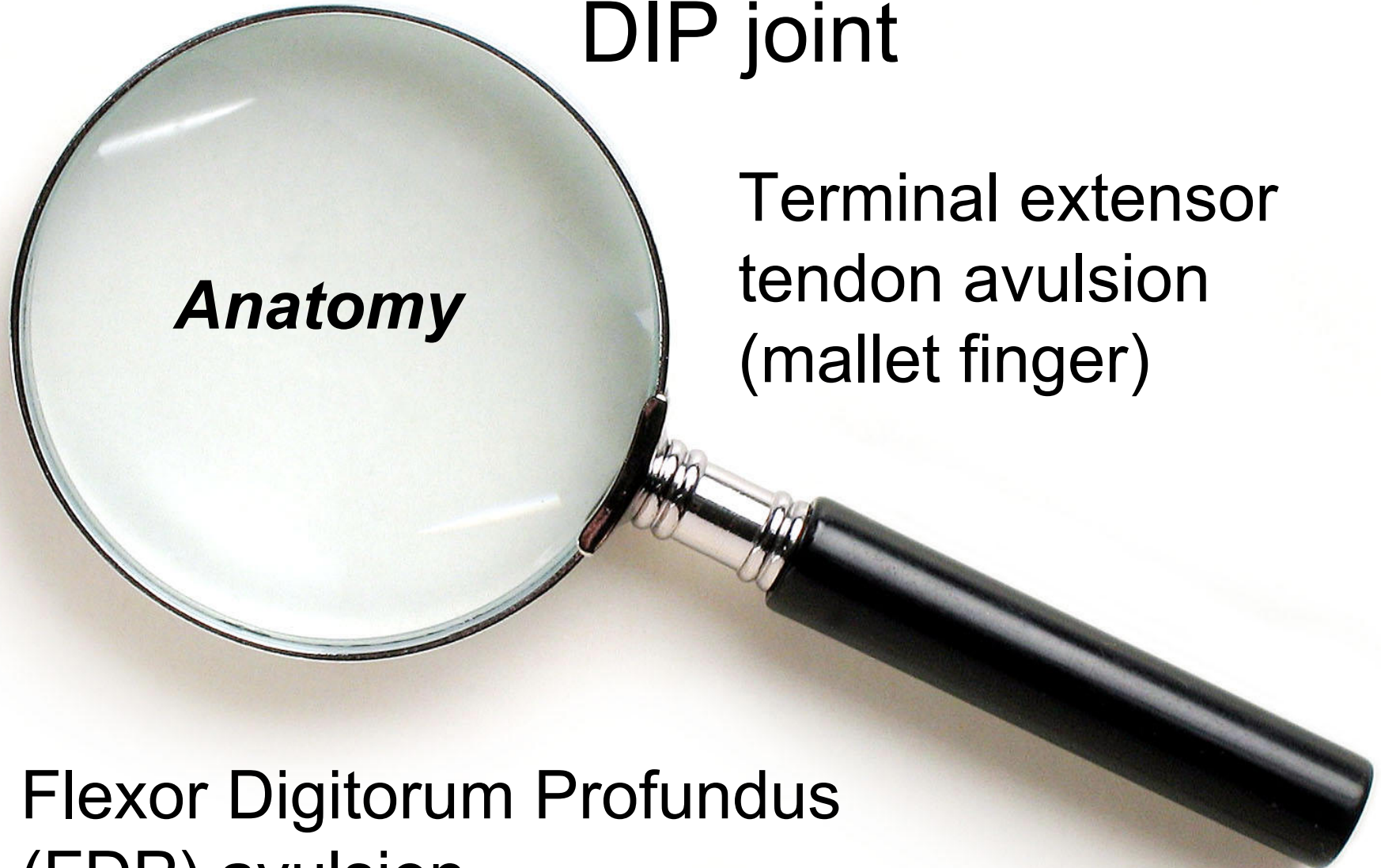


# Tendon Avulsions of the Distal Interphalangeal (DIP) Joint



Peter Belward  
Physiotherapist UHS

# Tendon Avulsions of the DIP joint

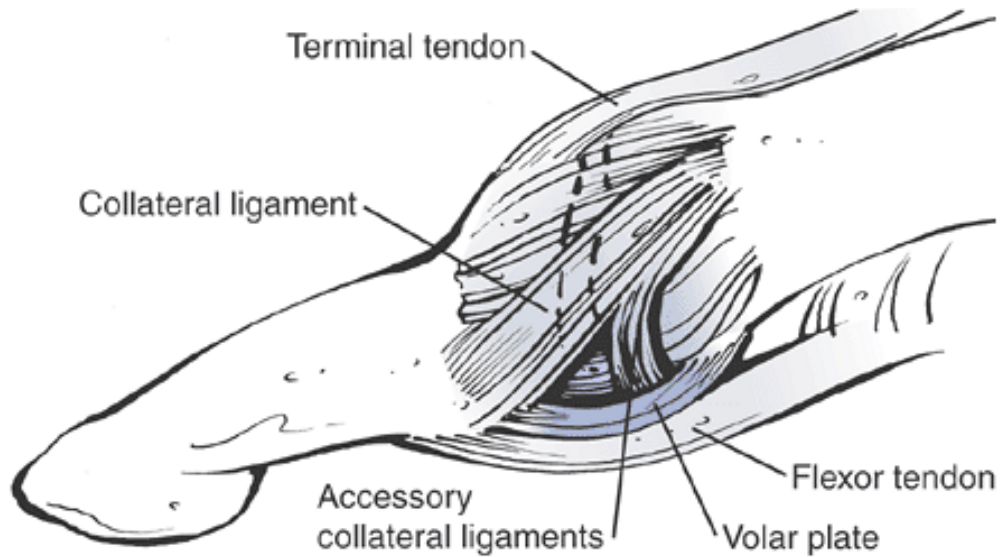


***Anatomy***

Terminal extensor  
tendon avulsion  
(mallet finger)

