Extensor Tendon Rehabilitation

Hand Therapy Training Program 2015

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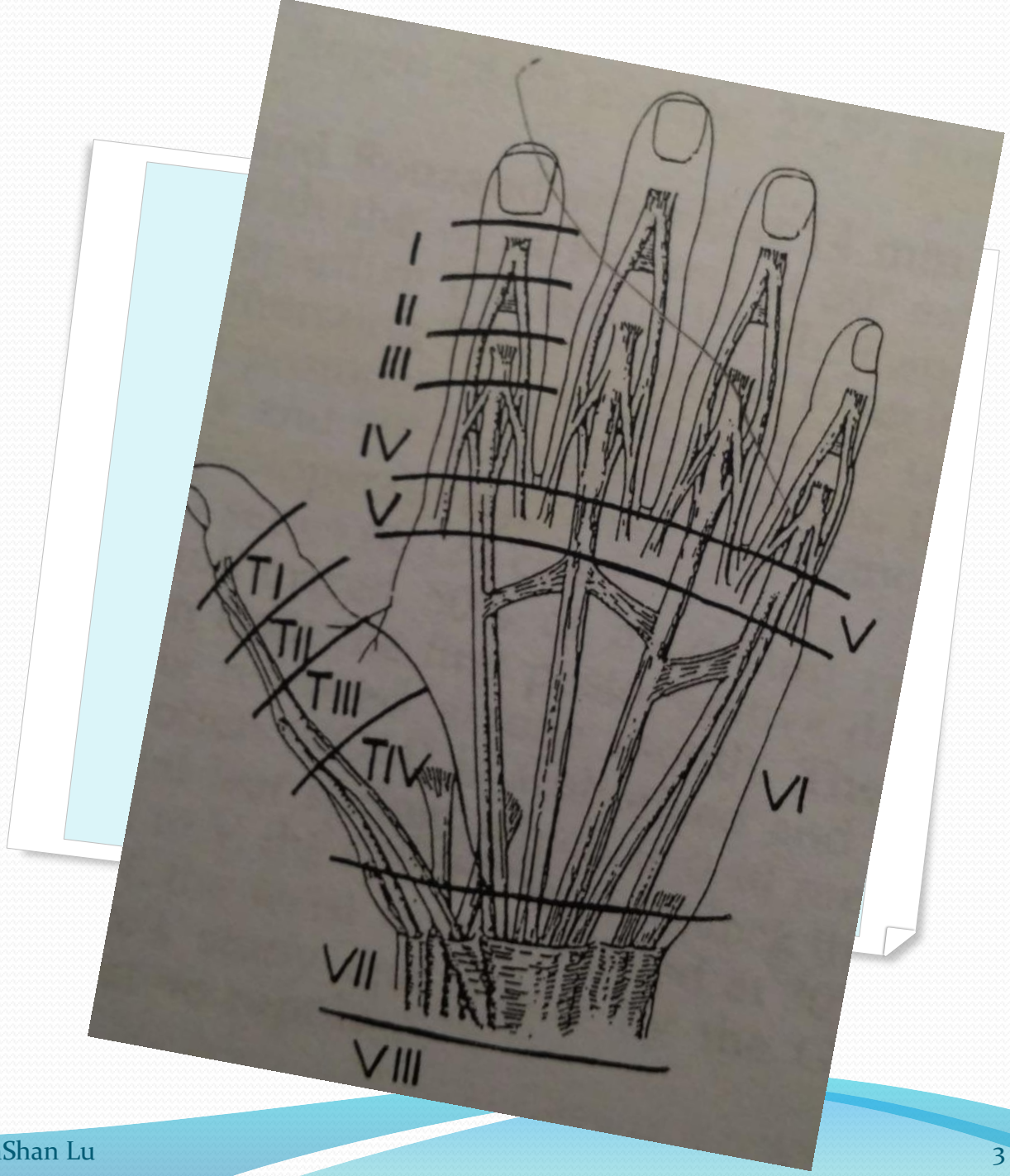
- Extensors of hand and wrist
- Thumb extensors

Zones and junctura



Differences between extensors and flexors

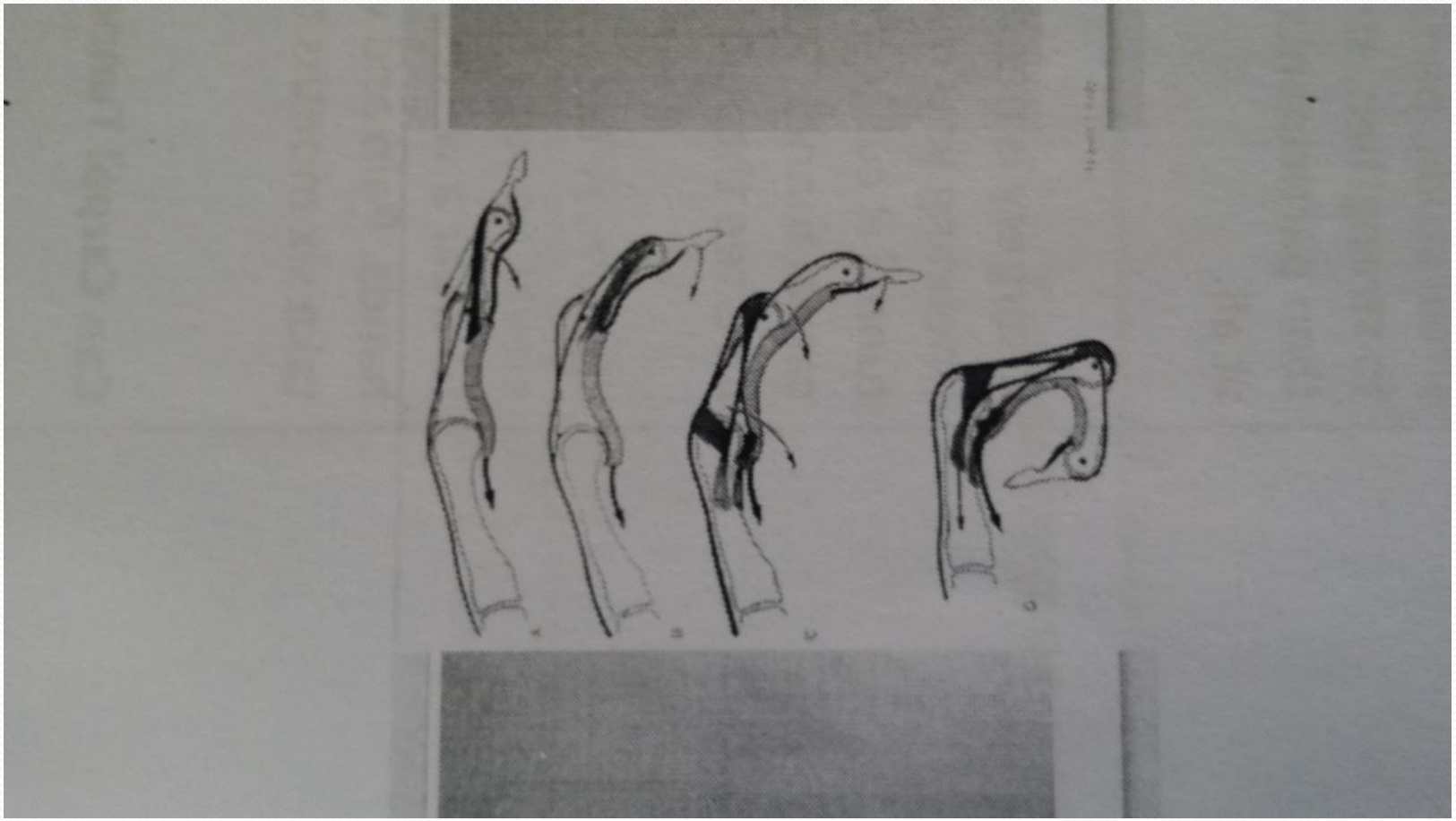
- power < 1/3
- Less excursion
- Synovial sheaths
- Dorsal hood
- superficial

