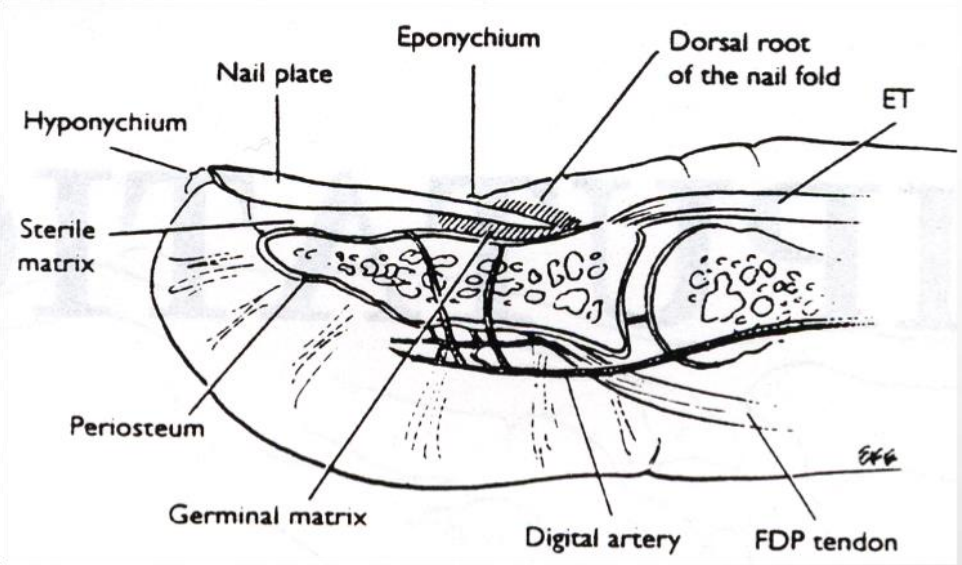
- DEFINITION
  - Mechanical injury distal to the DIP joint of the finger and distal to the IP joint of the thumb

NAIL BED

- ANATOMY
  - The skin over the palmar surface of the hand as with the plantar skin has unique characteristics
  - Very sensitive containing:
    - Meissner's corpuscles for touch sensation
    - Vater-Pachinni corpuscles as pressure receptors
  - Does not have hair or sebaceous glands

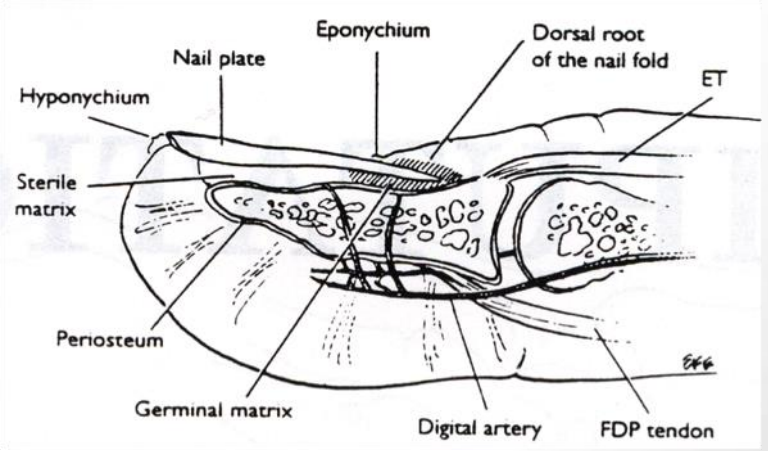
NAIL BED

- Nail bed
  - Germinal matrix (proximal part + milky white) + sterile matrix



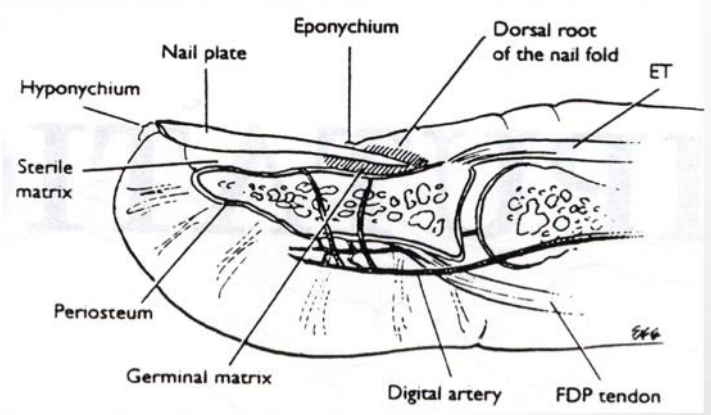
NAIL BED

- Nail bed
- Germinal matrix
  - Produces 90% of nail volume
  - Nail is soft and pliable
  - Exists 1 mm distal to insertion extensor tendon



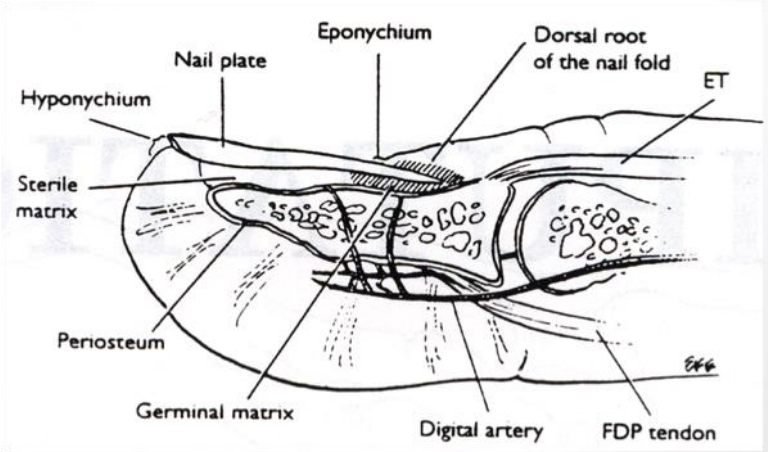
NAIL BED

- Nail bed
- Germinal matrix
- Sterile matrix
  - Extends from lunula to hyponychium
  - Closely adherent to dorsal periosteum of DP
  - Adds squamous cells to nail making a thicker, stronger, more adherent nail



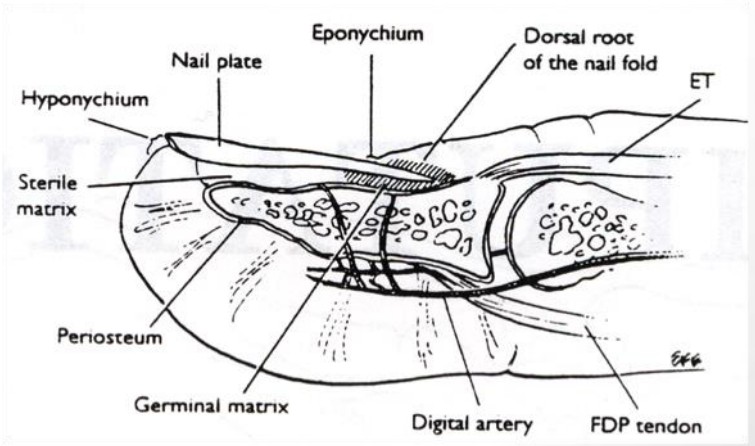
NAIL BED

- Nail bed
- Germinal matrix
- Sterile matrix
- Perionychium
  - Nail bed (germinal + sterile matrix) + surrounding soft tissue (paronychium)



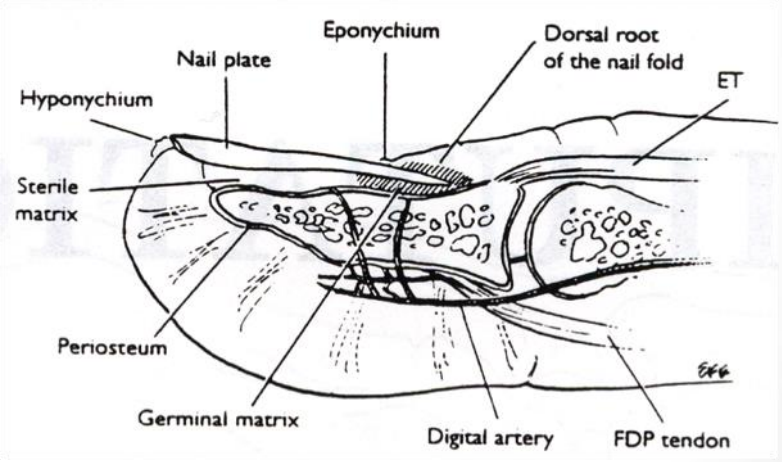
NAIL BED

- Nail bed
- Germinal matrix
- Sterile matrix
- Perionychium
- Hyponychium
  - Junction of nail bed (sterile matrix) and fingertip skin beneath the distal free margin of the nail



