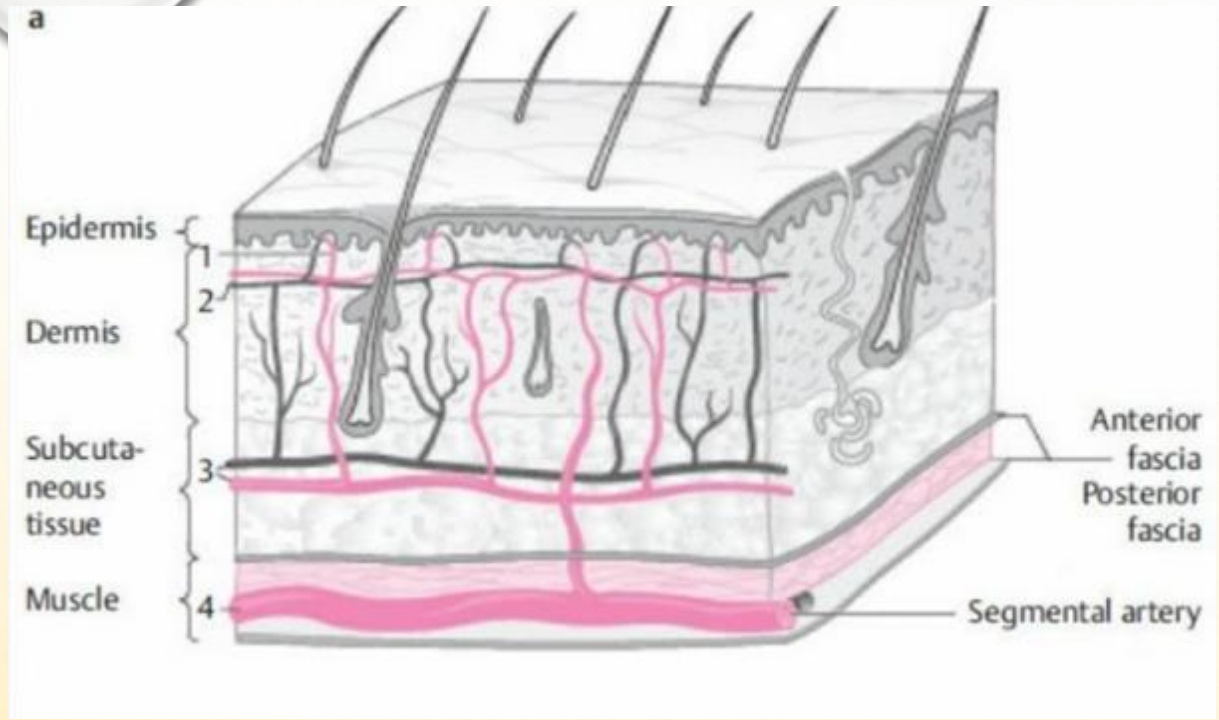
RECONSTRUCTIVE SURGERY IN MSF PROJECTS

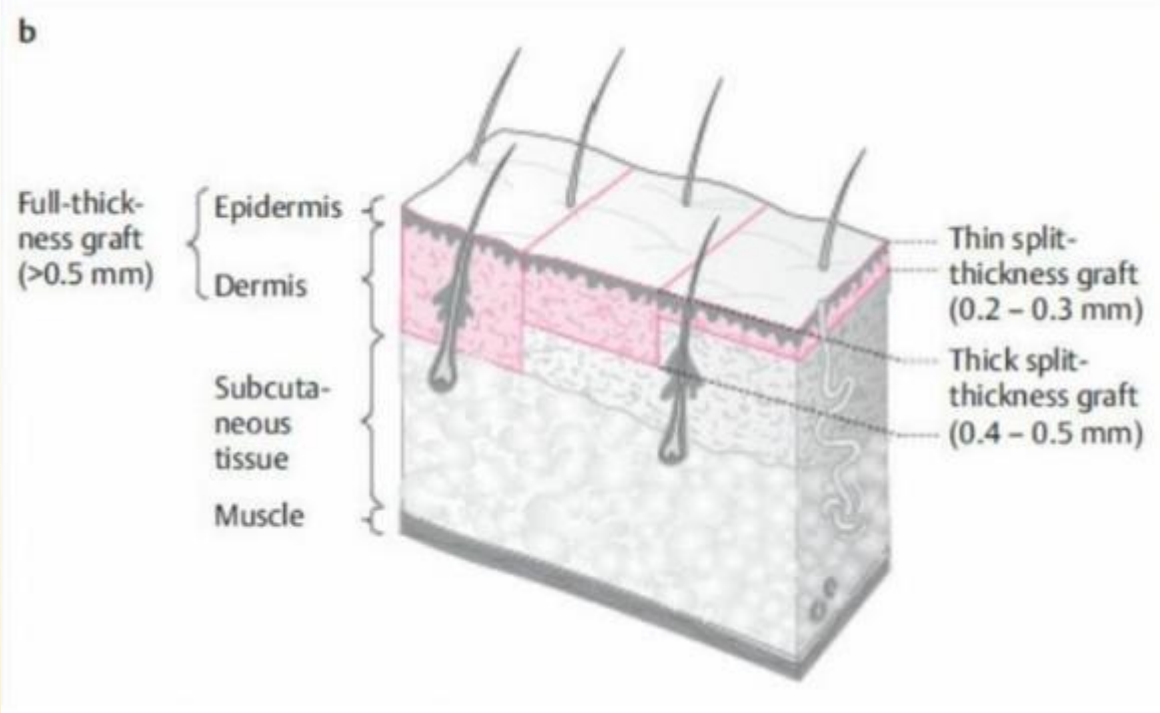


Dr Ryan Ko Chi Cheong

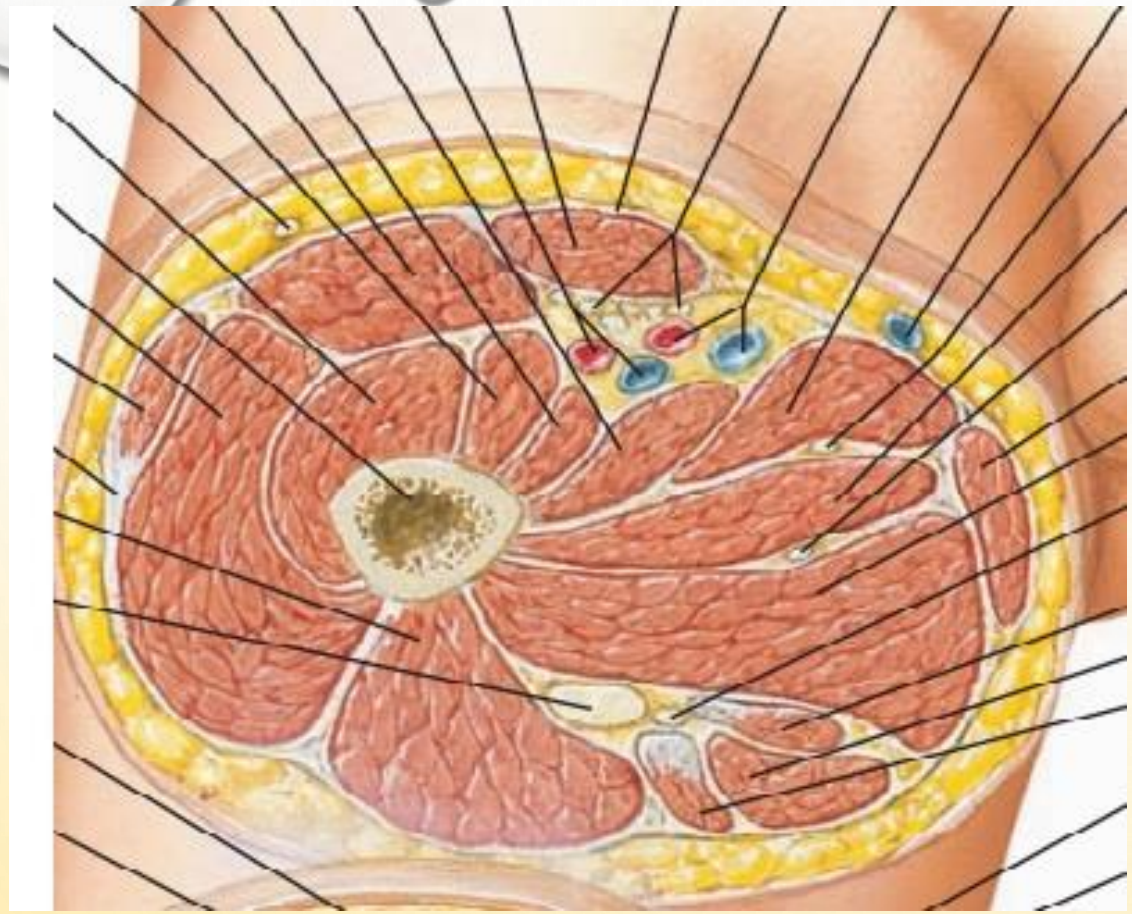
Skin Anatomy 1



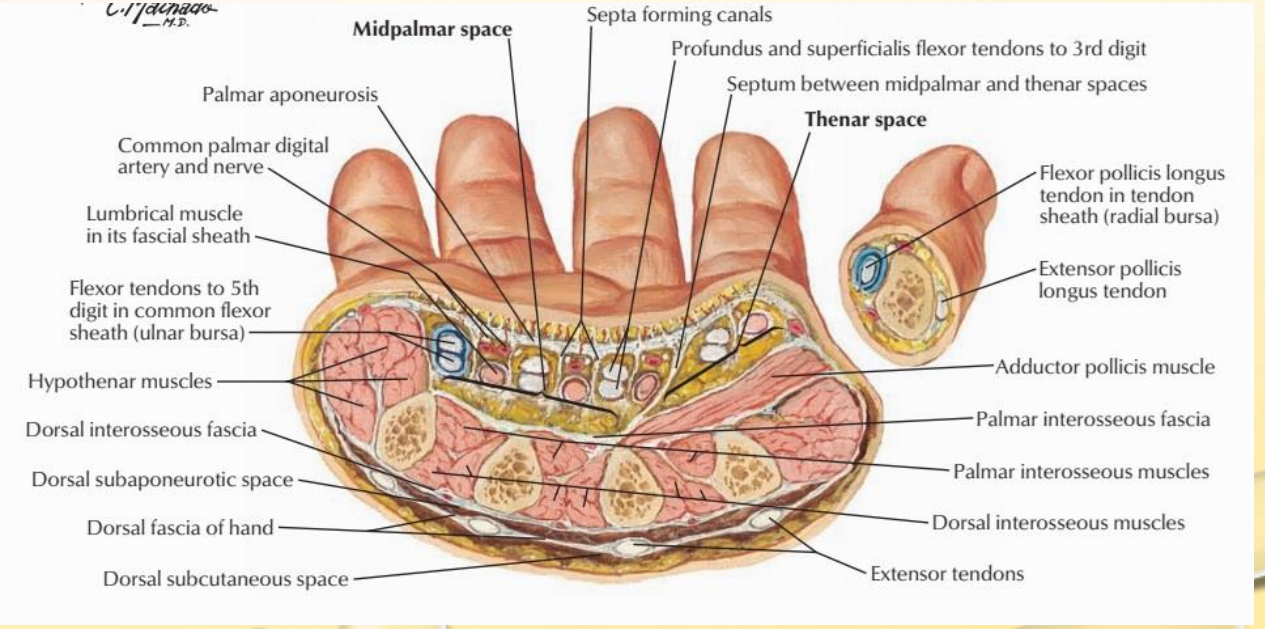
(a) Structure of the skin. Skin consists of epidermis and dermis, leading into the layers of subcutaneous tissue and muscle. Within the layers are vascular plexi, shown as listed. (*1*) Subpapillary vascular plexus; (*2*) dermal vascular plexus; (*3*) subdermal vascular plexus; (*4*) segmental vascular plexus.



(b) Composition of free skin grafts. Skin grafts can be classified as full thickness or split thickness



Skin Anatomy 2



RECONSTRUCTIVE LADDER

- *THIS IS A STEPWISE PROGRESSION FROM THE SIMPLEST OPTIONS FOR RECONSTRUCTION TO THOSE THAT ARE MORE COMPLEX:*

1. SECONDARY INTENTION HEALING
2. PRIMARY CLOSURE
3. GRAFT—SPLIT SKIN, FULL THICKNESS SKIN, OR COMPOSITE
4. TISSUE EXPANSION
5. LOCAL TISSUE TRANSFER
6. DISTANT TISSUE TRANSFER
7. FREE TISSUE TRANSFER
8. MISCELLANEOUS, SUCH AS, CELL CULTURE, VACUUM-ASSISTED CLOSURE (VAC)

WHY FLAP SURGERY?