Dorsal fascia

- Dorsal lacks fascial septa that stabilise the skin on the palm allowing full consummation of the loose dorsal skin in full flexion.
- Deep fascia is a continuation of extensor retinaculum
- Broad tendons run in between the layers surrounded by paratenon, which enhances glide but has capacity for general scar.
- Superficial fascia-fat and membranes house blood vessels and lymphatics, sensory nerves. Loosely attached to deep fascia therefore potential space for oedema, which if uncontrolled will tether the fingers in extension and thumb in extension and supination

Tendon Biomechanics

Mechanics of digital flexion and extension
Normal Excursion and glide
Role of the Intrinsic



Finger extension

- Extension starts at MCPJ
- EDC hyperextends proximal phalanx via saggital bands
- Lumbricals counteract flexors & maintain IPJ extension
- Central slip acts to extend PIP] , tensioning ORL extending DIP]
- EDC and intrinsic lateral bands complete DIP] ext

Role of interosseous

- Dorsal hood formed by palmar interosseous and palmer component of dorsal interosseous
- Two types:
  pure flexors act on MCPJ only
  lumbricals extend IPJ

Role of the lumbricals

- Control tension between flexor and extensor systems
- Extend IPJs whatever the position of MCPJs.
- Draws FDP attachment distally, (this suppresses the flexor pull) transferring tension through the lateral bands to extend IPJ.

Tendon excursion

- studies by Duran & Houser(1975) demonstrated that excursion of 3-5mm was sufficient to prevent adhesion of the healing tendon
- Although the study was on flexors tendon research.

Tendon excursion

- Studies by Gelberman et al demonstrated 3-4 mm glide required to stimulate the repair process

- Amadio- 1.7mm

Extensor tendon excursion

- Full finger & wrist flexion: 50mm
- Wrist flex/ex 31mm
- MPJ motion 16mm
- PIP] motion 3-4mm
- DIP] motion 3-4mm

Bunnell

Tendon rehab

- Re-establishing the ability to glide and transmit force with no gapping or rupture
  - When?
  - How often?
  - How far?
  - How much?

complication

- Lag
- Rupture
- Adhesions
- Contracture
- Hypertrophic scarring (tape)

Communication from surgeon

- Zone of repair
- Quality and type of repair
- Alternations in tendon length
- Integrity of the tissue
- Status surrounding tissue
- Any pathologic conditions to alter amount controlled stress.


Donna L. Hull

Mallet injury

- Hyperflexion of the DIPJ resulting in

  #DP/Avulsion of terminal tendon- aka “boney” mallet

- Disruption of terminal tendon-
- “soft tissue mallet

Zone 1 and 2 mallet finger

- Type 1: close or blunt trauma with loss of tendon continuity+/- small avulsion #
- Type2: laceration at or proximal to the DIPJ with loss of tendon continuity
- Type 3: deep abrasion with loss of skin, subcutaneous cover and tendon substance
- Type 4: tendon plus significant fracuture

Zone 1 & 2

- Type 4:

(A) Plus Transepiphseal plate # in children

(B) Plus # articular surface 20-50%, hyper flerxion injury

(C) Plus # articular surface> 50%, with early or late volar subluxation of the distal phalanx

Mallet finger treatment

- Type 1: splint
- Type 2: surgical repair then as type 1.
- Type 3: reconstructive surgery, skin coverage, tendon graft/arthrodesis.
- Type 4 (A): closed reduction to corrects deformity splint 3-4/52
- Type 4 (B) and (C): open reduction to correct volar subluxation if needed, K wire.

NB: Zone 1 is not suitable for an active protocol due to small excursion and stiffness of the tendon

Splinting for mallet finger

Mallet management

- Splint 24/7 for 6/52
- Skin care
- Tape/fixomull/hypoflex
- Resist temptation to check movement

complication

- Extensor lag
- Decrease DIPJ flexion
- Skin breakdown
- Swan neck deformity
- Nail deformities