Flexor Digitorum Profundus  
(FDP) avulsion

# DIP joint



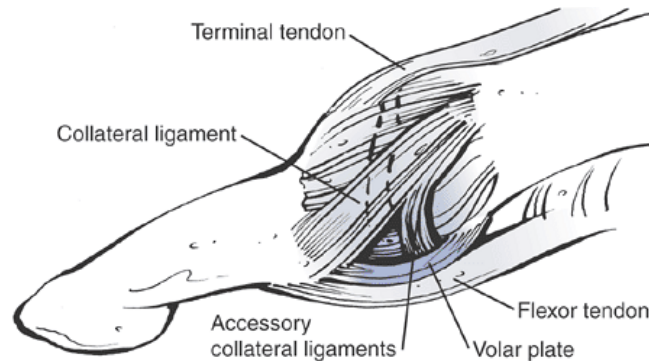
The volar plate has a weak proximal attachment, during injury proximal tears occur. Unlike the strong elastic 'check rein' capsular attachment at the PIP joint predisposing to distal avulsion.

# DIP Dislocation



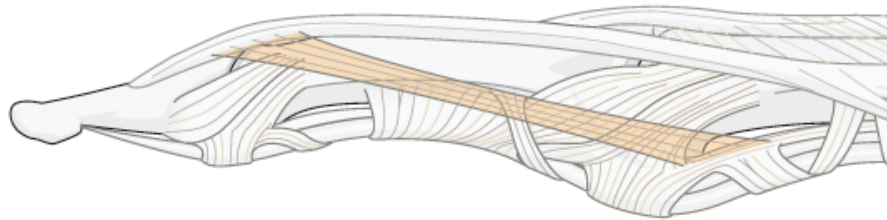
# Terminal Extensor Tendon

- Terminal extensor tendon 1mm thick and 4-5mm wide
- Attaches to the base of the dorsal distal phalanx, from one collateral ligament to the other, 1.2mm proximal to the germinal matrix



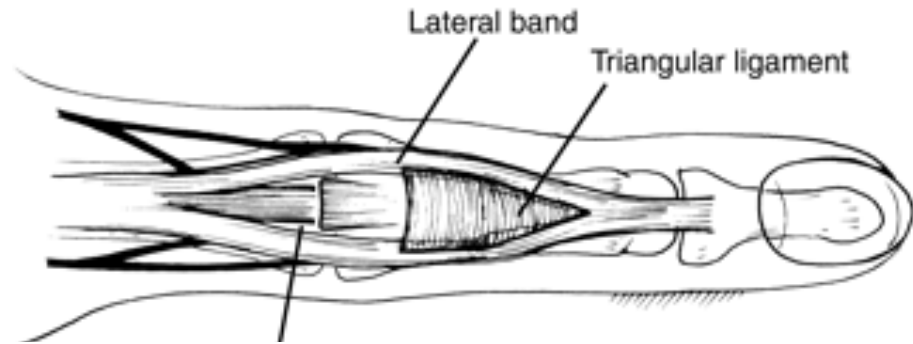
# The Oblique Retinacular Ligament (OLR)

- **Landsmere's** (1949) - Interphalangeal tenodesis
- Lying volar to the PIP they tighten in extension
- **Stack HG** - Extensor of the DIP from 90°–45 °
- **Harris et al** - Sectioning of the lateral bands resulted in 70° lag when PIP in extension



# Terminal Tendon and the Triangular Ligament

- Triangular ligament



- Prevents volar translation of the lateral bands, counteracting the ORL
- Inhibits proximal migration after distal tendon injury

# Mallet Finger

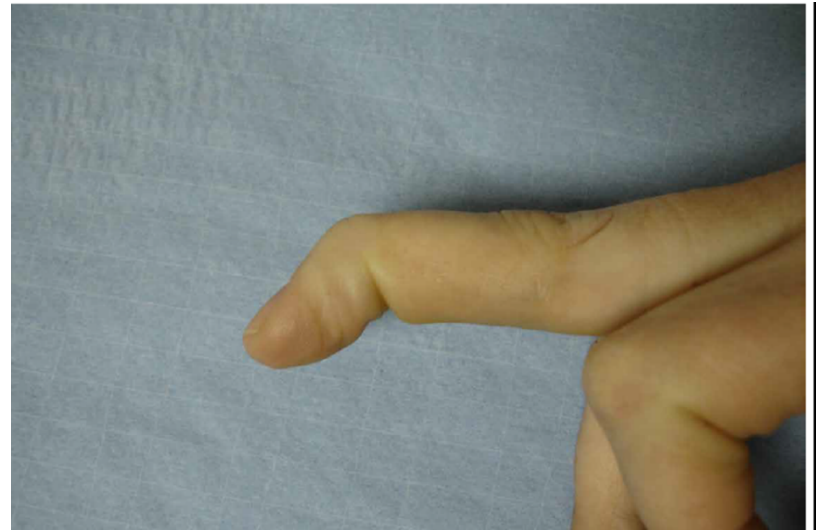
## Rozmaryn, leo

- Incidence 9.83/100,000
- Men to women 3:1
- 90% Ulnar three digits
- 20% miss six weeks of work