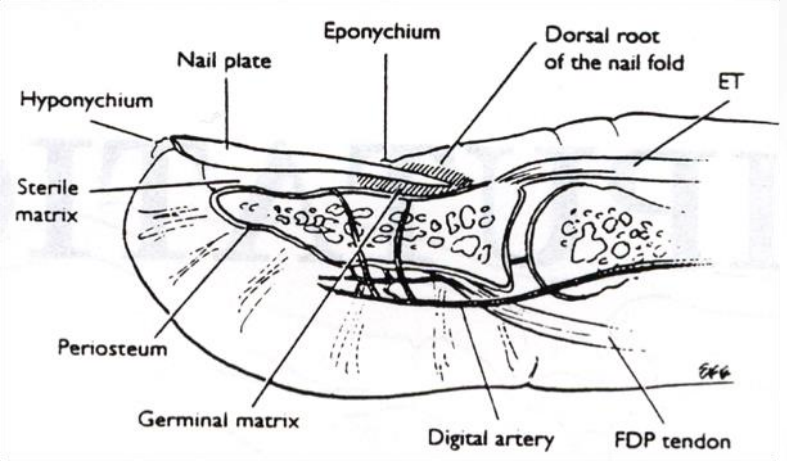
NAIL BED

- Nail bed
- Germinal matrix
- Sterile matrix
- Perionychium
- Hyponychium
- Paronychium
  - Extends along lateral border of the nail and to varying degrees folds over its edge



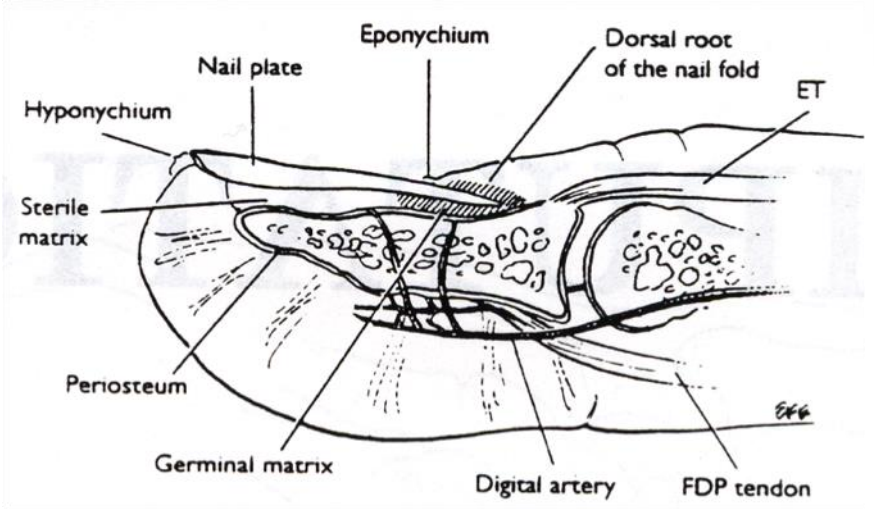
NAIL BED

- Nail bed
- Germinal matrix
- Sterile matrix
- Perionychium
- Hyponychium
- Paronychium
- Eponychium
  - Distal portion of nail fold where attached to the surface of nail (cuticle)
  - Adds thin layer of cells to the surface of the nail therefore gives the nail its smooth shiny appearance



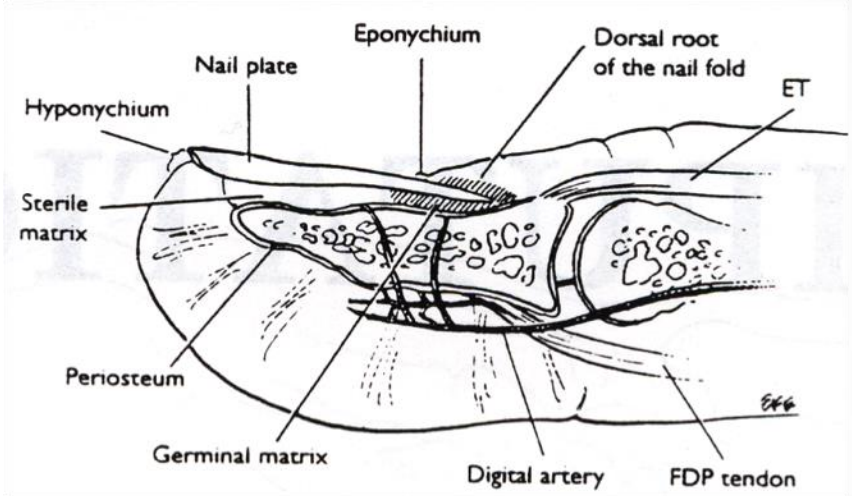
NAIL BED

- Nail bed
- Germinal matrix
- Sterile matrix
- Perionychium
- Hyponychium
- Paronychium
- Eponychium
- Nail fold
  - Composed of germinal matrix on ventral floor + portion of nail bed that forms cells on the dorsal roof



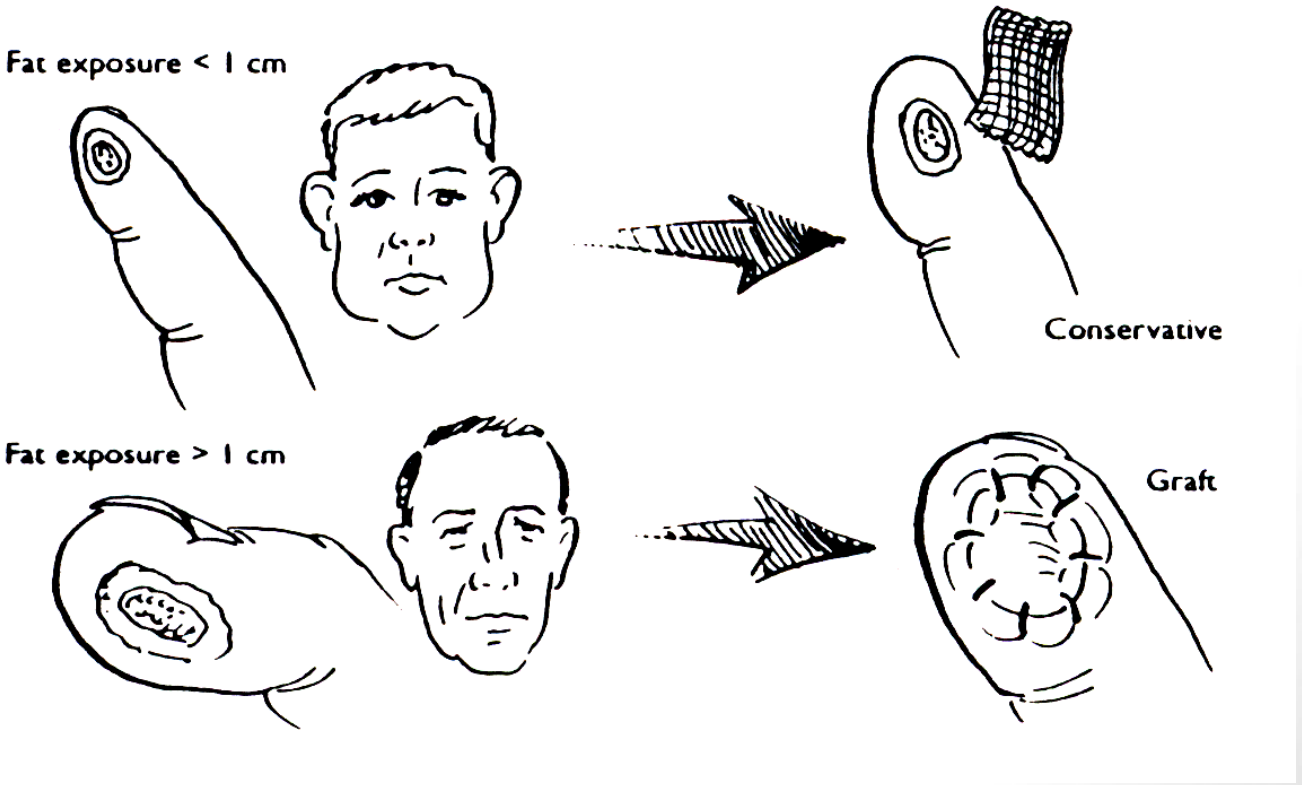
NAIL BED

- Nail bed
- Germinal matrix
- Sterile matrix
- Perionychium
- Hyponychium
- Paronychium
- Eponychium
- Nail fold
- Lunula
  - White arc just distal to eponychium