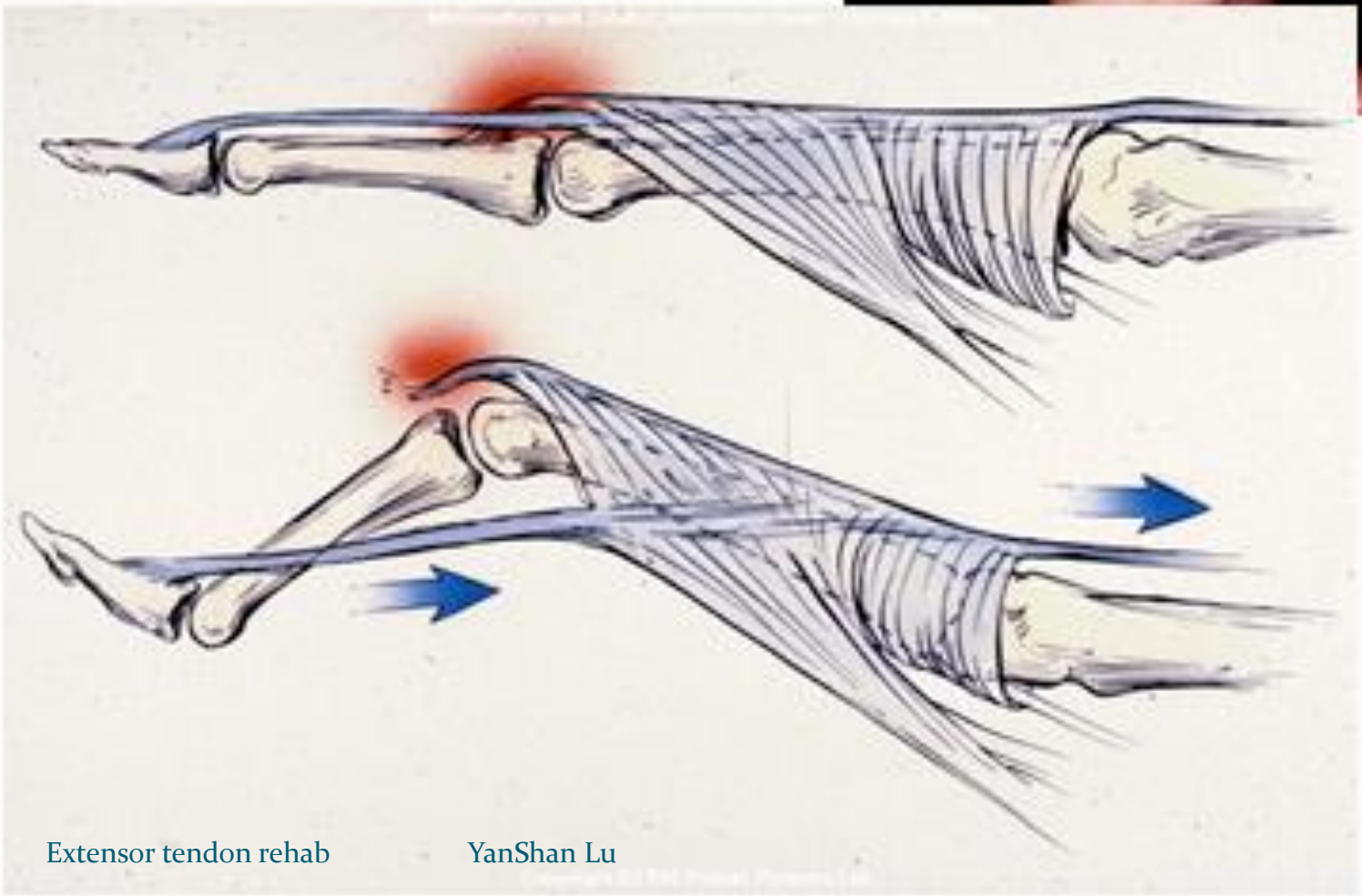
Mallet /anti swan-neck

Extension taping

Wean off splint

- 6/52 check lag after gentle flexion
- If increase lag need longer splinting
- Gradually wean off the splint
- DIPJ flexion goals: ~1/52: 25-30, ~ 2/52: 35-40
- Desensitization
- Night splint 6/52

Boutonniere deformity



Zone 3 and 4 (Boutonnière)

- Open or close injury

Commonly PIPJ acutely flexed tearing the central slip

- occational directs trauma,
- laceration/crush
- volar dislocation PIPJ
- may develop slowly over time

Boutonniere (zone 3 and 4)

- Mechanism : damage to central slip and triangular ligament ----lateral bands flex PIPJ and ext DIPJ.

  -----progressive volar displacement and shortening lateral bands.

  -----ORL shortens.

  ------secondary joint contracture

Boutonniere Treatment

- Depends on type injury and surgeons/therapist preference
- ?close or open
- # stable /unstable
- Surgical repair
- Associated injuries
- Early or late presentation

Treatment with immobilisation

- Immobilise 4-6/52
- If lateral bands intact, no need to immobilise DIPJ
- Oedema control
- Gradually increase flex
- Wean off static splint
- 8/52 strengthening

PIPJ cylinder extension /DIPJ free

Active short arc motion (SAM)

- Injury with repaired central slip
- Provides 3-5 mm excursion to prevent adhesions
- Stimulates the repair and increases tensile strength
- Splint-volar static PIPJ /DIPJ absolute 0 degree

(SAM) zone3/4

- Wrist flexion 30 degrees, MCPJ 0 degree
  (less flexor resistance, facilitate interossei function).
- 1-2/52 PIPJ flex 0 to 30, DIPJ flex 0 to 25
- 3/52, PIPJ flex: 40
- 4/52 PIPJ flex: 50
- If lateral bands unrepaired PIPJ 0, DIPJ flexion
- 20 reps hourly, slowly sustained full ext.

SAM

- 6/52 full AROM
- Resistance: strengthening with a home program
- Wean off splint 5-6/52