In MSF setting, we handle lots of patients with open wounds, mainly from war wounded, infection and accidents.
For many of us, the only thing we could do is skin graft, but not every wound could be covered by SG especially those with exposed tendons, bones or joints. In these scenario, we could only do repeated COD, hoping that granulation will finally cover these important structures before they died out. And this resulted in some of our patients having a super long stay in our hospital. Not to mention, some of them would die of infection if we discharged them home.

Benefits of flap surgeries:

1. Save important structures so as to avoid amputation
2. Shorten hospital stay
3. Better wound quality
4. Less future complications cf SG



1. Save important structures so as to avoid amputation



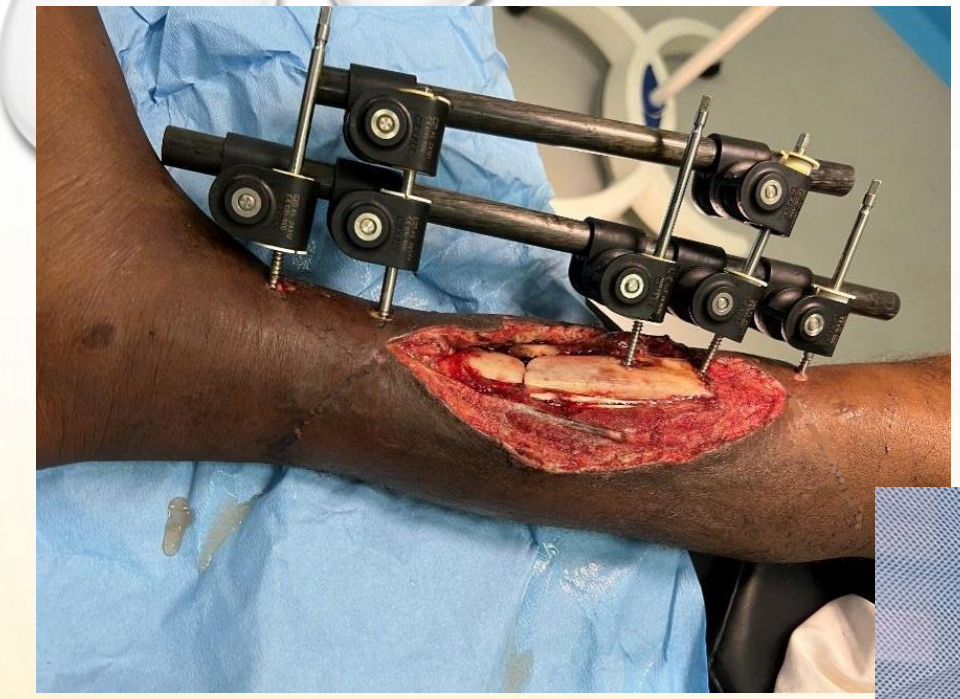








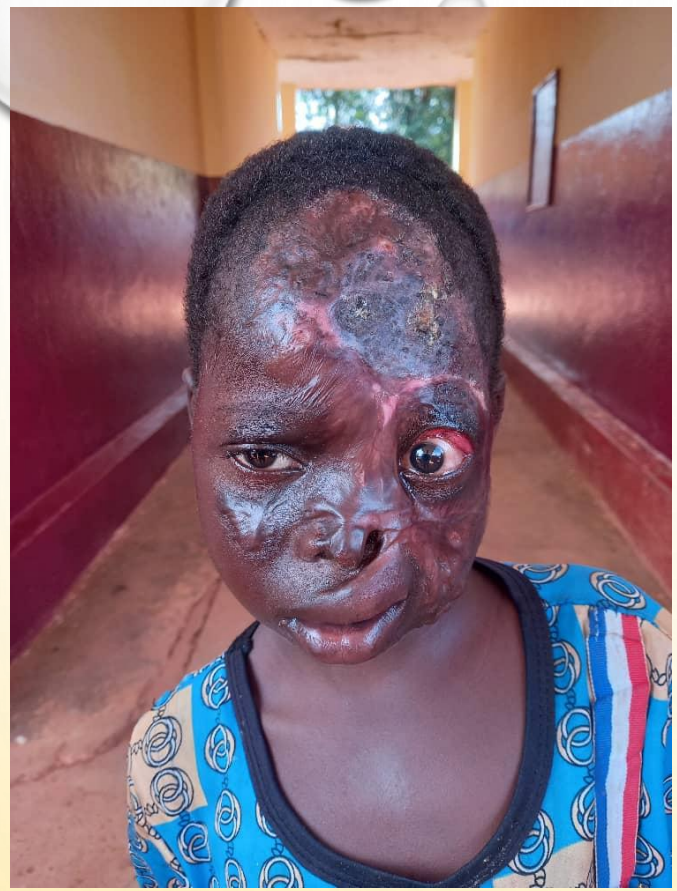
2. Shorten hospital stay







3. Better wound quality













Lashkar Gah, Afghanistan 2023





Dog bite at ® flank, bilateral keystone flap was done
Patient was discharged on D1 with wound gapped on follow up but one can see the gap is way much smaller than the initial wound which can be closed by secondary suture but patient defaulted.
So we count this as partial failure.











Large wound in left forearm, bilateral keystone flap was performed to cover the whole wound. Wound healed nicely on follow up.

4. Less future complications cf SG









A FLAP IS A UNIT OF TISSUE WITH VARIOUS COMPOSITIONS THAT CARRIES ITS OWN BLOOD SUPPLY WHEN TRANSFERRED FROM A DONOR SITE TO A RECIPIENT SITE.