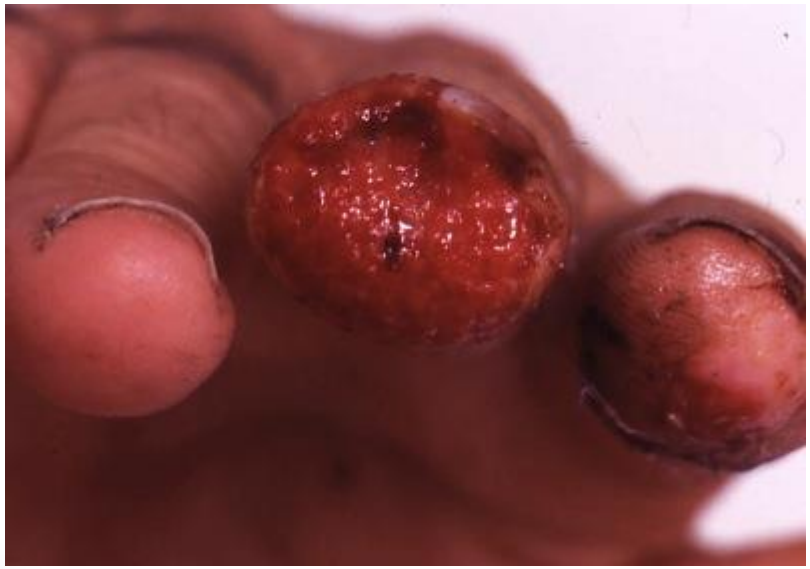


Procedures for fingertip injuries

- Skin defect of the pulp, without bone exposure (adult)

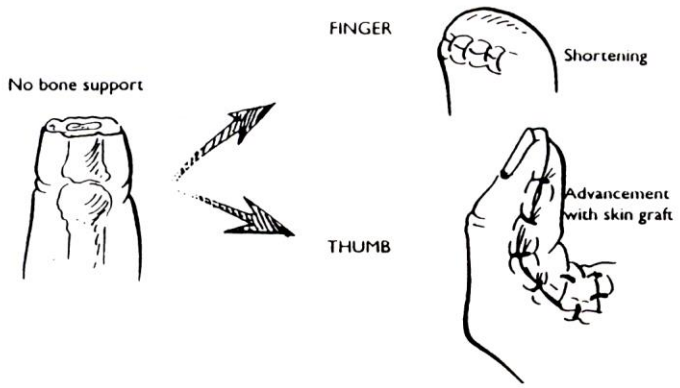


Procedures for fingertip injuries



Procedures for fingertip injuries
Fingertip amputation with bone exposure

- Preserved bone less than 2 mm from the eponychium fold; complete extirpation of the germinal matrix, shortening and covering by palmar skin, preserve the length with covering by a flap



Procedures for fingertip injuries
VY-advancement flap

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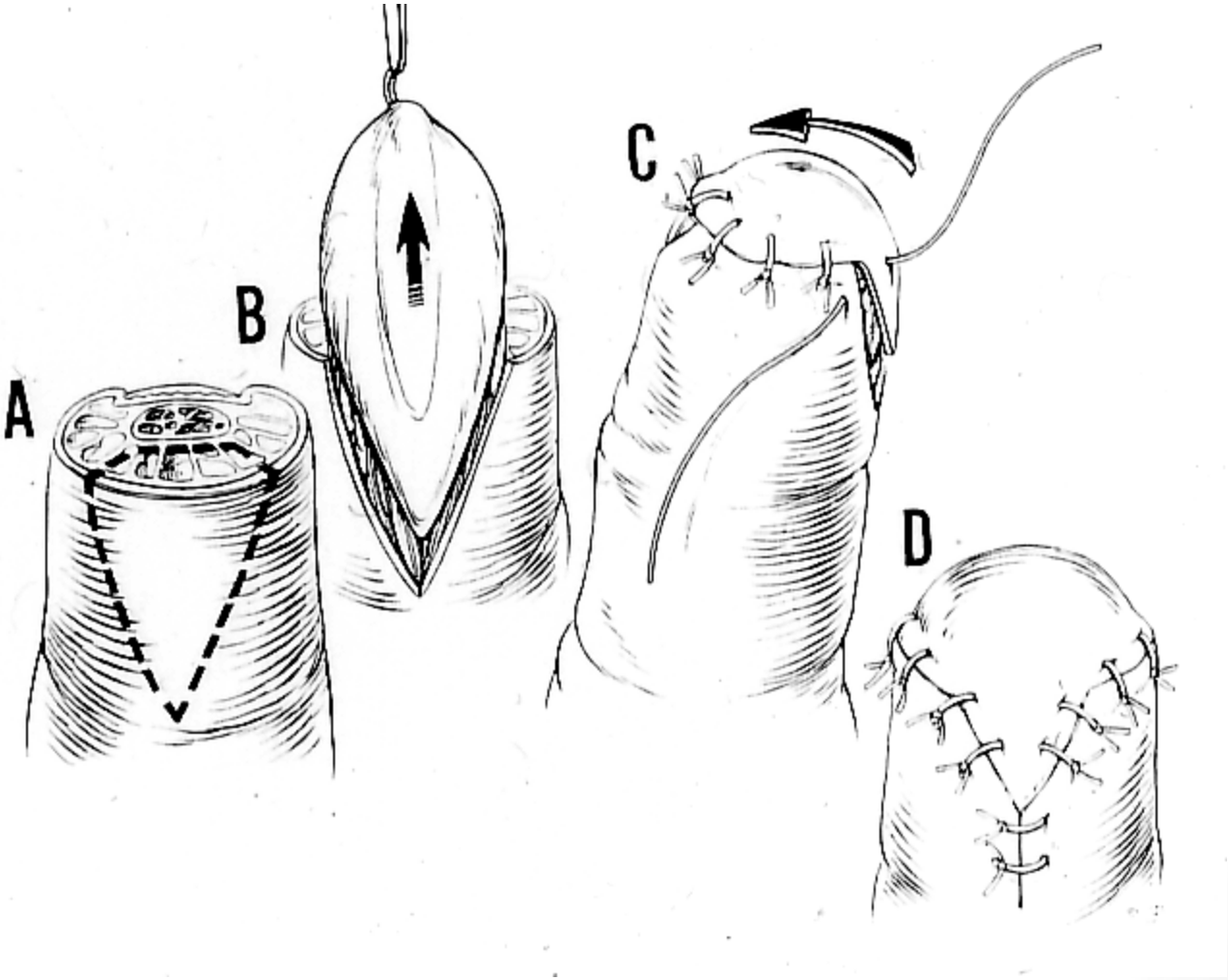
VY-advancement flap



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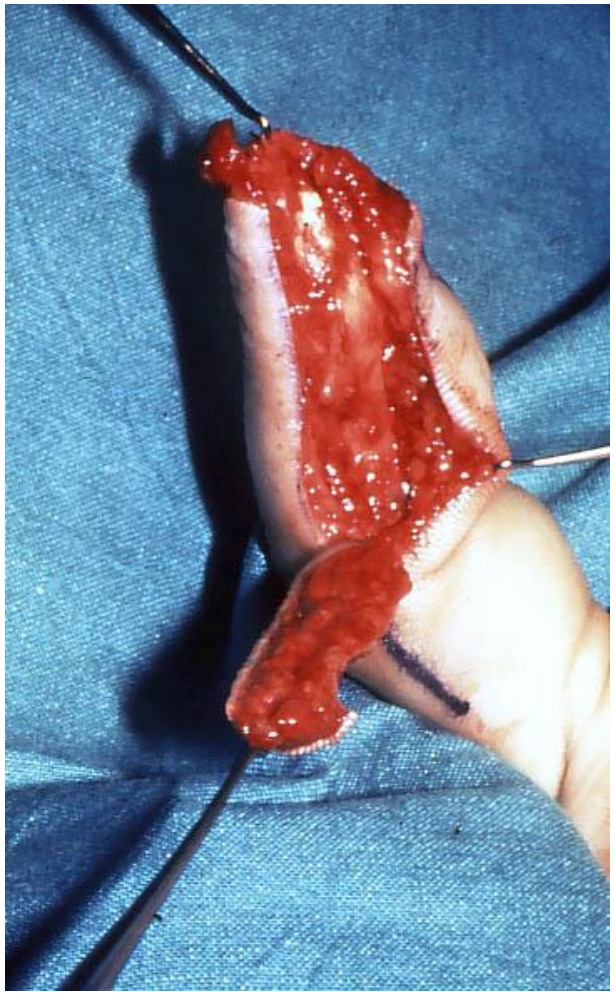