  neoprene, capener may be required

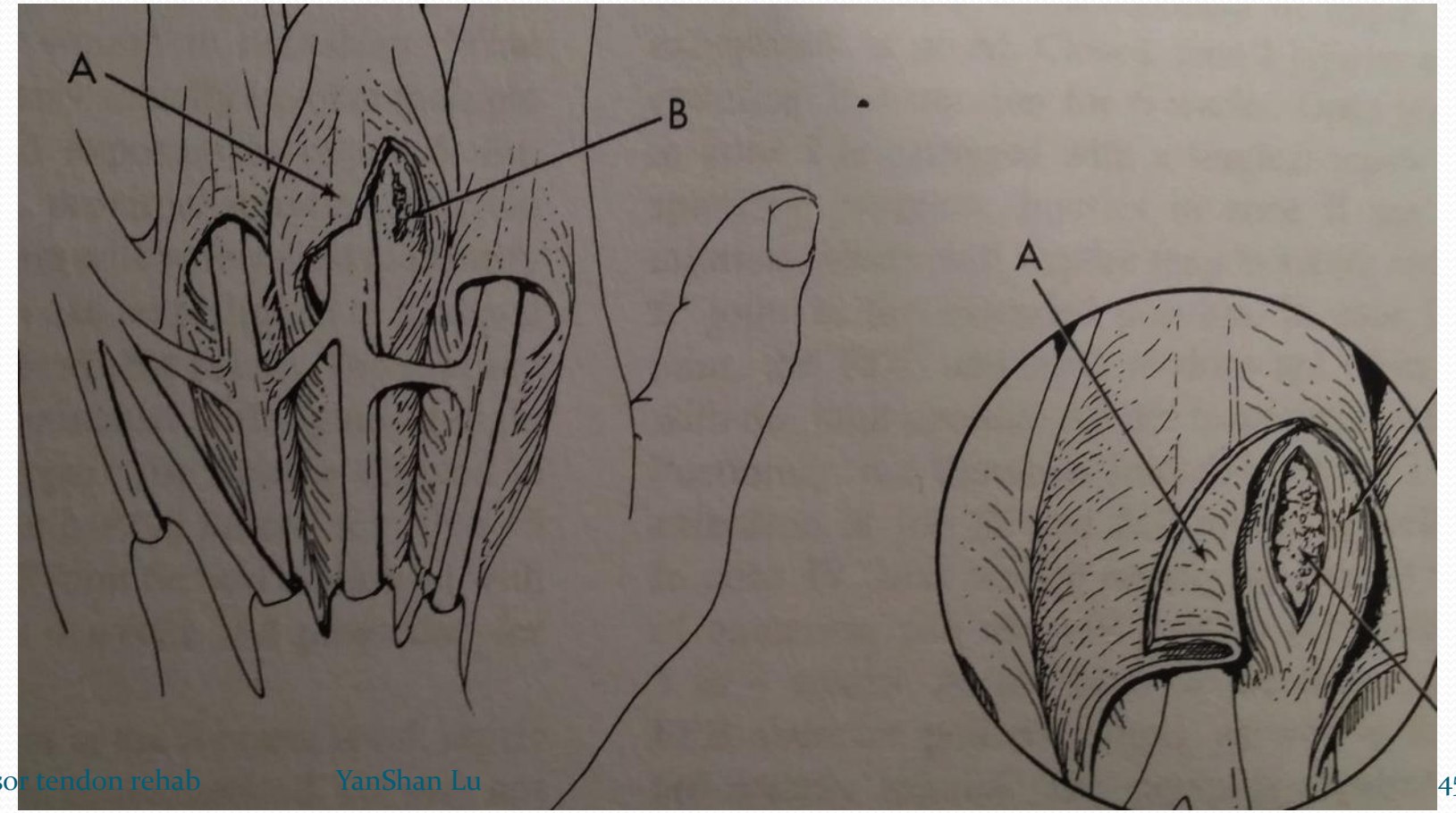
PIPJ dynamic splints

Zone 5,6 and 7

- Simple laceration
- Laceration + crush
- Complex injury + #
- Spontaneous rupture
- Human bite

Zone 5 blunt trauma

- Injury to sagittal hood system—subluxation of tendon or ulnar drift
- Repair
- 4-6/52 extension


A
B
A

Zone 5 human bite

- Infection
- Septic arthritis
- Osteomyelitis
- Problem with lag. Adherence or stiffness even if no tendon damage

Protocols

- Immobilization---suitable for children or non-compliant patient
- Passive/dynamic
- Early controlled movement/active

Protocol considerations excursions

- Zone 5&6 EDC has 11-16mm excursion requiring protection of both wrist & fingers immobilised
- Formulate for calculation degrees of joint movemnt required for 5mm excursion at mcpj=30^0 mcpj flexion of MF, IF and 40^0 of RF & LF provided wrist >21^0 extension

Effects of Juncture

- Zone 5 repair distal to juncture
- Flexion adjacent digits approximates sutures reducing the tension : ? Need to immobilise all digits

  ? Immobilised in more flexion
- Zone 6 proximal or distal to junctura
- If proximal, flexion pulls on the repair site so need splintage QWW