FLAPS ARE CLASSIFIED ACCORDING TO THE FIVE CS, AS FOLLOWS:

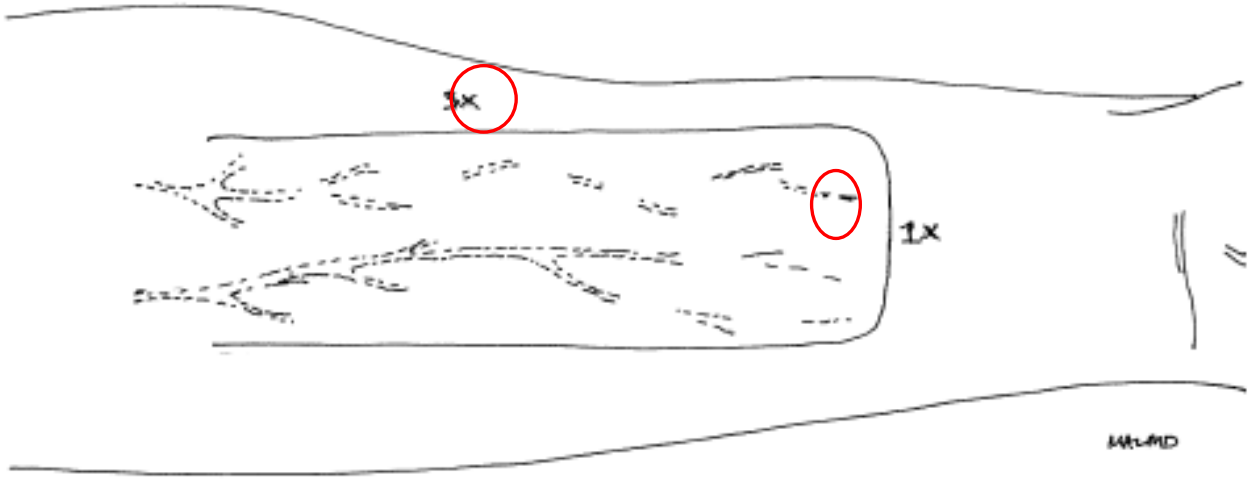
- CIRCULATION
- COMPOSITION
- CONTIGUITY
- CONTOUR
- CONDITIONING

CIRCULATION

- **RANDOM**: NO DIRECTIONAL BLOOD SUPPLY, NOT BASED ON ANY VESSEL, SUCH AS, MOST LOCAL FLAPS ON FACE. LENGTH TO BREADTH RATIO IN FACE IS 1:6, BUT 1:1 IN LOWER LIMB.
- **AXIAL**: NAMED ARTERY ALONG AXIS, SUCH AS, GROIN FLAP ON SUPERFICIAL EXTERNAL ILIAC VESSELS OR DELTOPECTORAL FLAP ON PERFORATORS OF INTERNAL MAMMARY ARTERY.
- **FASCIOCUTANEOUS**: FROM DEEP ARTERIES TO FASCIA.
- **MUSCULOCUTANEOUS**: PERFORATORS REACH SKIN THROUGH MUSCLE.
- **VENOUS**: VENOUS PEDICLES.

RANDOM FLAPS

- **TINY VASCULAR CONNECTIONS FROM THE PEDICLE INTO THE FLAP**. THE **PEDICLE MUST BE BULKY TO INCREASE THE NUMBER OF VASCULAR CONNECTIONS.** THE MORE VASCULAR CONNECTIONS, THE BETTER THE CIRCULATION TO THE FLAP. THE BETTER THE CIRCULATION TO THE FLAP, THE BETTER ITS SURVIVAL. IN GENERAL, A RANDOM FLAP DOES NOT HAVE AS RELIABLE A BLOOD SUPPLY AS AN AXIAL FLAP. NONETHELESS, THE RELATIVE EASE OF CREATING RANDOM FLAPS MAKES THEM USEFUL ALMOST ANYWHERE ON THE BODY. THE CIRCULATION AND THUS THE RELIABILITY OF THE FLAP CAN BE INCREASED BY "DELAYING" THE FLAP BEFORE FINAL TRANSFER.

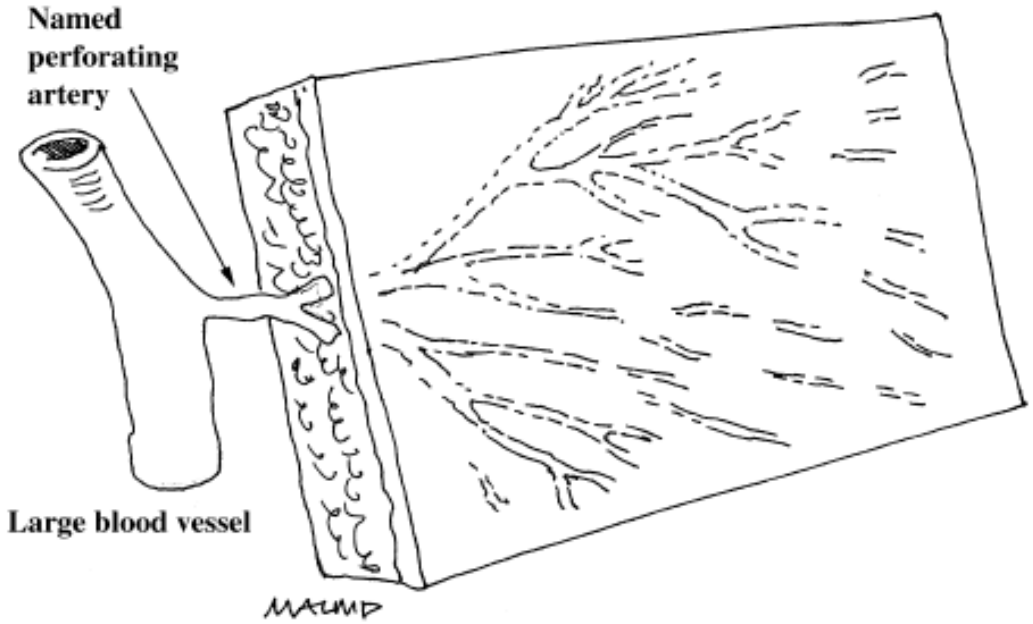


Random skin flap. The blood supply comes diffusely from the remaining skin attachment, which serves as the pedicle. For optimal circulation and flap survival, the flap should be designed so that the length is no more than three times the width.

AXIAL FLAPS

- THE CIRCULATION OF AN AXIAL FLAP IS SUPPLIED BY SPECIFIC, IDENTIFIABLE BLOOD VESSELS. CAREFUL ANATOMIC STUDY HAS IDENTIFIED SEVERAL DONOR SITES WITH A SINGLE ARTERY AND VEIN RESPONSIBLE FOR CIRCULATION TO A PARTICULAR AREA OF SKIN.