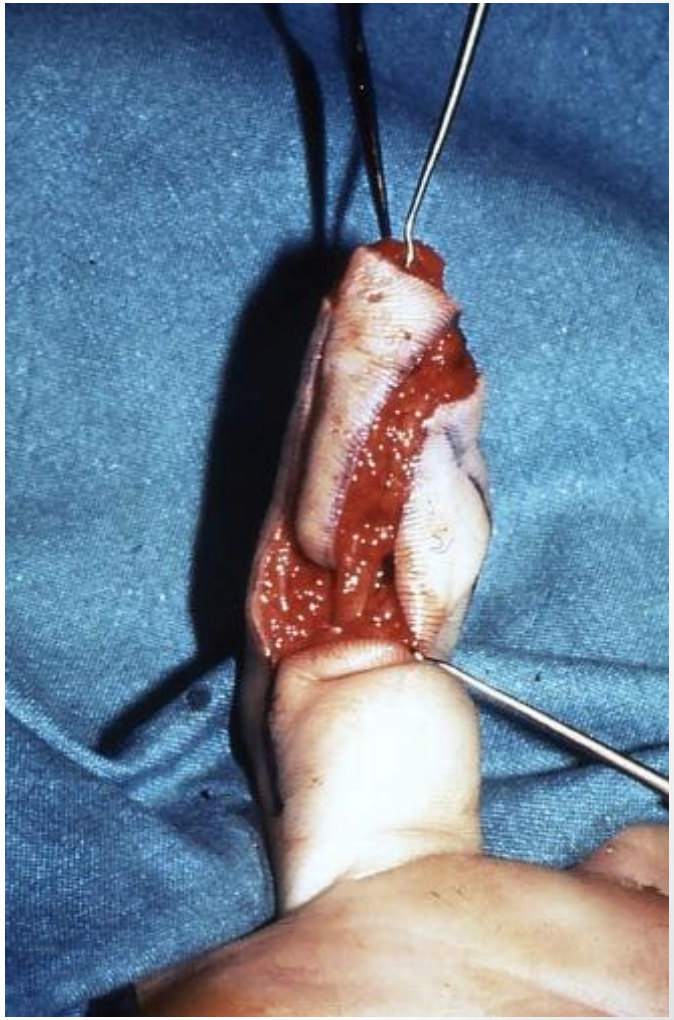

Procedures for fingertip injuries
VY-advancement flap

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Procedures for fingertip injuries
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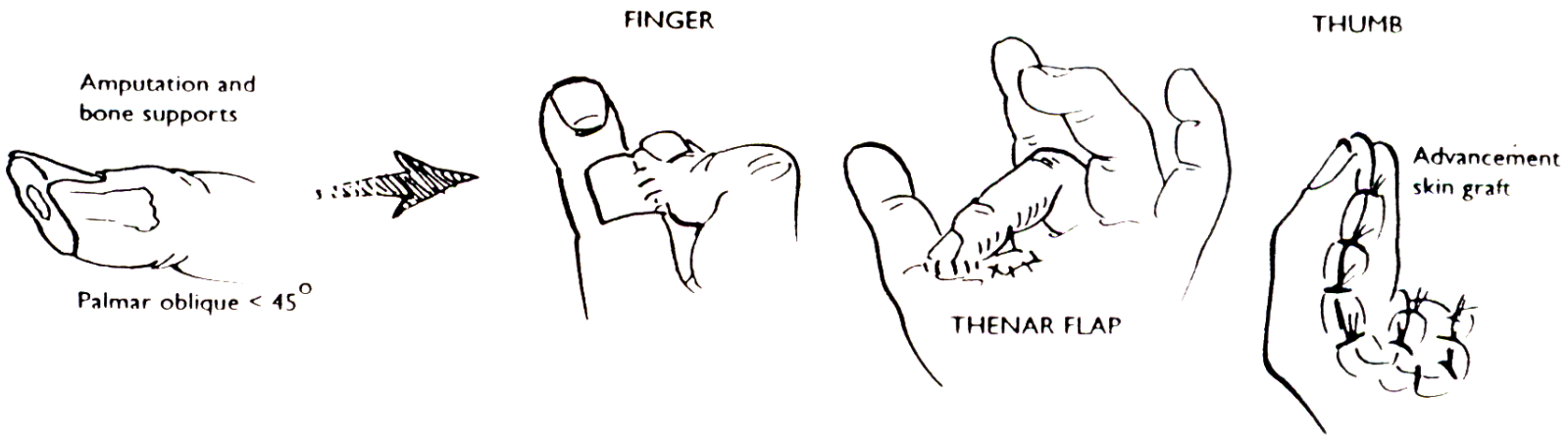
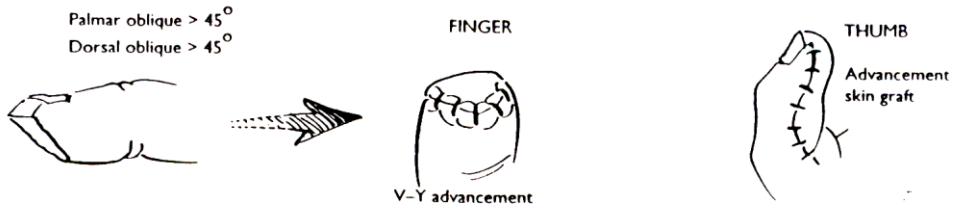
Procedures for fingertip injuries

- Bone support more than 2 mm from the eponychium fold
  - Palmar oblique < 45°



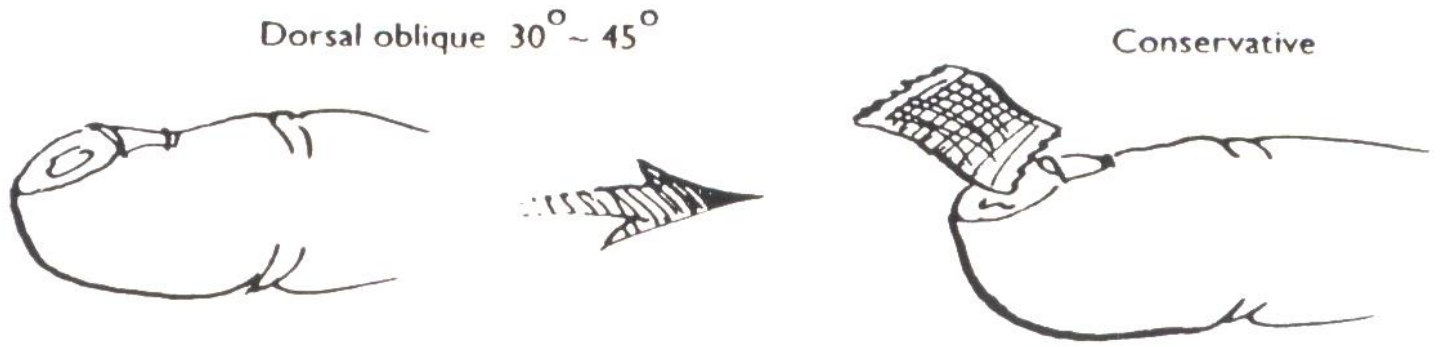
Procedures for fingertip injuries

- Bone support more than 2 mm from the eponychium fold
  - Palmar oblique < 45°
  - Dorsal oblique > 45 °