## UHS audit bony Mallets

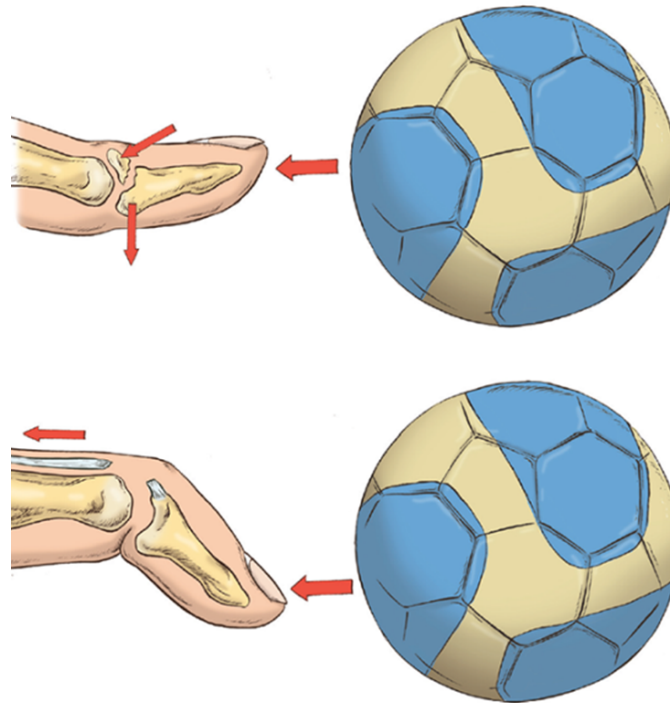
- Men 67% women 33%
- 67% right hand
- RF 33% LF 22%





# Doyle's Classification

- **Type 4C** *Hyperextension injury with fracture of the articular surface greater than 50 % with early or late volar subluxation of the distal phalanx*



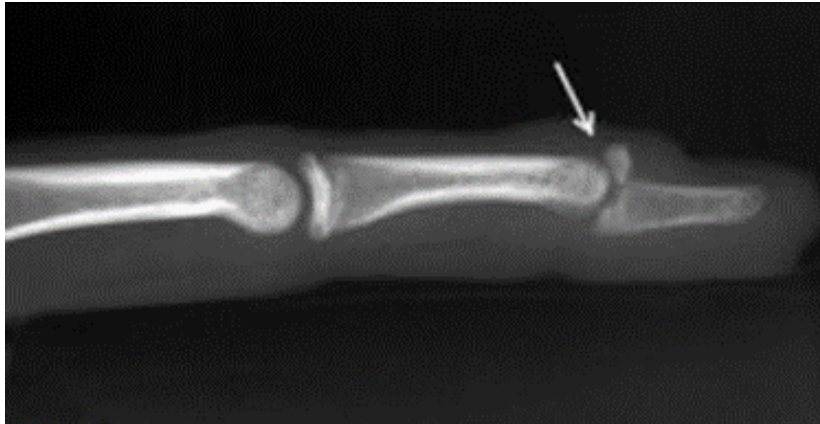
# Webhe and Schneider's classification of mallet fractures

- **Type 1** No DIP joint subluxation
- **Type 2** DIP joint subluxation
- **Type 3** Epiphyseal and physeal injuries
  
- **Subtype 1** Less than  $1/3$  of the articular surface
- **Subtype 2**  $1/3$ – $2/3$  of the joint surface
- **Subtype 3**  $> 2/3$  of the joint surface