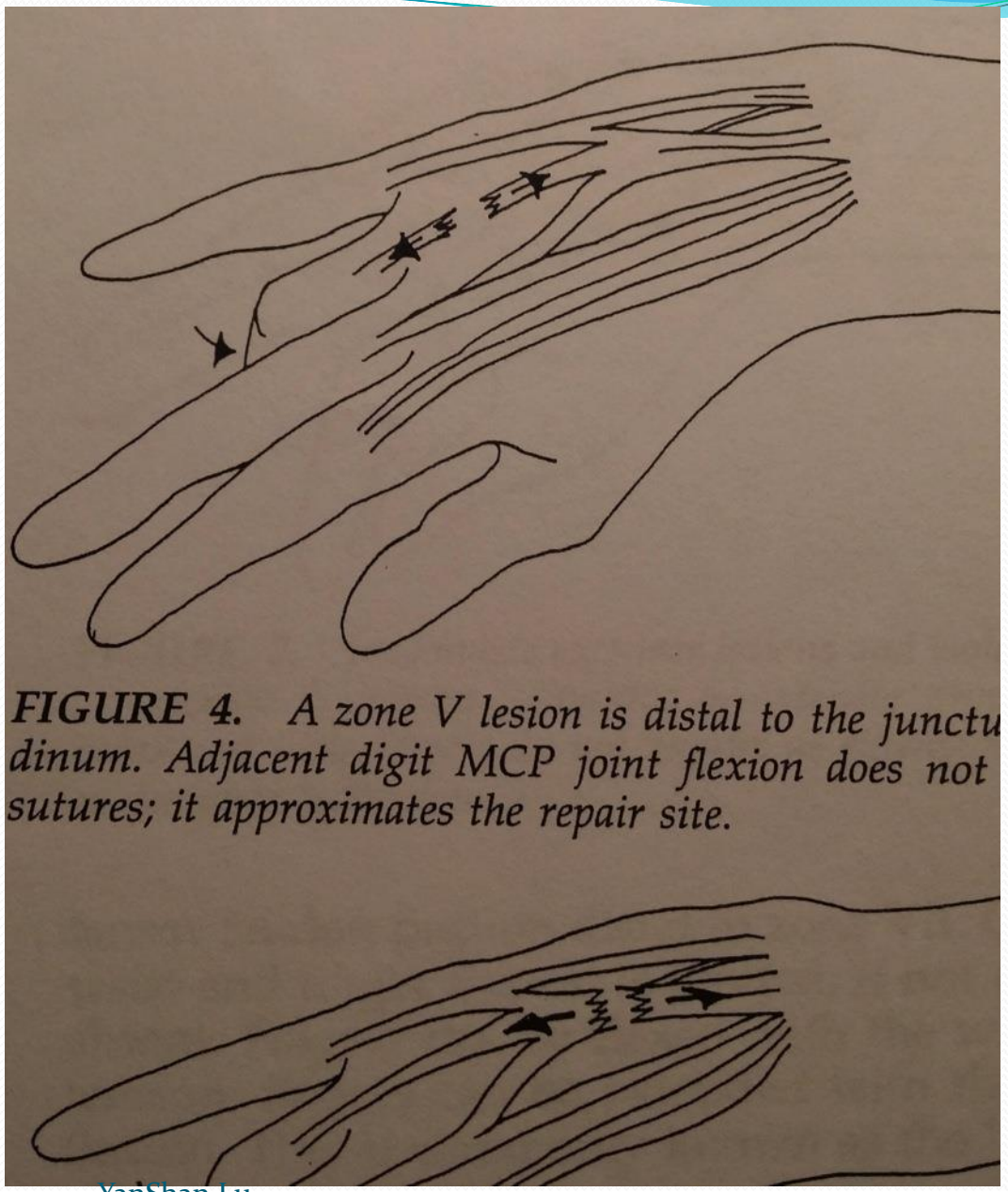
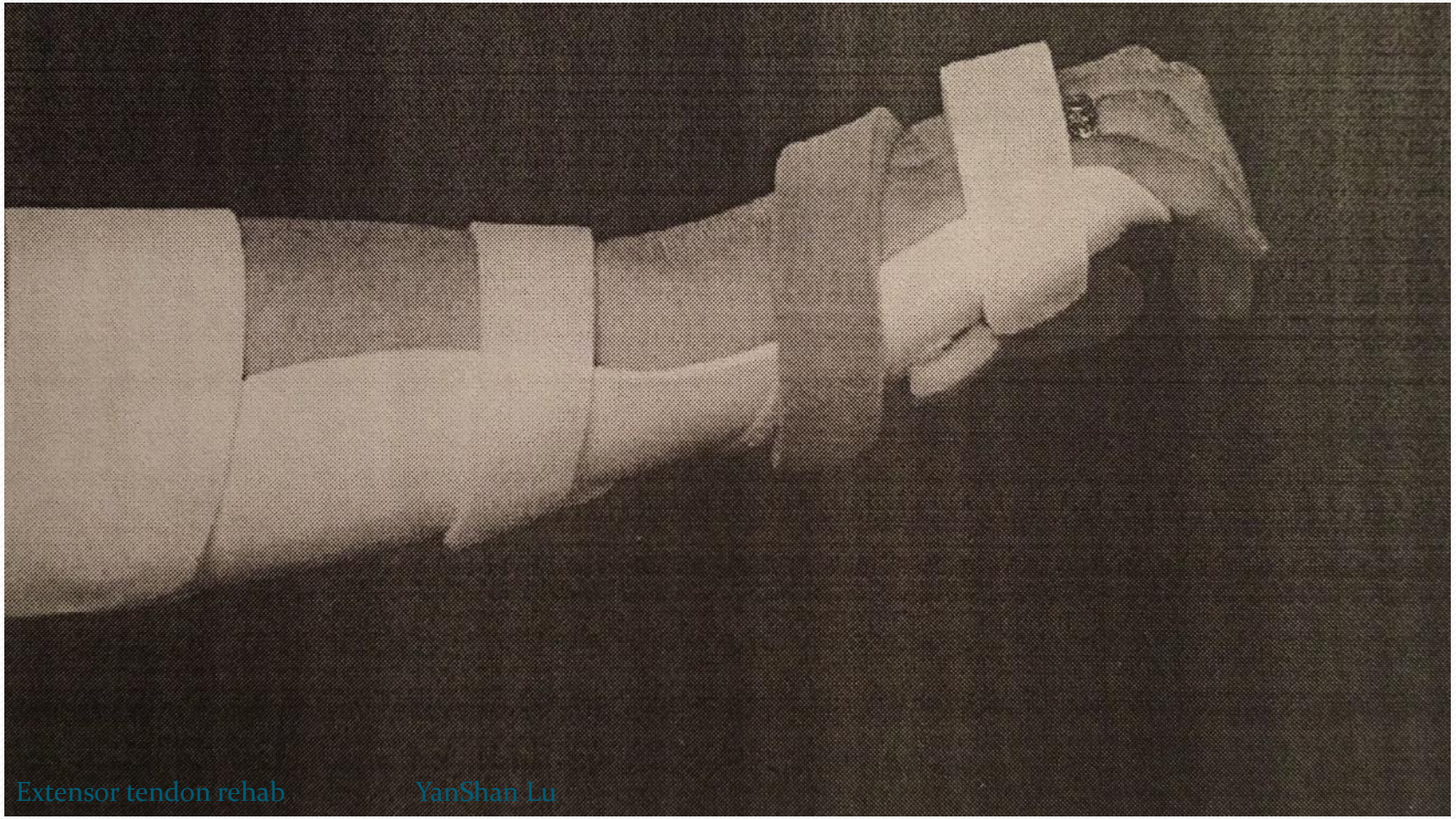


FIGURE 4. A zone V lesion is distal to the junctu
dinum. Adjacent digit MCP joint flexion does not
sutures; it approximates the repair site.