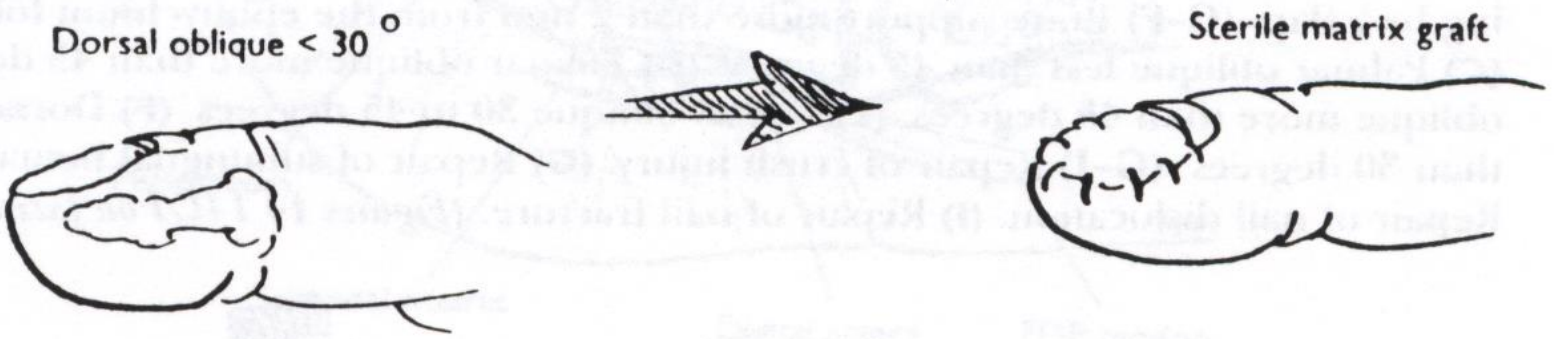
Procedures for fingertip injuries

- Bone support more than 2 mm from the eponychium fold
  - Dorsal oblique 30-45 °



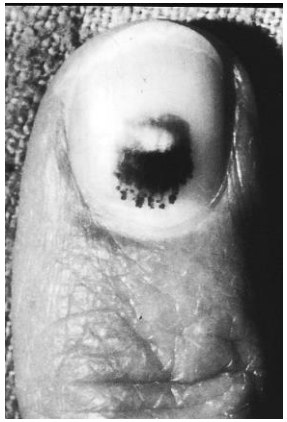
Procedures for fingertip injuries

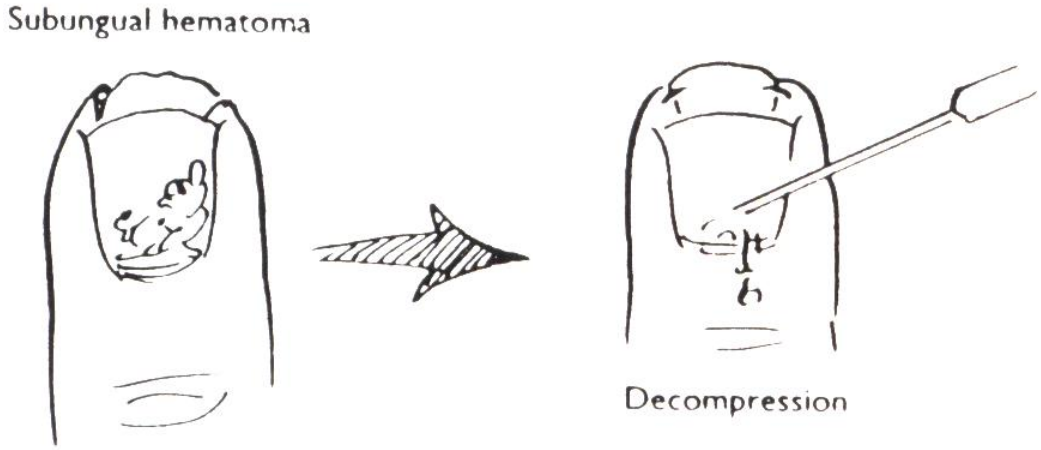
- Bone support more than 2 mm from the eponychium fold
  - Dorsal oblique < 30 °



Procedures for fingertip injuries
Repair of crush injuries

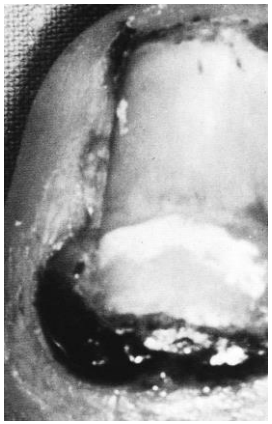
- Subungual haematoma

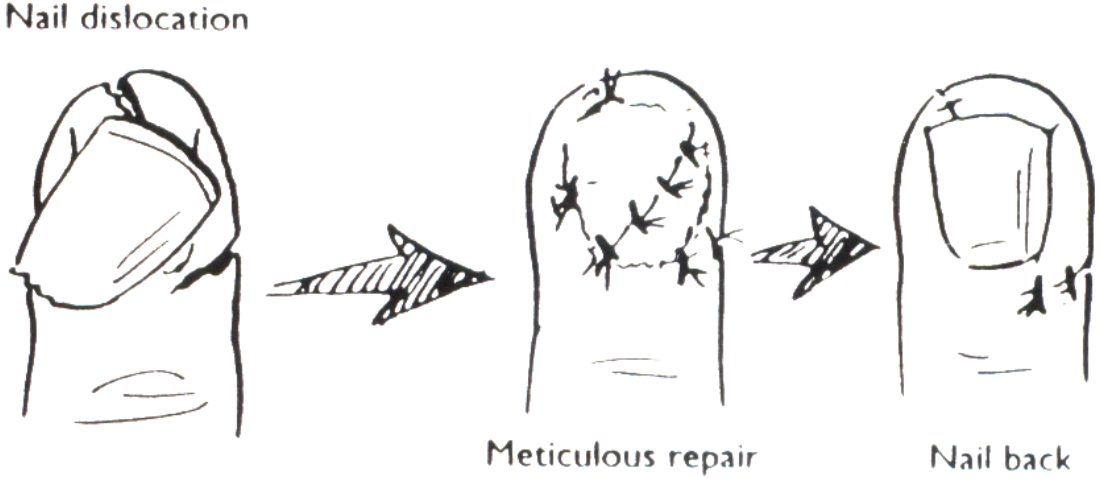




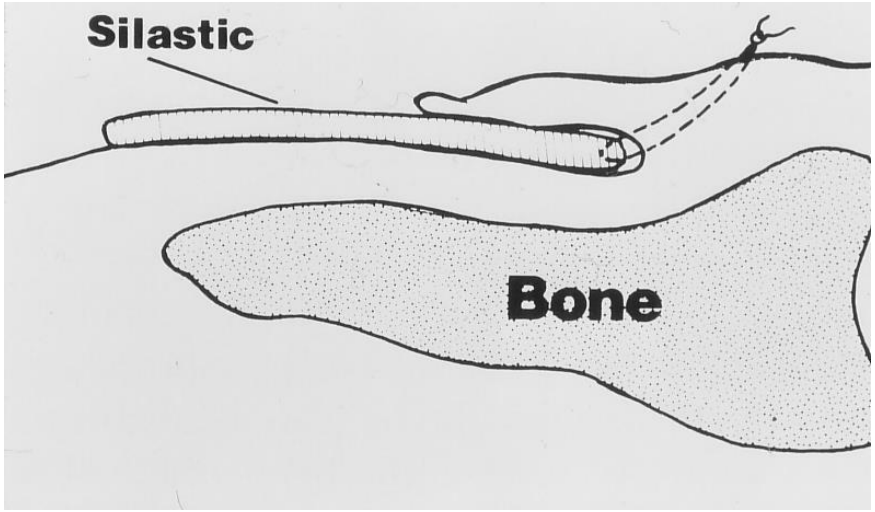
Procedures for fingertip injuries
Repair of crush injury