# Articular injury



# Articular injury



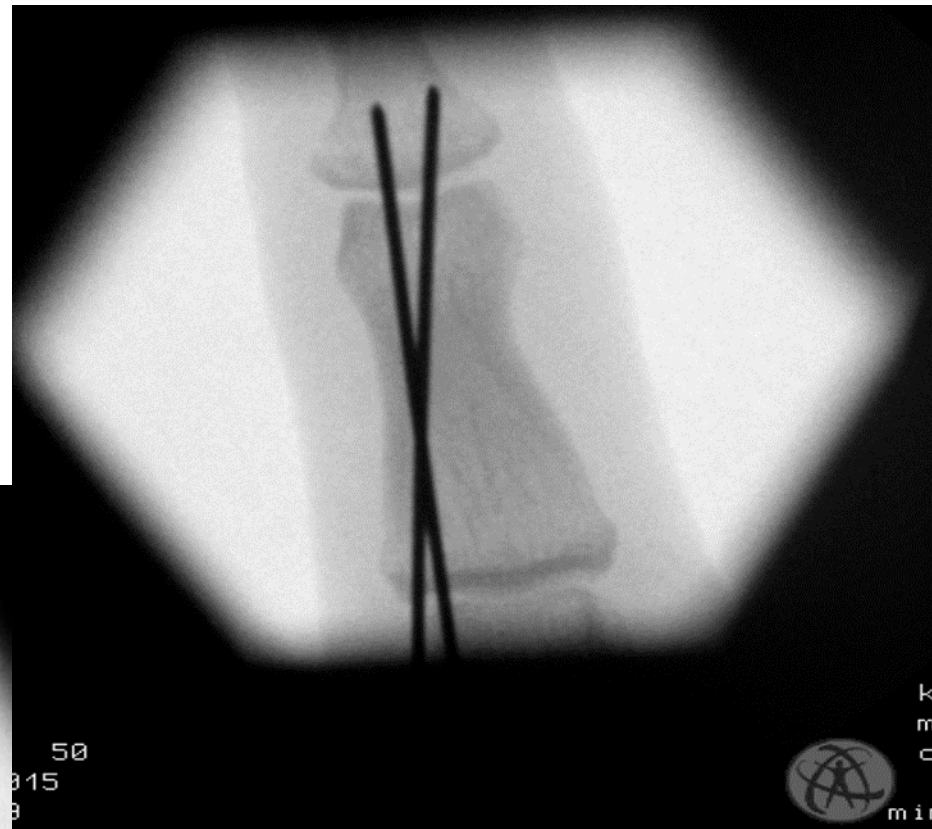
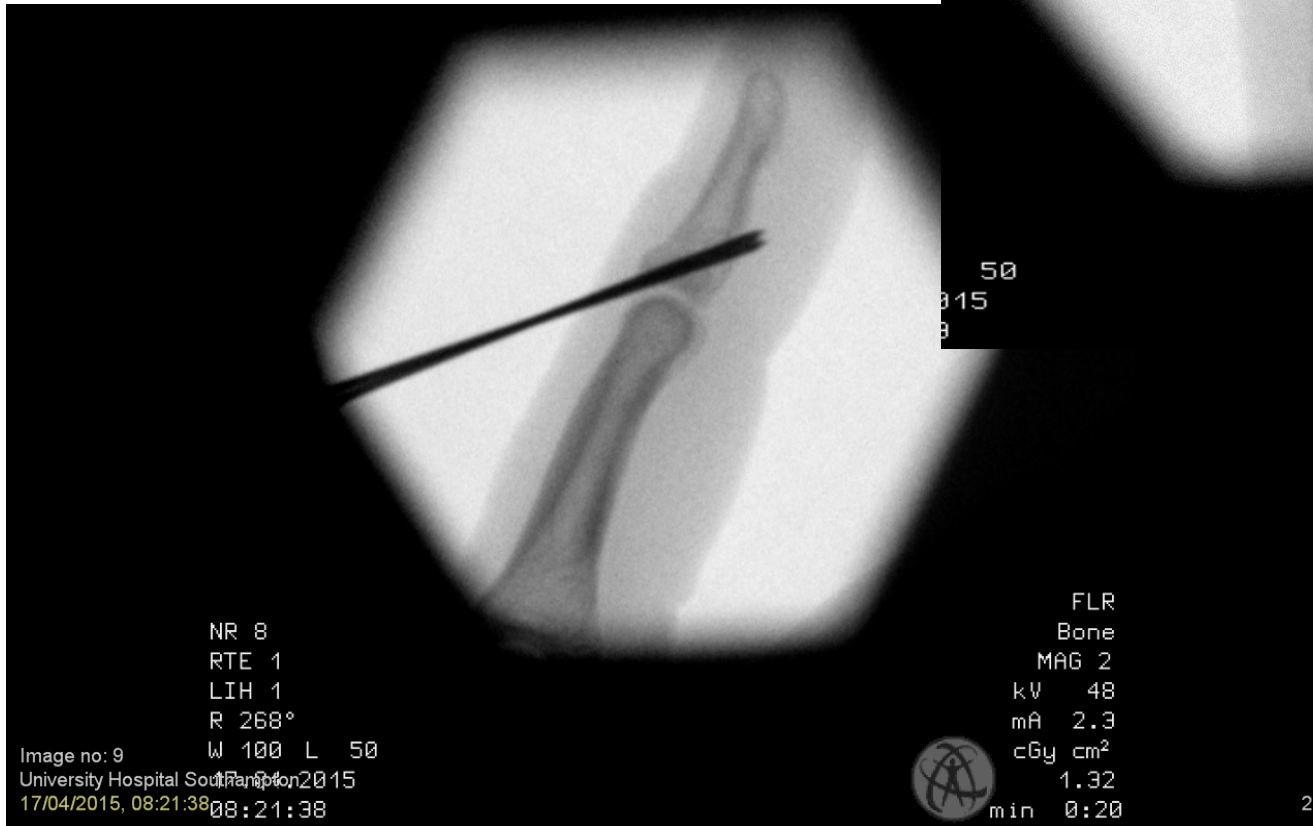
# K wires



# Pre-surgery



# Surgery



# Mallet finger long term follow up

- 10° Lag in 40% – 70%
- 53% complication rate with surgery
- 48.5° ROM at the DIP
- OA changes in 48%
- 29% mild swan neck deformity

***High patient satisfaction***





# Type 1 Mallet

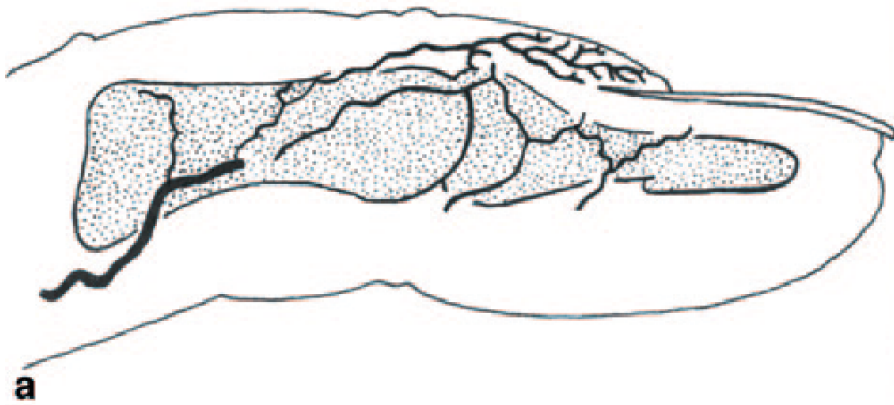


# Conservative treatment of mallet finger



# Anatomy

- Circulation, blanching of the skin said to occur at 50% of normal ext, (28.3°) Rayan G.M. et al.