Example:
Groin flap
Deltopectoral Flap



Axial flap. Note that the blood supply comes from an identifiable vessel. As a result, the pedicle can be quite thin, which makes transferring the flap to its new site an easier task.

COMPOSITION

- CUTANEOUS
- FASCIOCUTANEOUS
- FASCIAL
- MUSCULOCUTANEOUS
- MUSCLE ONLY
- OSSEOCUTANEOUS
- OSSEOUS

CONTIGUITY

- **LOCAL FLAPS:** THE TISSUE LIES ADJACENT TO DEFECT.
- **REGIONAL FLAPS:** THE TISSUE IS TAKEN FROM SAME REGION OF BODY AS DEFECT, SUCH AS, HEAD AND NECK.
- **DISTANT PEDICLED FLAPS:** THE TISSUE IS TAKEN FROM A DISTANT PART OF THE BODY BUT REMAINS ATTACHED VIA A PEDICLE.
- **DISTANT FREE FLAPS:** THE TISSUE IS COMPLETELY DETACHED AND ANASTOMOSED TO VESSELS CLOSE TO DEFECT

CONTOUR

METHODS OF TRANSFERRING FLAPS INTO DEFECT:

- ADVANCEMENT
- TRANSPOSITION
- ROTATION
- BILOBED
- INTERPOLATION
- CRANE PRINCIPLE: THE CRANE PRINCIPLE IS THE TRANSFORMATION OF AN UNGRAFTABLE BED INTO ONE THAT WILL ACCEPT A SKIN GRAFT. INITIALLY, A FLAP IS PLACED INTO THE DEFECT TO ENABLE VASCULARIZATION. THE SUPERFICIAL PORTION IS THEN REPLACED INTO ITS ORIGINAL POSITION, LEAVING A SUBCUTANEOUS PORTION, WHICH CAN BE GRAFTED.

CONDITIONING

DELAY IS A PREOPERATIVE MANEUVER TO INCREASE FLAP SURVIVAL. THE DELAY PHENOMENON DEVELOPS THE FLAP BY TRANSFERRING IT IN MORE THAN ONE STAGE TO ENSURE ITS VASCULAR SAFETY. AT THE FIRST STAGE DIVISION OF PART OF THE VASCULAR SUPPLY OR DRAINAGE IS CARRIED OUT, FOLLOWED BY DEFINITIVE RAISING OF THE FLAP AT 1 TO 3 WEEKS.

DELAY IS THOUGHT TO WORK BY:

- DISRUPTION OF TRANSVERSE VESSELS
- REORIENTATION OF THE VESSELS LONGITUDINALLY ALONG FLAP
- OPENING OF CHOKE VESSELS
- VASODILATION DUE TO INFLAMMATORY MEDIATORS AND SYMPATHECTOMY
- REACTIVE HYPEREMIA SECONDARY TO RELATIVE ISCHEMIA AND OXYGEN-FREE RADICALS
- TOLERANCE TO HYPOXIA
- INTERFLAP SHUNTING HYPOTHESIS