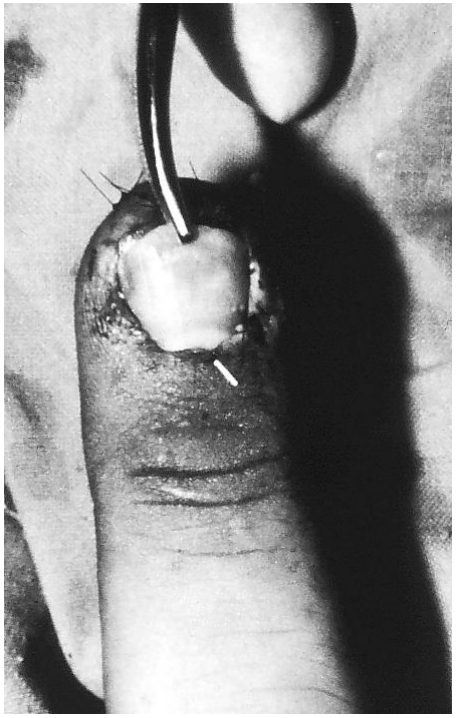
- Nail dislocation



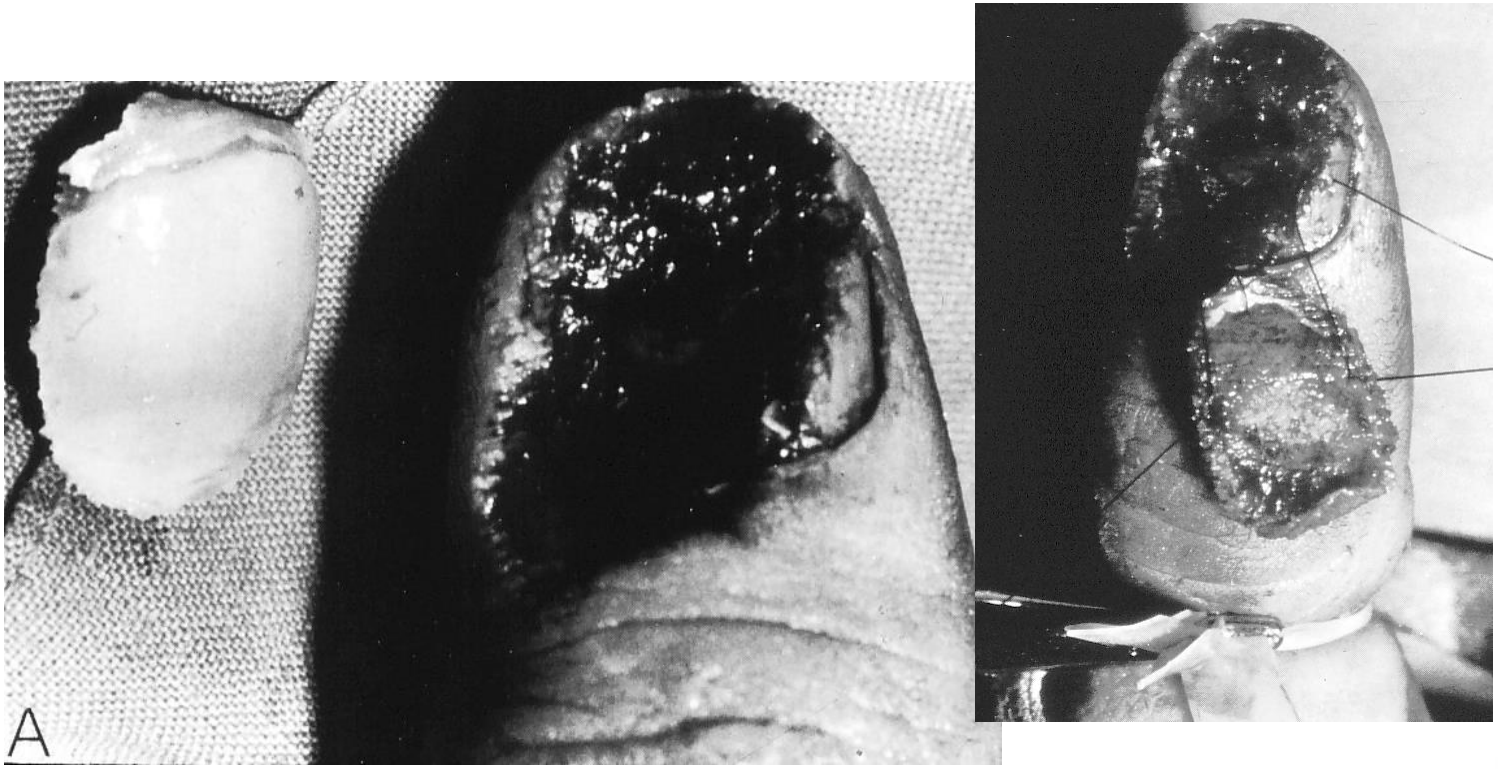


Post repair nail bed – replacement of either nail or silastic substitute





80% avulsion of nail bed

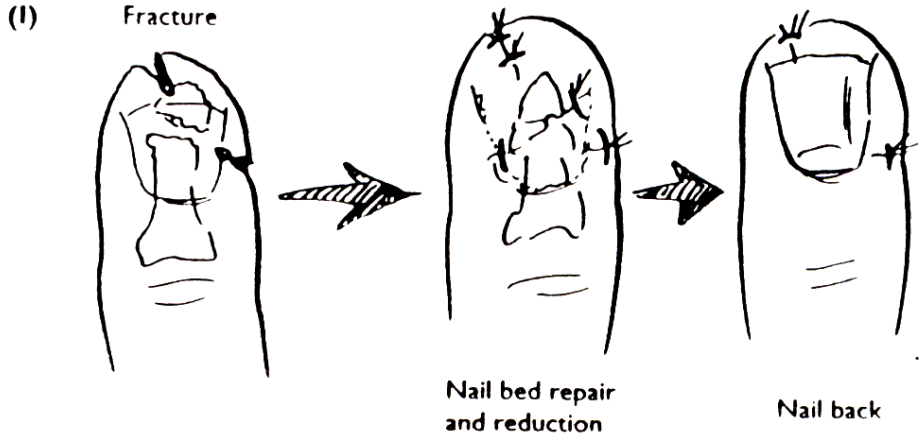


80% avulsion of nail bed

- Post - repair

Procedures for fingertip injuries
Repair of crush injury

- Fracture



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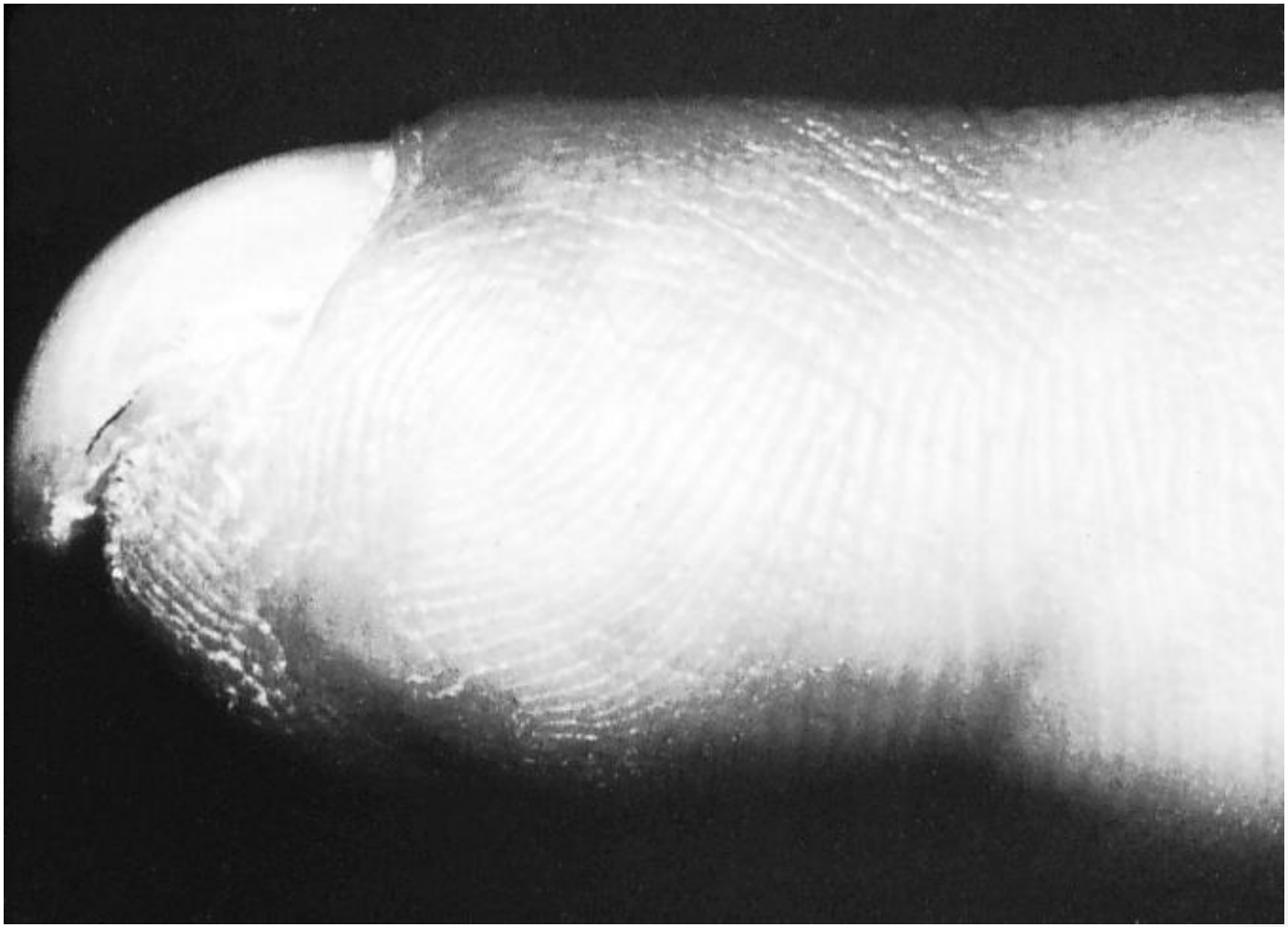
Nail bed injuries – Complications
Nail cysts – incomplete resection