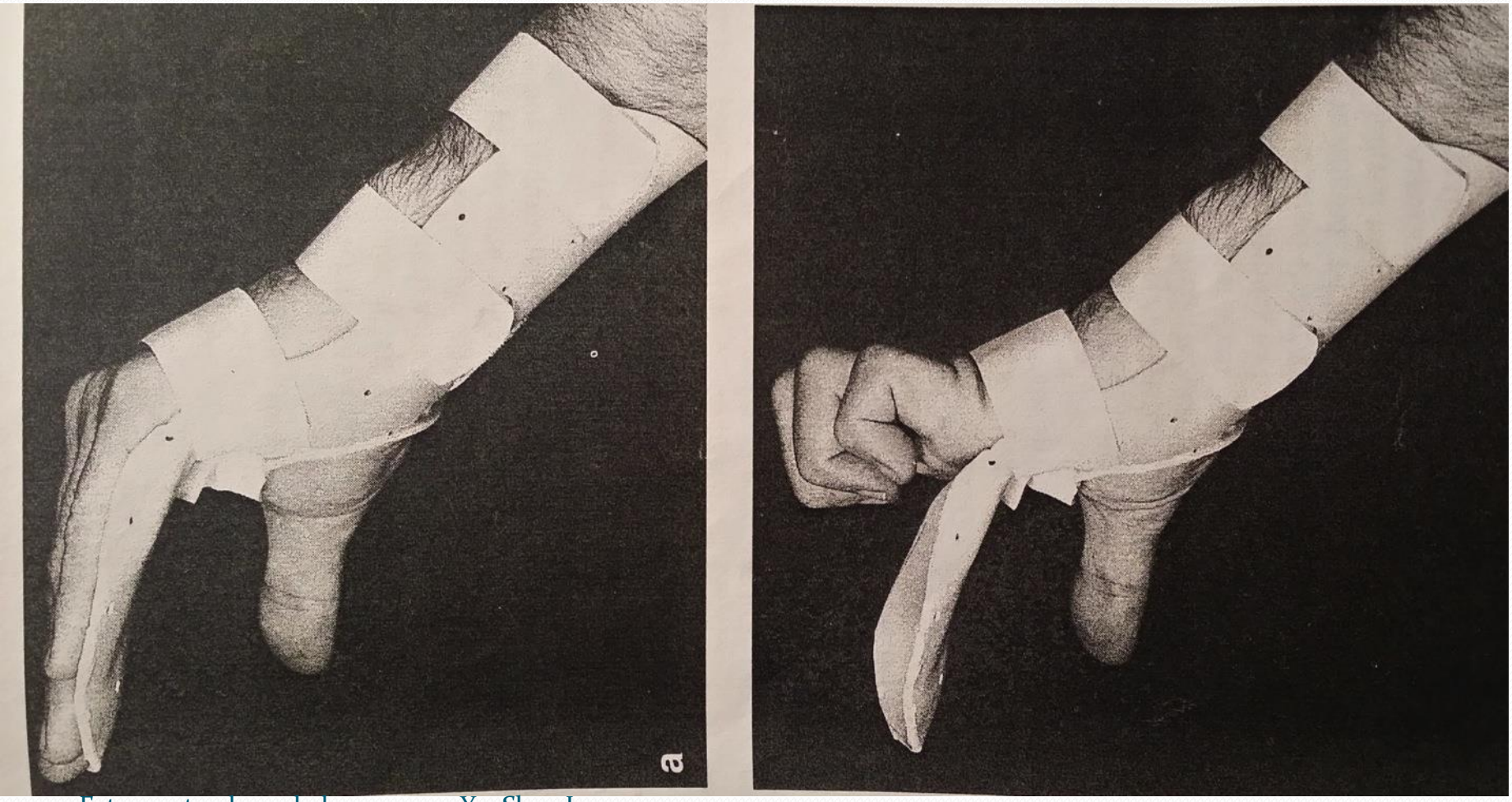
Billericay type of splint



Splint position (Billericay)

- Wrist 40-45^0 extension
- MCPJ 0-30^0 flexion
- IPJ free
- At sleep, clip on for IPJ extension part

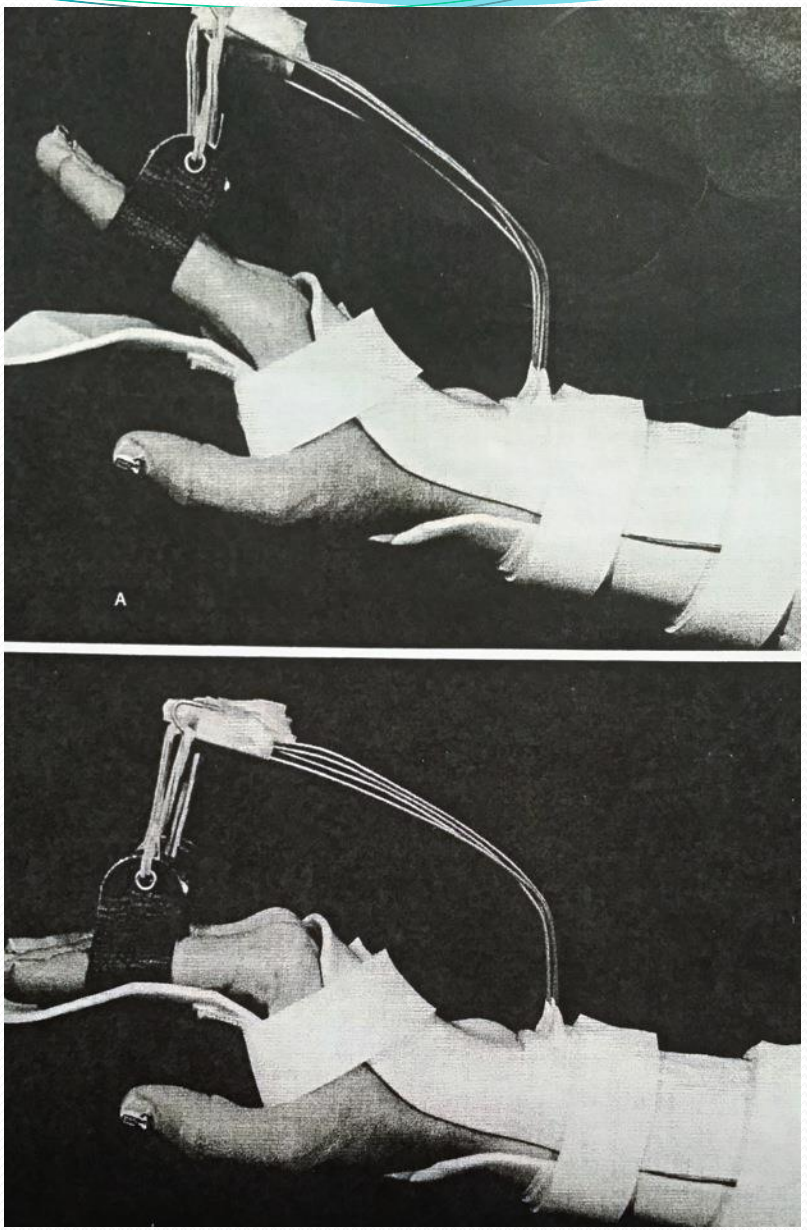
Norwich splint



SPLINT POSITION (Norwich)