# IFSSH Consensus

- **Immobilisation is at least 6 - 12 weeks (sometimes longer).**
- 0.5mm Terminal Tendon (TT) gap = 10° DIPJ lag;  
1mm TT gap = 25 ° DIPJ lag.
- **20% of all patient outcomes have at least a 10° or greater DIP extension lag.**
- Despite the best compliance return to normal is a challenge.
- **Skin breakdown, satisfaction with appearance and joint pain/stiffness may be issues.**
- Later surgical intervention may be an option.

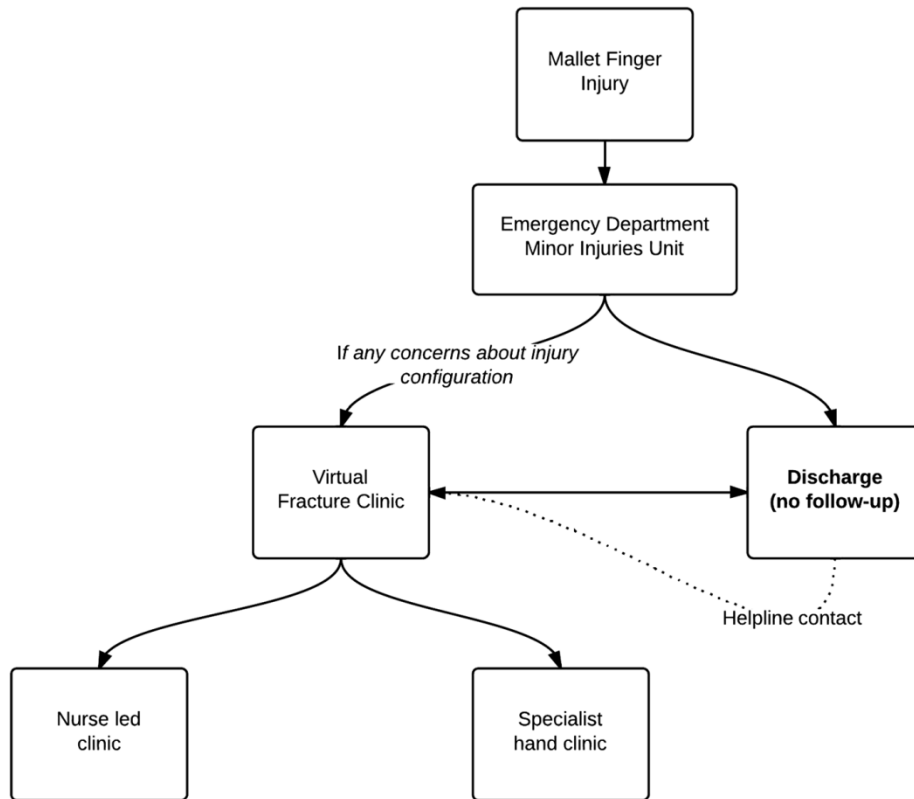
# IFSSH No Consensus

- Joints to be immobilised – DIPJ only or PIPJ + DIPJ
- Type of device- Orthotic or cast or commercial dorsal, volar, circumferential
- Definition of acute and chronic
- Duration of full time immobilisation – bony and tendinous the same or different
- Patient removal or not
- Effectiveness of night immobilisation
- How long after injury can immobilisation be used and be effective
- Best method(s) to measure outcome – ROM, pain, oedema, appearance etc
- Effect on outcome - % of articular surface, chronicity, oedema, age, PIPJ hyperextension, compliance etc
- At what time should the final outcome be measured
- Definition of successful outcome

# Crawford's outcome measure

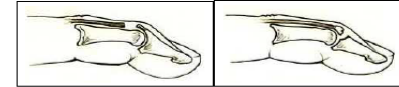
- **Excellent:** Full DIP extension, full flexion, no pain
- **Good:** 0–10° of extension deficit, full flexion, no pain
- **Fair:** 10–25° of extension deficit, any flexion loss, no pain
- **Poor:** > 25° of extension deficit or persistent pain

# Self care



## Discharge Advice Mallet Finger Injury

- You have snapped the tendon that normally straightens the end joint of the finger. The tendon may even pull off a small fragment of bone.
- This causes the tip of the finger to lie in a bent position and you are unable to straighten it.
- A splint will be applied and should be worn continuously, even at night, to keep the finger straight for 8 weeks (6 weeks if bony fragment).
- At the end of this time the splint is worn for the next one month at night and whenever the finger might be at risk of injury.
- During this time, it is important to keep the finger straight, even when taking the splint off to wash. This can be done by placing the hand flat on a table, removing the splint and cleaning the finger. Replace the splint without bending the finger.
- Try to limit washing the finger as little as possible to reduce the chance of the finger bending. Initially aim for cleaning the finger twice a week.
- It is important to keep the finger and splint dry to avoid skin irritation.
- Most injuries heal without any problems however it may take several months to regain full function.