Nail bed injuries – Complications

Loss of support – hang nail



DIGITAL, METACARPAL AND RAY AMPUTATIONS

- INDICATIONS
  - After trauma when replantation is not feasible or desirable
  - Congenital malformations
  - Arteriovenous malformations
  - Chronic infection
  - Malignancies
  - Loss of function (eg a stiff, contracted little finger)

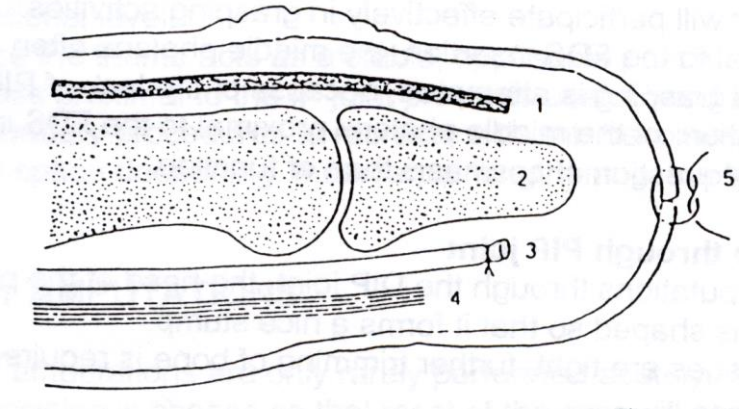
DIGITAL, METACARPAL AND RAY AMPUTATIONS

Preoperatively –

it is important to know whether function or appearance are the primary consideration of individual patient

Digital amputations

- Techniques for amputation of a fingertip
  1. The ET and FT are cut so they retract from the stump
  2. The bone end is trimmed into a rounded stump
  3. The artery is dissected from the nerve and ligated
  4. The nerve is cut about 1 cm proximal to the stump
  5. The skin is closed loosely with fine sutures



Digital amputations

- Amputations through distal phalanx
  - If bone divided proximal to nail-fold → remaining volar soft tissues may allow direct closure
  - If bone needs further trimming → may be left with very broad-based remnant of DP → creates broad, unsightly stump
  - Further trimming → removes collateral ligaments → creates unstable stump → resect bone back to MP

Digital amputations

- Amputations through DIPJ
  - Head of MP shaped so that resembles DP shaft – in particular care to reshape overhanging of MP head to prevent clubbed stump
  - If soft tissue will not allow tension-free closure → bone trimmed further
  - When cartilage removed → stronger inflammatory response than when cartilage preserved → helps soft tissues to adhere to bone → more resistant to shearing forces

Digital amputations

- Lumbrical plus problem
  - Proximal migration of divided FDP tendon increases tension associated lumbrical muscle (contributes to extensor mechanism)
  - As active finger flexion attempted → FDP moves further proximal → increase tension lumbrical and lateral band → prevents PIPJ flexion
  - If occurs → requires lumbrical tendon sectioning

Digital amputations

- Amputation through MP
  - If distal to FDS insertion → active PIP flexion preserved → finger will actively participate in grasping activities
  - If proximal to FDS insertion → MP often stands out when grasping attempted as lack PIPJ flexion
  - Preservation MP proximal to FDS insertion → cosmesis rather than function

Digital amputations

- Amputation through PIPJ
  - As per amputation through DIPJ – head PP shaped so forms nicer stump
  - If soft tissues tight → further trimming of bone required

Digital amputations

- Amputation through proximal phalanx
  - PP controlled by extensor mechanism and intrinsics
  - Allows about 50° flexion at MCPJ → thus participates in grip formation and keeping smaller objects in palm

Digital amputations

- Amputation through proximal phalanx
  - If stump very short → functional problems may arise
  - Two central rays → short stump allows small objects to fall out of palm
  - IF → pinching carried out by MF and TH
    - Ray amputation through 2nd MC more fxal solution
    - 4-fingered hand cosmetically more appealing than stump
    - By removing 2nd MC, breadth of palm diminished and grip strength decreased

Digital amputations

- Amputation through proximal phalanx
  - LF → Problems may arise with stump in the way.
  - However the ulna 2 digits impt in grip strength
    - Compromise to ray amputation = amputation through head 5th MC → leaves intermetacarpal lgt intact → preserves stability and width of palm

Thumb amputations

- As a rule → surgeons try to preserve the length of the bone
- Because tip of thumb important for pinch, skin cover must provide good sensibility
- If closure too tight and tip hyperaesthetic or dysaesthetic thumb will be excluded in activities

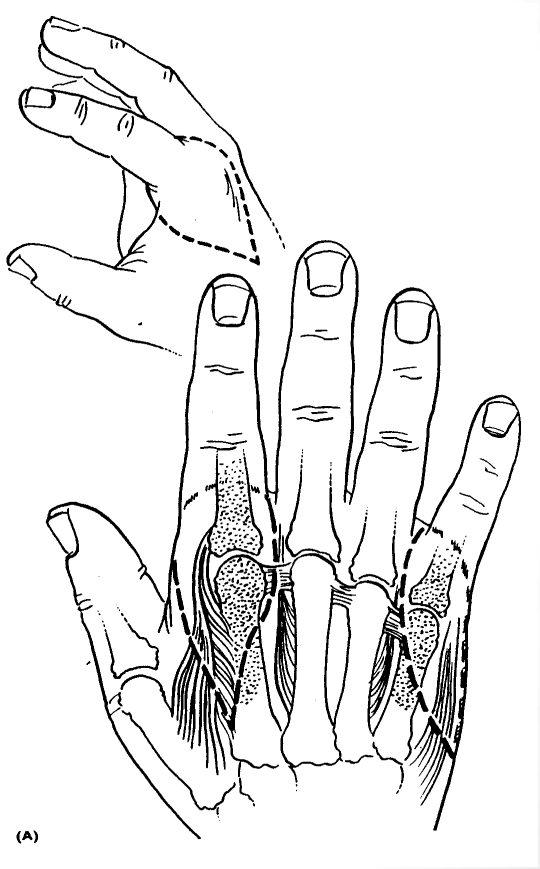
Thumb amputations

- Any amputation distal to IPJ regarded as a very functional level
- Since thumb acts as a stable, opposable post for other fingers, loss proximal to IPJ prevents hand function
- Secondary procedures to recreate thumb becomes necessary (eg web space deepening, metacarpal lengthening, toe transfer

Thumb amputations

Ray amputations

- Only rarely performed acutely
- Incision chosen so that most of scar lies dorsally

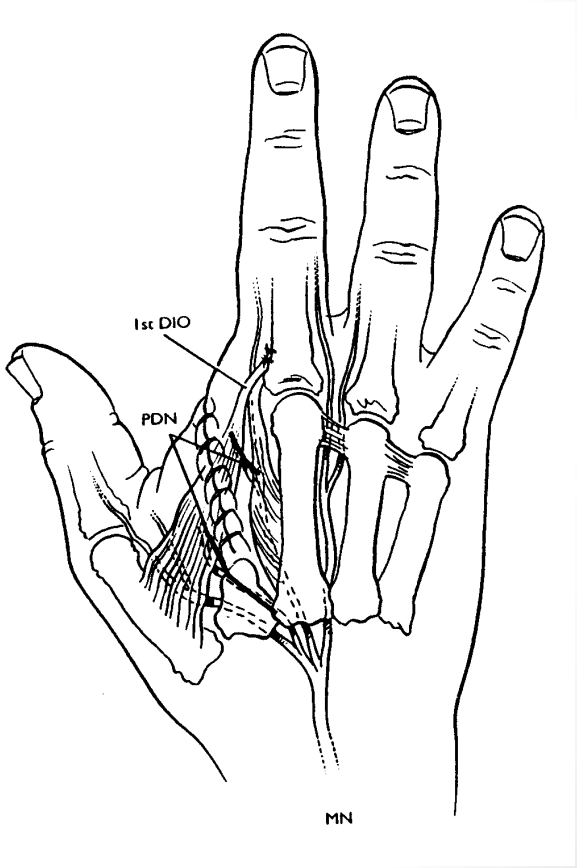


Ray amputations

- Surgical technique
  - Nerves, ET, and FTs divided as proximal as possible
  - Volar nerve stumps usually buried within muscle
  - Osteotomy of metacarpal performed close to its base
  - 1st DI (IF) or ADM (LF) muscles sutured to PP on radial or ulnar aspect respectively
  - MF or RFs – essential for transverse MC lgt to be recreated to provide stability