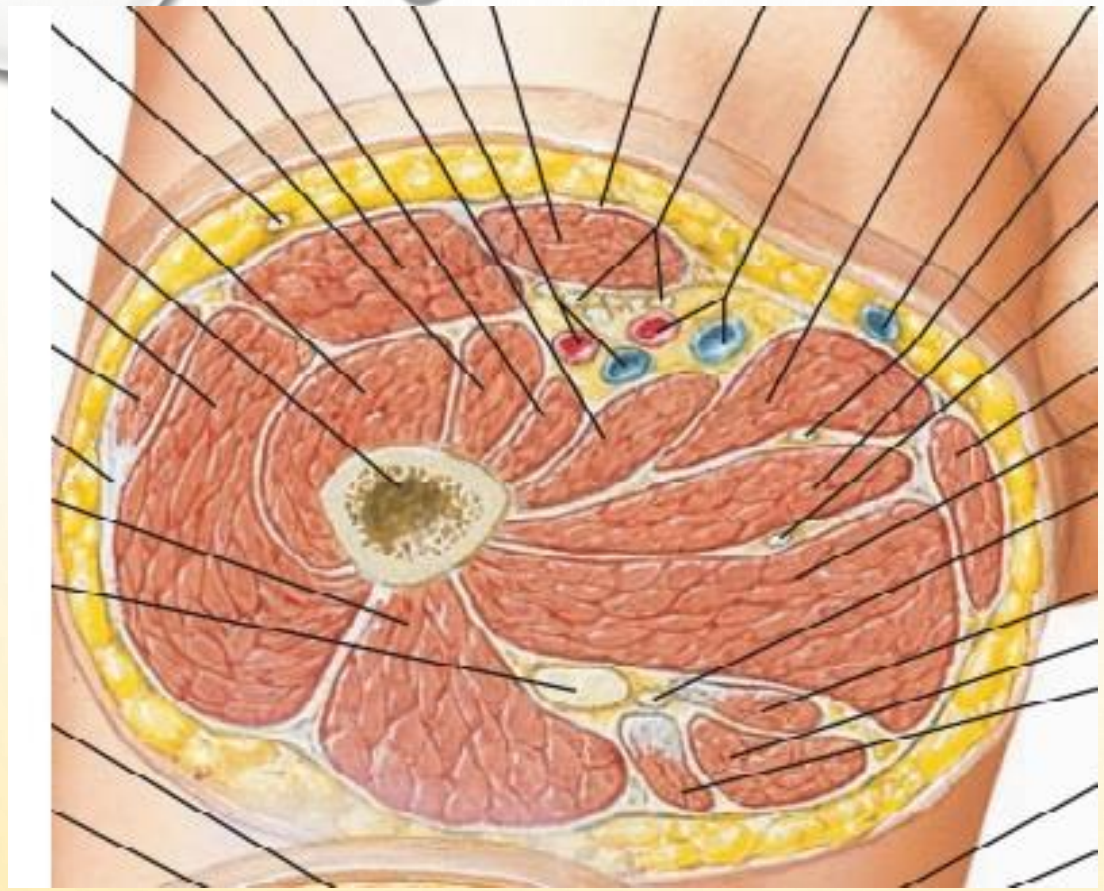
DELAY PROCEDURE

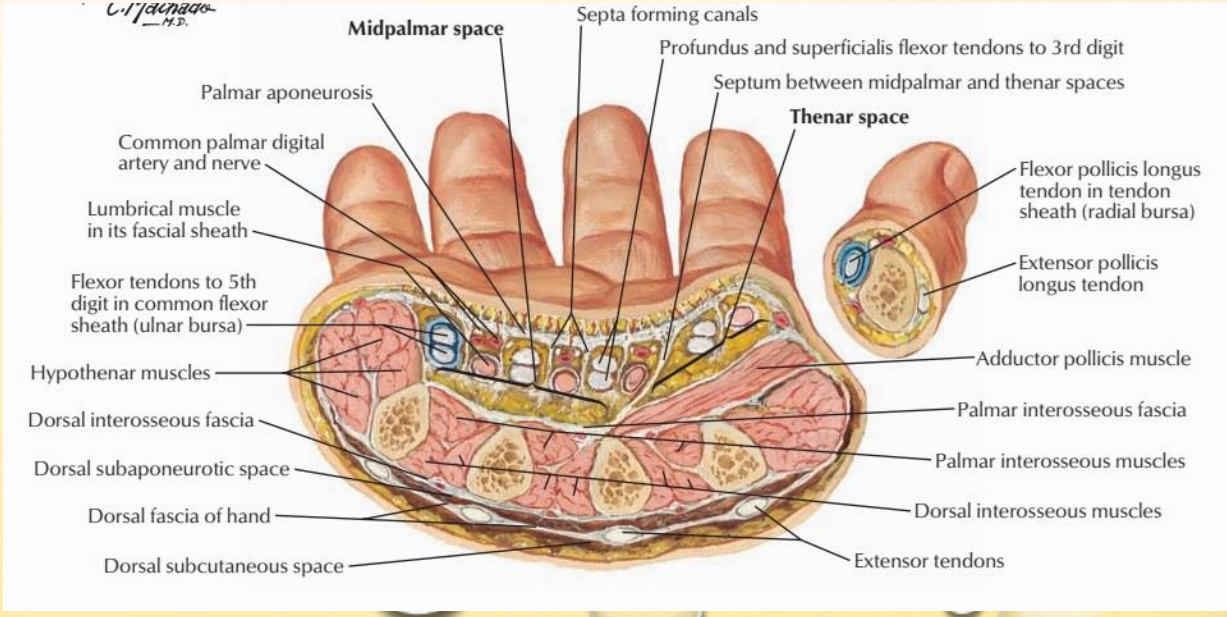
- THE PURPOSE OF THE DELAY PROCEDURE IS TO ENABLE THE PEDICLE TO ASSUME ITS ROLE AS THE MAIN SOURCE OF CIRCULATION BEFORE THE FLAP IS MOVED TO ITS NEW POSITION. THIS GOAL IS OBTAINED BY ***MAKING SOME OF THE INCISIONS NEEDED TO CREATE THE FLAP*** ***BUT NOT SEPARATING THE FLAP FROM THE UNDERLYING TISSUES***. THE FLAP IS NOT MOVED TO ITS NEW POSITION; INSTEAD, THE ***SKIN EDGES ARE SUTURED TOGETHER LOOSELY.***
- THE TOTAL BLOOD SUPPLIED TO THE FLAP INITIALLY DECREASES WHEN THE INCISIONS ARE MADE. THIS DECREASE PROMOTES OPENING OF NEW VASCULAR CHANNELS BETWEEN THE PEDICLE AND FLAP. THUS, MORE BLOOD WILL FLOW INTO THE FLAP THROUGH THE PEDICLE THAN IF THE DELAY PROCEDURE HAD NOT BEEN DONE.
- DELAYING THE FLAP BEFORE FINAL TRANSFER ALLOWS MORE CONFIDENCE IN THE VIABILITY OF THE FLAP. ***WAIT ABOUT 7–10 DAYS AFTER THE DELAY PROCEDURE BEFORE MOVING THE FLAP TO THE RECIPIENT SITE***.