- After the splint has stopped being used (around 10-12 weeks) it is important to keep gently moving the finger and gradually resume daily activities within the limits of discomfort. This will help improve any stiffness and ensure the safest return to normal function. If you are struggling to get the movement back please contact the fracture clinic.
- There may be redness, swelling and slight pain over the joint for a few months afterwards. This will settle.
- You may be left with a small bump or be unable to straighten the finger fully. If this happens it is unfortunately a permanent feature but will not affect function of your finger.
- Occasionally after 3 months splint treatment the tendon may fail to heal. Most fingers function well despite a droop at the end joint however surgical fusion of the end joint may be considered.

**Should you have any worries or concerns following discharge from hospital, please contact either the**

**1) Fracture Clinic: 0141 211 5034**  
 (8.30am until 4.30pm, Monday to Friday)

or

**2) Emergency Department: 0141 211 4344**  
 (outwith these times)



# Glasgow outcome

- 47 patients entered study.
- 36 followed up mean 322 days.
- Help line used by 9 (25%) all satisfied
- 7 (17%) had visited another Dr usually GP
- 20 patients very satisfied, 16 satisfied

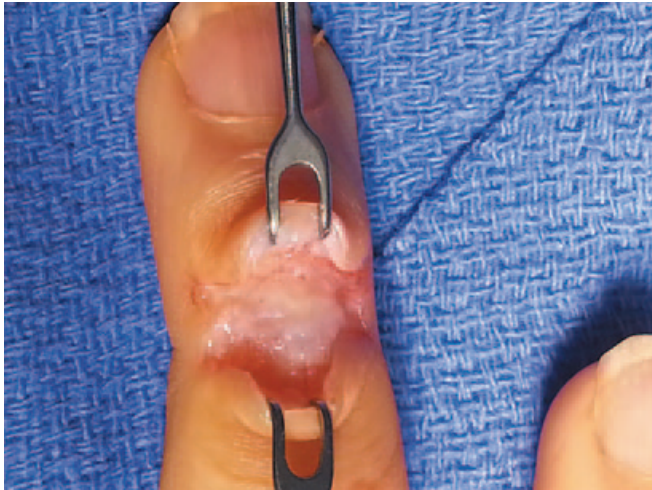
## **Conclusion**

Elimination of regular review resulting in  
good function and excellent satisfaction