- Wrist 45 extension
- Mcpj flexed to at least 50^0
- IPJ extended

Dynamic splint



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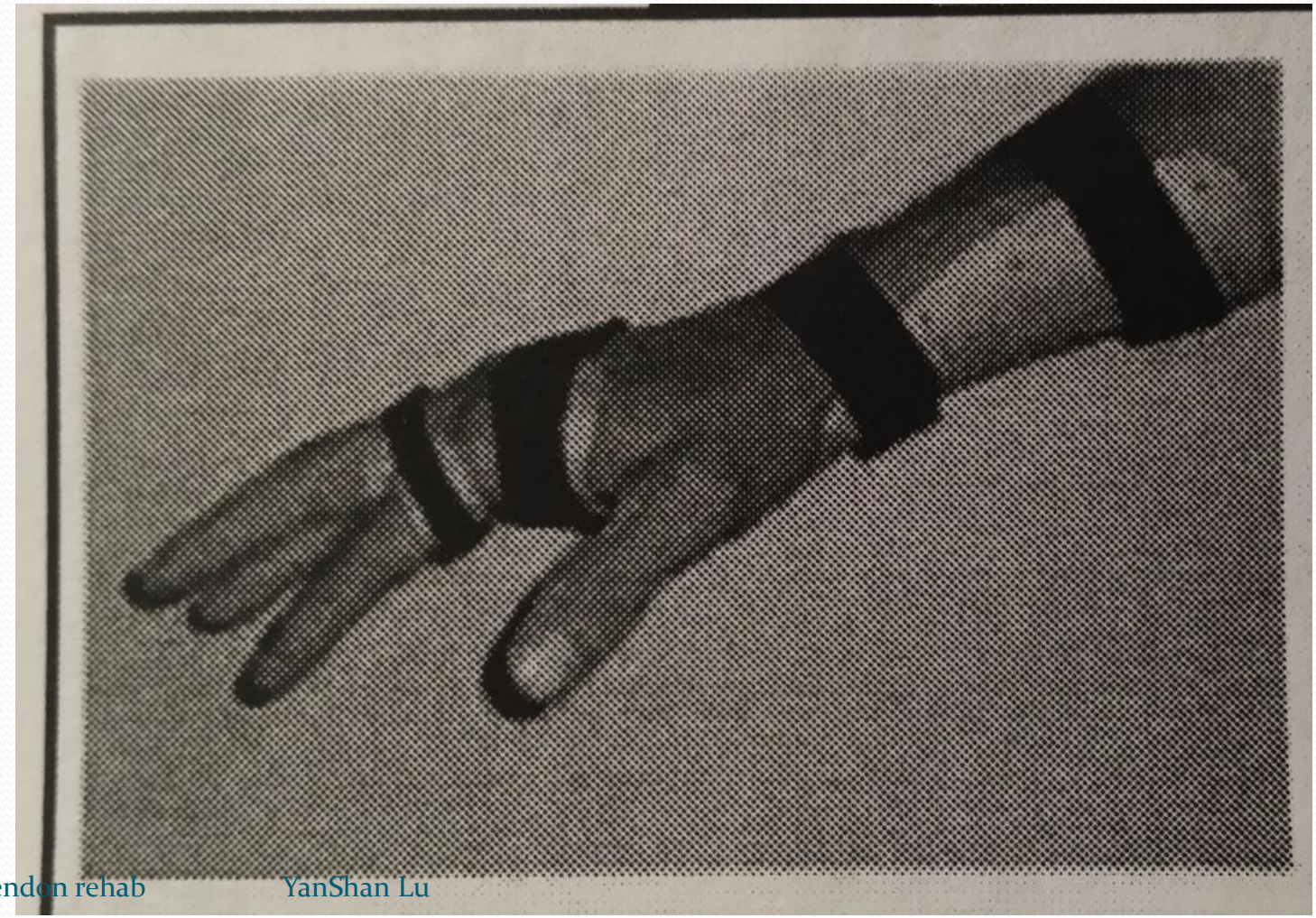