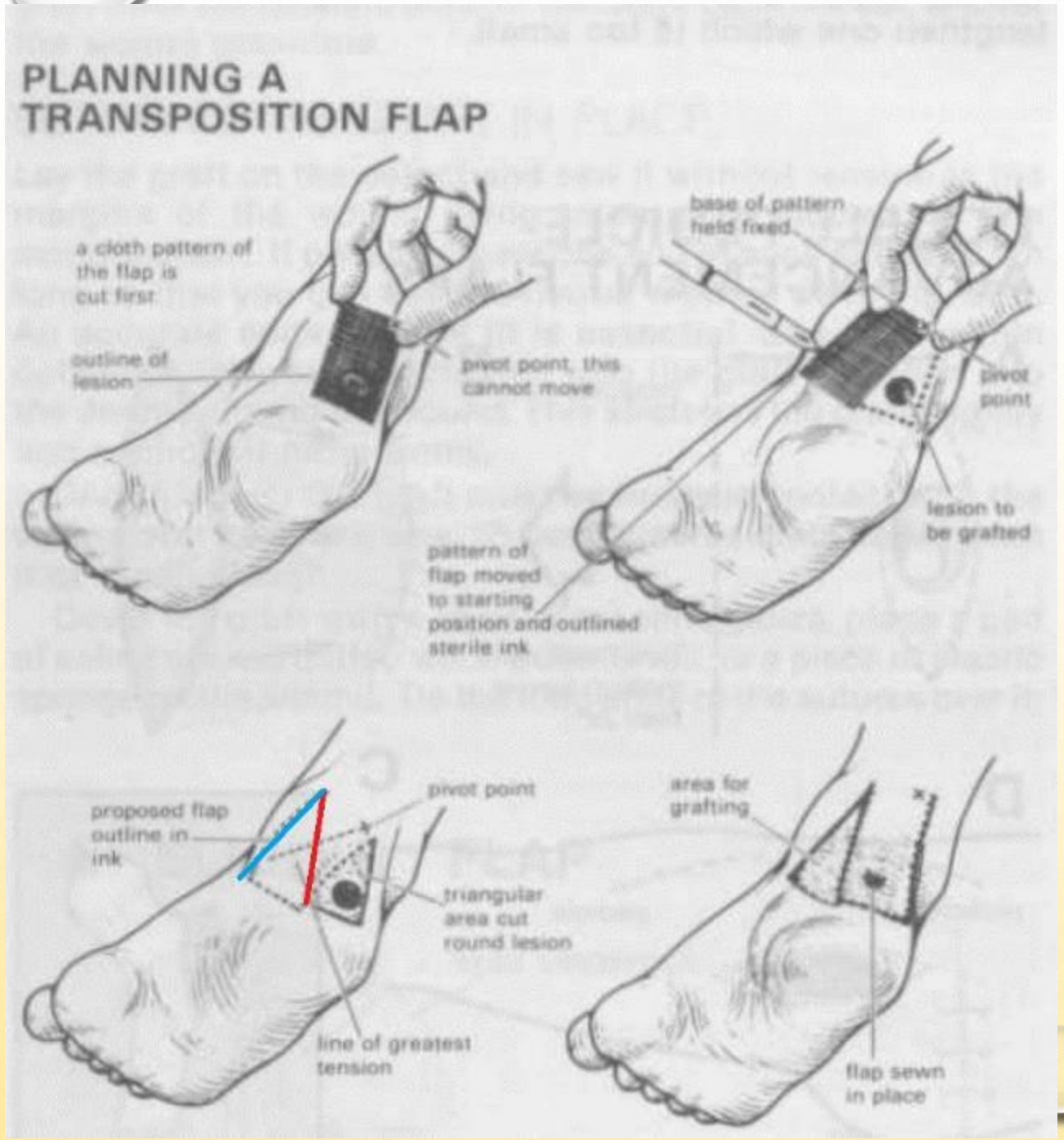
LOCAL FLAPS

GENERAL INFORMATION

- RANDOM FLAP PROCEDURES OFTEN CAN BE DONE UNDER ***LOCAL ANESTHESIA*** IF THE AREA (FLAP PLUS DEFECT) IS NOT TOO LARGE (< 8–10 CM). FOR LARGER AREAS, GENERAL ANESTHESIA PROBABLY WILL BE REQUIRED.
- BE SURE TO ***CLEAN THE WOUND*** THOROUGHLY BEFORE CREATING AND PLACING THE FLAP. USE A SCRUB BRUSH OR THE FLAT PART OF A SCALPEL TO SCRAPE AWAY THE TOP LAYER OF GRANULATION TISSUE FROM THE WOUND. THEN WASH WITH SALINE. THE WOUND PROBABLY WILL BLEED, BUT GENTLE PRESSURE SHOULD CONTROL THE BLEEDING.
- HINT: ***OUTLINE THE FLAP*** BEFORE MAKING ANY INCISIONS. A WATER-BASED MAGIC MARKER ALLOWS YOU TO MAKE CORRECTIONS TO YOUR DESIGN BEFORE MAKING ANY INCISIONS. INCORRECT MARKS CAN BE REMOVED BY WIPING WITH ALCOHOL.
- *TO OPTIMIZE CIRCULATION AND RELIABILITY OF A RANDOM FLAP*, PLASTIC SURGEONS HEED THE ***3:1 RULE***. THE FLAP SHOULD NOT BE LONGER THAN 3 TIMES ITS WIDTH.
- ***DELAYING THE FLAP*** IS ALSO USEFUL.
- ***MINIMAL TENSION*** *SHOULD BE APPLIED TO THE FLAP WHEN IT IS SUTURED INTO PLACE.* TENSION ON THE FLAP DECREASES CIRCULATION AND CAN LEAD TO TISSUE NECROSIS (DEATH). YOU CAN TELL THAT TOO MUCH TENSION HAS BEEN APPLIED IF ***PORTIONS OF THE FLAP LOOK PALE ONCE IT IS IN ITS NEW POSITION***.
- IF THE ***DONOR SITE*** CANNOT BE CLOSED PRIMARILY WITHOUT PLACING TENSION ON THE FLAP, AVOID PRIMARY CLOSURE. A SKIN GRAFT CAN BE USED TO COVER THE DONOR SITE DEFECT—OR, IF THE DEFECT IS JUST A FEW CM, IT CAN BE ALLOWED TO HEAL SECONDARILY.
- FOR COVERAGE OF A WOUND > 7–8 CM, IT IS USEFUL TO PLACE A ***DRAIN*** UNDER THE FLAP TO PREVENT COLLECTION OF FLUID, WHICH WILL INTERFERE WITH HEALING. THE DRAIN CAN BE A SUCTION DRAIN, IF AVAILABLE, OR A PASSIVE DRAIN (E.G., PENROSE DRAIN). A PIECE OF STERILE GLOVE CAN SUBSTITUTE FOR A PENROSE DRAIN. THE DRAIN **USUALLY CAN BE REMOVED AFTER 48 HOURS**.




Midpalmar space
Septa forming canals
Profundus and superficialis flexor tendons to 3rd digit
Septum between midpalmar and thenar spaces
Palmar aponeurosis
Thenar space
Common palmar digital artery and nerve
Lumbrical muscle in its fascial sheath
Flexor tendons to 5th digit in common flexor sheath (ulnar bursa)
Hypothenar muscles
Dorsal interosseous fascia
Dorsal subaponeurotic space
Dorsal fascia of hand
Dorsal subcutaneous space
Flexor pollicis longus tendon in tendon sheath (radial bursa)
Extensor pollicis longus tendon
Adductor pollicis muscle
Palmar interosseous fascia
Palmar interosseous muscles
Dorsal interosseous muscles
Extensor tendons



1. Upon transposition, the farther edge needs to cover the nearest corner of the wound, meaning the length of the flap, especially the farther edge (blue line needs to be equal or more than the diagonal of the flap (red line)
2. As circulation to the flap is random in pattern, so the wider & thicker the fascial pedicle, the safer the flap. So, take all fascia that's above tendons





Kilo, Yemen 2019



Wound with exposed archilles tendon, transposition flap was done to cover the tendon, and PTSG to cover the donor site

Kilo, Yemen 2024









® heel wound with exposed Tendo Achilles, Transposition flap + FTSG was performed