# Secondary procedures

Repair



Fusion



Fowler's tenotomy,  
not recommend on  
greater than 36  
deformity



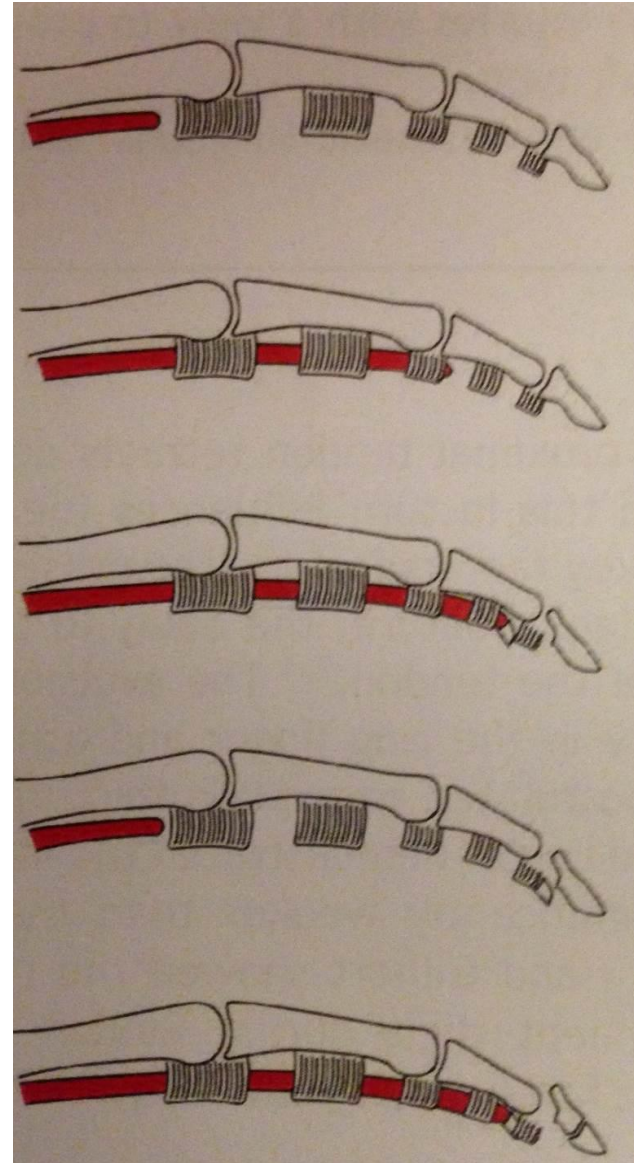
# FDP Avulsion



# Leddy and Packer

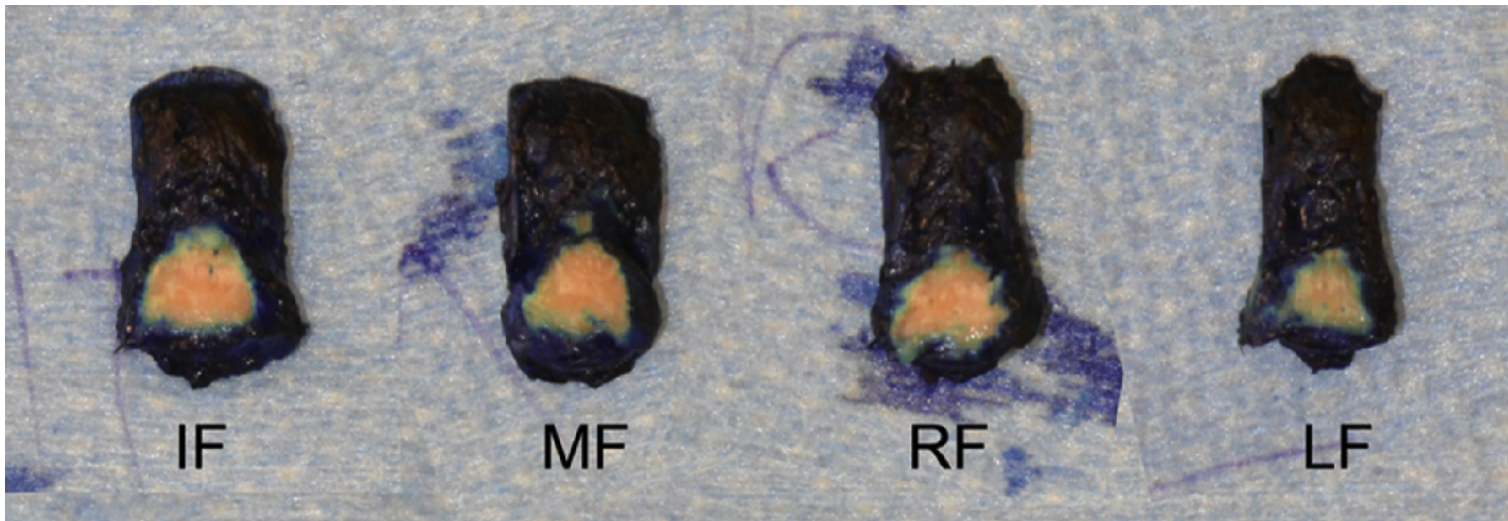
J Hand Surg 2;66:1977

- I. FDP in the palm vincula disrupted.
- II. FDP at the level of A3, vincula longus intact.
- III. FDP at the level of A4, both vincula intact, large avulsion fracture.
- IV. FDP in the palm, large avulsion fracture detached from FDP.
- V. FDP at A4, large avulsion fracture concomitant distal phalanx fracture.



# Flexor Digitorum Profundus Attachment

- Kyle, J et al. (J Hand Surg Am.2015;40(2):240e244.)
- Average insertion surface area 20%.
- Average distance from joint 3.6mm or 20% of the length of the phalanx.



# Jersey Finger

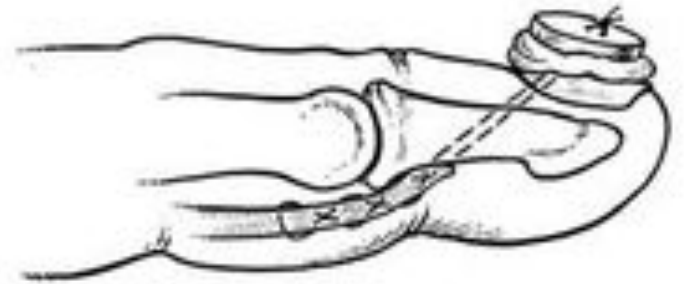
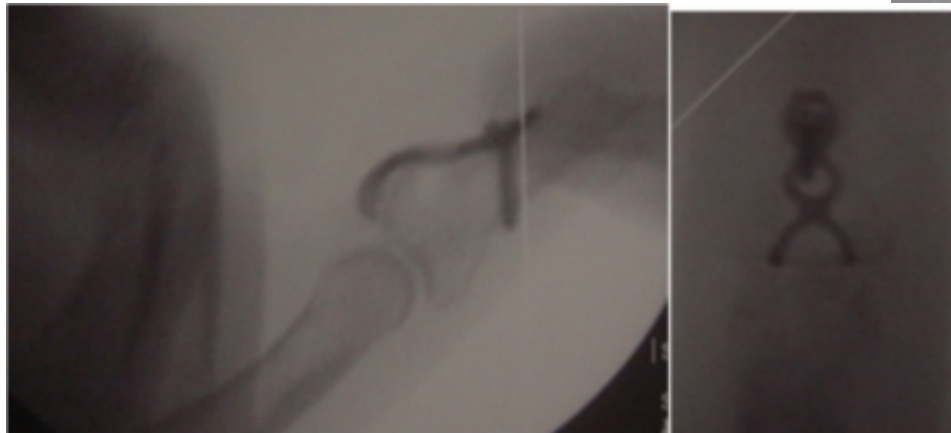
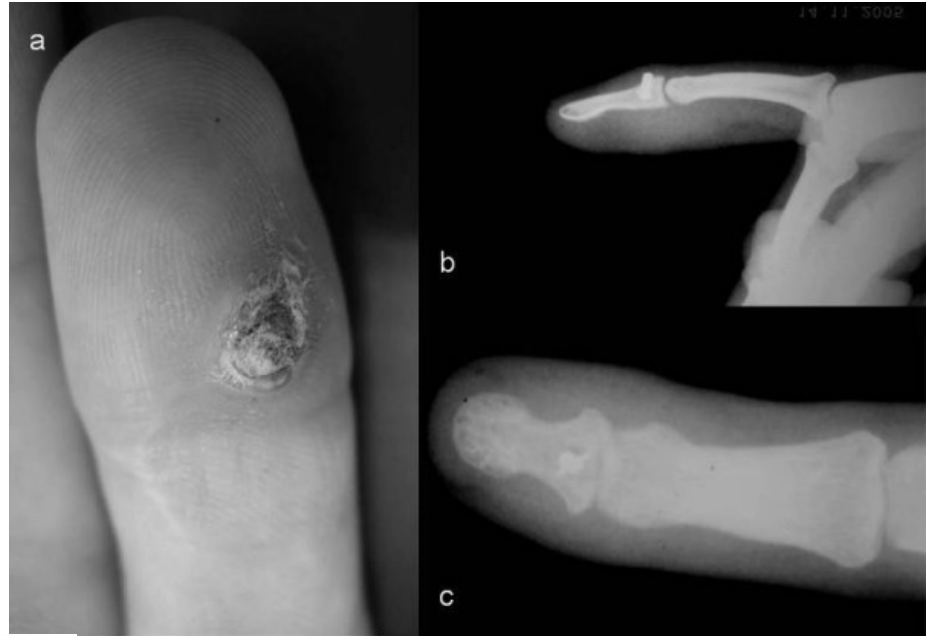
- Ring finger more prominent or longer during grip in 90% of people.
- Absorbs more force than any other finger in pull-away testing.
- In cadaver studies has a significantly weaker insertion when compared with the middle finger.