Ray amputations

- Index ray amputation
  - Note: median nerve and its digital branches and the level of section of the nerve relative to the amputation of the index finger.
  - Note: the reattachment of the 1st DI to the base of the PP of the MF



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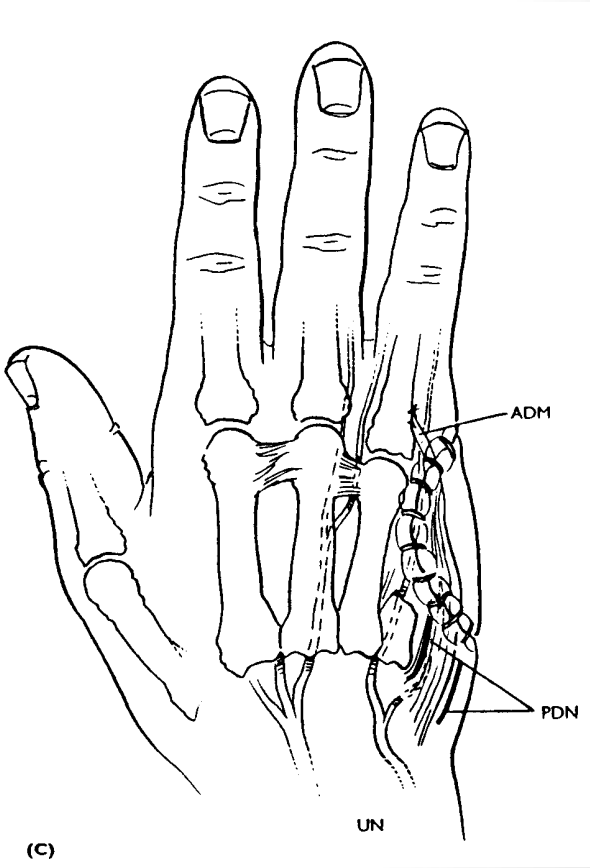
Ray amputations

- Little finger amputation
  - Note: ulnar nerve and its digital branches on the level of section of the nerves relative to the amputation.
  - Note: the reattachment of the ADM to the base of the PP of the RF



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- HAND THERAPY MANAGEMENT

Treatment Goals / Post Op Therapy

Amputations

Post-operative management

- Commence from 2nd to 3rd post-op day
- Therapy goals
  - Promote wound closure and optimize scar formation
  - Maintain full ROM of all uninvolved joints
  - Maximize ROM of all involved joints
  - Desensitization/sensory reeducation of injured tip
  - Return patient to previous level of function
  - Emotion support and reassurance

Amputations

Post-operative management

- Splintage
  - For single digit amputation is not usually necessary
  - Indicated for a few days if whole hand traumatized and swollen + painful → splinting in safe position (POSI = wrist ext, MCP flex, IPJ ext)

Amputations

Post-operative management

- Wound care
  - Initially keep clean and dry
    - ? Silicone oil
  - Following RO sutures
    - Lux soaks, moisturize and massage if scabby

Amputations

Post-operative management

- Oedema control
  - Elevation
  - Compression
    - Glove, coban, lycra fingerstall etc
  - Gentle active exercises
  - Massage
  - NB: some patients do not use their hand well with gloves/finger socks on due to lack of sensory input → may therefore be indicated for night use only

Amputations

Post-operative management

- ROM
  - Isolated active flexion and extension of remaining joints and digits
  - Gross active flexion and extension of all remaining finger joints eg squeeze sponge
  - Passive stretches to remaining joints as tolerated
  - Early functional use of hand → encourage patient to use injured digit

Amputations

Post-operative management

- Pain management
  - Adequate analgesia
  - Massage
  - Interferential
  - TENS

Amputations

Post-operative management

- Scar management – once wound healed
  - Massage
  - Otoform / Elastomer
  - Silicone sheeting
  - Coban / Lycra / Silipos digisleeves
  - Hypafix

Amputations

Post-operative management

- Desensitization programme
  - 5-10 minutes (stop when stimulus becomes noxious)
  - 3-4 x day
  - Demonstrate technique on self or patient's uninvolved side
  - May need to protect the area initially (splint with bubble, gel sheet, elastomer, Duoderm thin)
  - Less irritating stimulus should feel comfortable before advancing to a more irritable stimulus

Desensitization programme

- Techniques
  - Vibration
    - Graded use of vibration can range from tuning fork to a battery/electrically powered vibrator with various shaped attachments and varying speeds
    - Progression can range from stimulating only the periphery of hypersensitive area → intermittent stimulation of actual area → continuous contact with actual area as tolerance allows

Desensitization programme

- Techniques
  - Vibration
  - Texture
    - Graded textures (attached to dowels) can be used to stroke and tap the hypersensitive area
- List of suggested guidelines for progression
  - Cotton
  - Lambswool
  - Felt
  - Orthopaedic felt (1/8”)
  - Orthopaedic felt (1/4”)
  - Terrycloth towel
  - Velcro loop
  - Velcro hook or fine grades of sandpaper

Desensitization programme

- Techniques
  - Vibration
  - Texture
  - Immersion particles
    - Immersion of involved hand into a number of containers filled with particles ranging from least irritating to most
- List of suggestions for particle media
  - Cotton
  - Styrofoam pieces
  - Sand
  - Beans
  - Popcorn
  - Rice
  - Macaroni

Desensitization programme

- Techniques
  - Vibration
  - Texture
  - Immersion particles
  - Maintained pressure
    - Use of continuous mild pressure with Isotoner glove, gelsheet, elastomer mould, Duoderm thin → can increase comfort of hypersensitive areas
    - Progress treatment using varying degrees of pressure over area, including weight-bearing pressure as patient tolerates

Desensitization programme

- Techniques
  - Vibration
  - Texture
  - Immersion particles
  - Maintained pressure
  - Other modalities to decrease hypersensitivity
- Suggestions
  - Massage
  - Tapping
  - TENS (directly on or adjacent to area)
  - Fluidotherapy (aerodyne or whirlpool)
  - Moist heat for relaxation
  - Contrast baths
  - biofeedback

Desensitization programme

- Techniques
  - Vibration
  - Texture
  - Immersion particles
  - Maintained pressure
  - Other modalities to decrease hypersensitivity
  - Therapeutic activities to regain confidence and restore function
    - Theraband and exercises for strengthening
    - Work simulation and/or craft activities

Amputations

Post-operative management

- Strengthening
  - Gradual progressive strengthening programme eg
    - Play dough
    - Tongs
    - Secateurs
    - Pegs

Amputations

Post-operative management

- Functional activities
  - Early functional use of hand very beneficial
    - Helps prevent stiffness and increase circulation → decrease pain
    - Discourages preoccupation with injured hand
    - Reassures patient that hand can still be useful
    - Decreases likelihood of RSD
    - Helps desensitize suture line and stump

Amputations

Post-operative management

- Functional ability due to physical defect
  - A functional assessment to determine why the patient is unable to do a certain task
  - Teach different ways to perform task
  - Fabrication of splints / supply equipment which enable patient to do the task

Amputations

Post-operative management

- Psychological / emotional support
  - Reassurance +++
  - It is sometimes beneficial for a patient to see or talk to someone with a similar injury

Amputations

- Early complications
  - Haematoma (suture too tight)
  - Infection (inadequate debridement)
  - Wound breakdown (inadequate debridement)
  - Depressive reaction

Amputations

- Late complications
  - Painful stump (inadequate desensitization)
  - Painful neuroma (inadequate resection of nerves)
    - May require further resection and placed in a soft tissue bed or vein capping
  - Wrong amputation level (eg proximal index stump interferes with function or cosmesis)
  - Neuroma formation (inadequate resection of nerves)
  - Decreased grip strength
  - Central ray amputation
    - Instability of transverse MC arch (inadequate suture of transverse intermetacarpal lgt)
    - Rotational deformity / scissoring of remaining adjacent fingers

Aknolodement

- Sarah Weldin
- Handworks colleagues
- Plastic and Hand Surgeons in Auckland