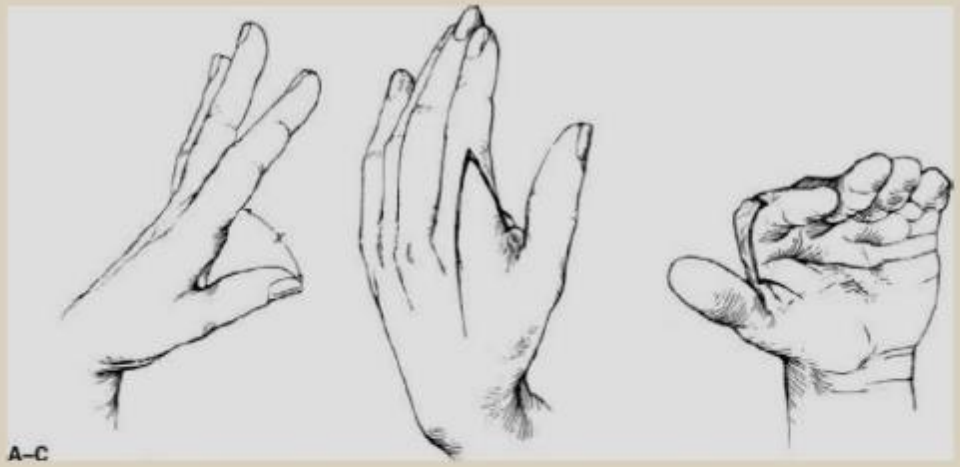


FIGURE 328.1 A: Adduction contracture of the thumb (*X*). **B:** Oblique view, demonstrating the triangular flap based proximally on the dorsoradial aspect of the index finger. **C:** Volar aspect, demonstrating the thenar and index finger incision. (From Spinner, ref. 1, with permission.)

Transposition Flap for web space

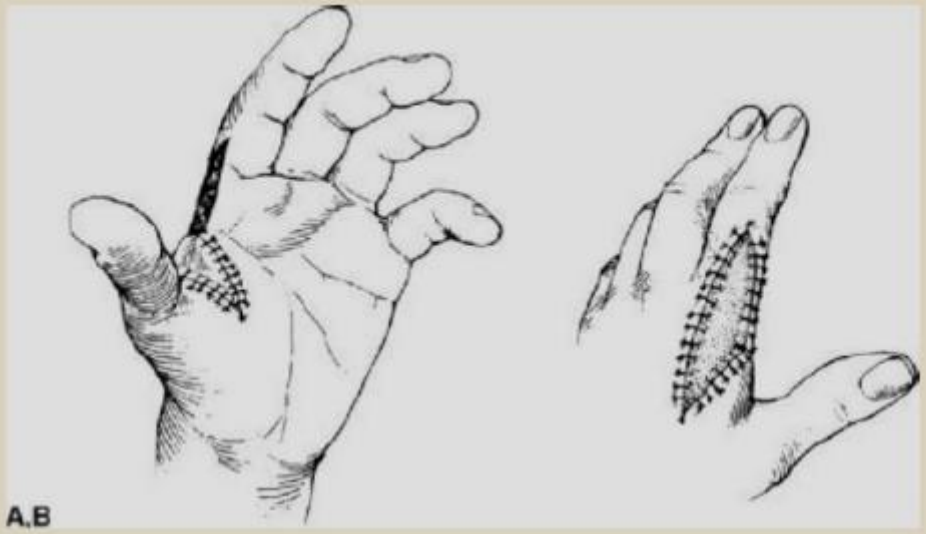


FIGURE 328.2 A,B: Palmar and dorsal views. The adduction contracture has been released, and the transposition flap and split-thickness skin graft have been sutured in place. (From Spinner, ref. 1, with permission.)

Mosul, Iraq 2018







Narrow scarred 1st & 2nd web space, dorsal index finger flap was performed for 1st,
Dorsal rectangular flap was performed for the 2nd

DORSAL RECTANGULAR FLAP

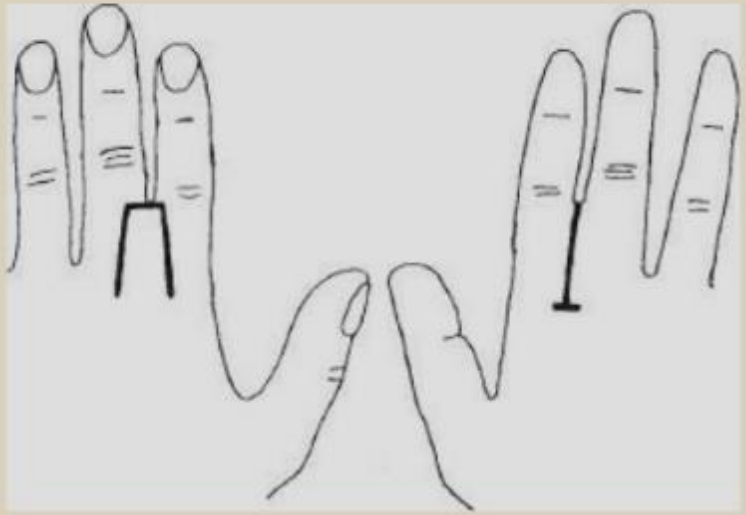


FIGURE 325.1 Dorsal, proximally based rectangular flap, set into inverted volar T.

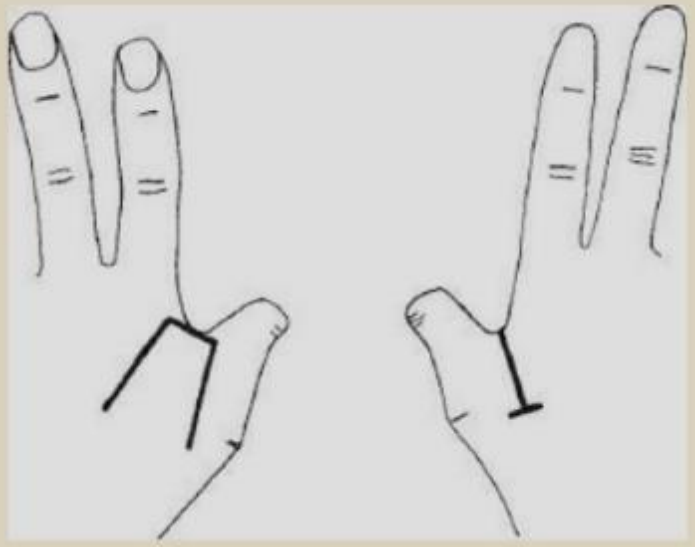


FIGURE 325.2 Use of flap to deepen first web space.



Mosul, Iraq 2018