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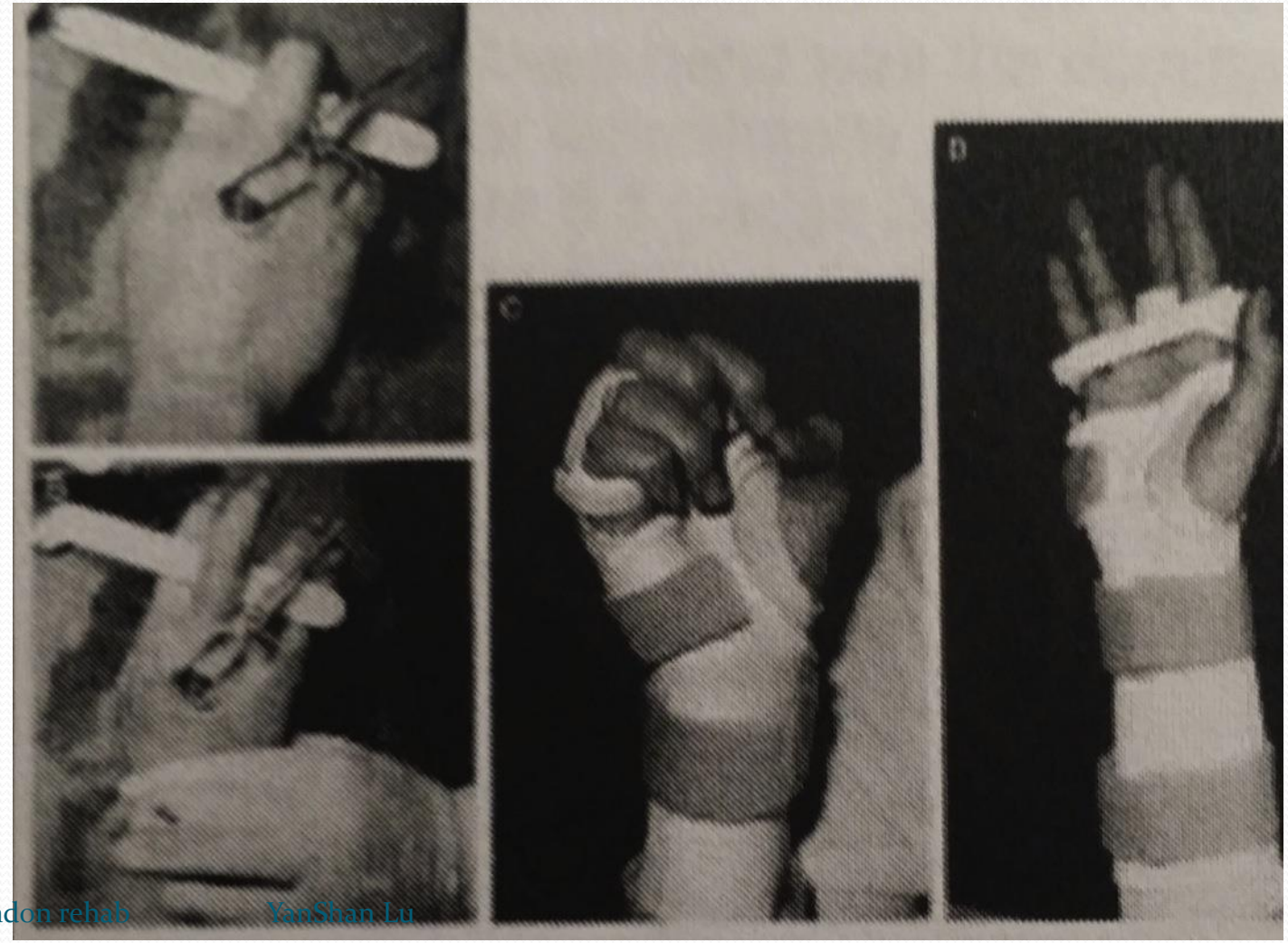

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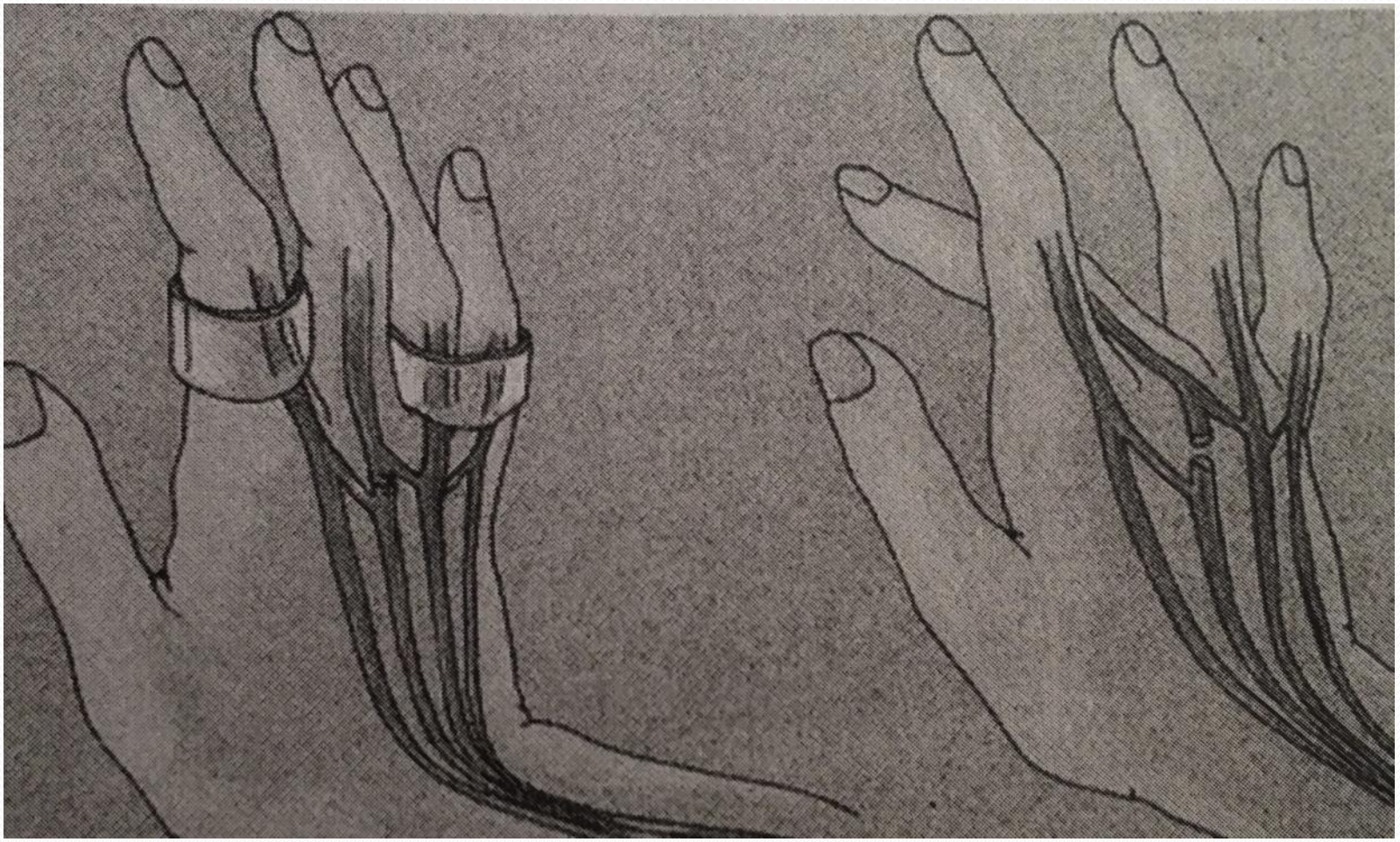

Splint patten (Howell, J 2005)

Thumb extensor tendons

- Thumb zone 1 and 2: mallet type
- Zone3 and 4: immobilised with MP and IP 0 degree extension, clinical results show little difference between immobilization
- Zone 5: Synovial=complex injury

(Evens dynamic splinting , wrist 20-30 ext, cmcj and mp 0 degree of ext. IPJ excursion of 60 degrees(=5mm excursion at the Listers tubercle)

The End