**R**  
**JW**  
RING FINGER





# Surgery





# **Flexor Digitorum Profundus Avulsions**

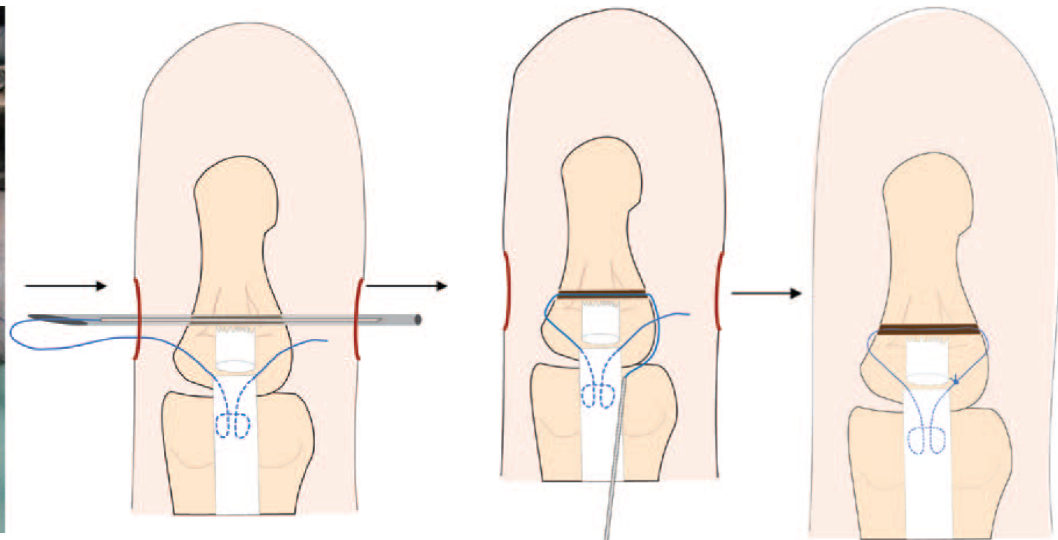
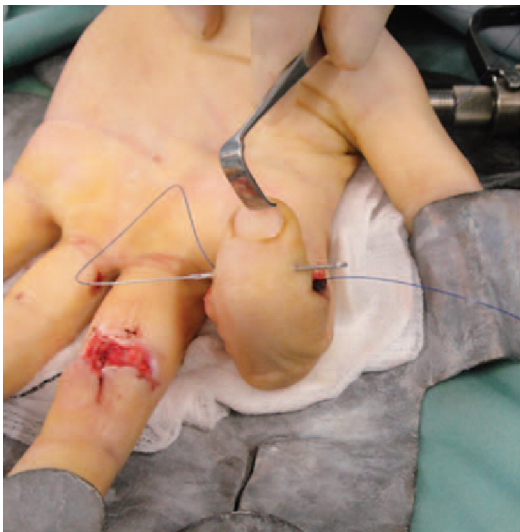
**“No one technique better than another”**

**Huq S. et al JPRAS (2013) 66,1023 - 1031**

**Good to excellent in 54%, despite  
reduced movement**

- Button - 22% infection
  - Abnormal nail growth in 35%
- Bone Anchor - 15% infection
  - Cost £180 - Long term osteomyelitis
  - Migration

# Transverse Intraosseous Phalangeal Suture



Markeson DB, et al Wexham Park

DOI:10.1097/PRS.0b013e3182879f17

# Manchester short splint



Fiona Peck, M.S.C.P.  
*Manchester, United Kingdom*  
*Plast. Reconstr. Surg. 134: 913e, 2014.)*

Thank you